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SCIENTIFIC MANAGEMENT METHODS

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Dissertation submitted as partial requirement for the conferral of

Master in International Management

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November 2015

ACKNOWLEDGEMENTS

ABSTRACT

The world is becoming more and more complex, so do companies. As a consequence, the decisions that managers have to make are increasingly more difficult, since they have to contemplate every single element part of society, such as persons, resources, external environment, etc. Decision making process' goals are quite simple this days: companies try to reduce risks, to increase the probability of their success, to predict impacts and changes with very low margins of errors, in order to be prepared to every single eventuality and increase their survivability odds.

Science was born thousands years ago, and it's being used to understand the world and how it works. For scientists the only way to do this is by having a rational and credible process of study, what they call scientific method. So, it is possible to define two different types of decisions, some as being supported by a rational and credible analysis, in other words by a scientific process; and other decisions by being supported by managers' feelings, intuition, experience.

This dissertation aims to provide deeper understanding about management decisions and their rationality or lack of it, by looking into the subject of business research methods and its presence in management.

The research conclusion is that decisions are becoming more rational since the majority of managers are using rational and scientific tools to support their choices. The research also suggests that companies don't use mathematical and statistical tools as much, which makes their prediction analysis to have higher margins of errors.

Keywords: Science, Management, Business Research Methods, Scientific Management

JEL Classification: M10, M19

RESUMO

O mundo está a tornar-se cada vez mais complexo, tal como as empresas. Como consequência, as decisões dos gestores possuem um grau de dificuldade acrescido, visto que têm de ser contemplados todos os elementos integrantes da sociedade, como as pessoas, recursos, envolvente, entre outros. Então o processo de tomada de decisão atual visa: reduzir riscos, aumentar a probabilidade sucesso, prever impactos e alterações com reduzidíssimas margens de erro, com o propósito das empresas estarem preparadas para qualquer eventualidade e aumentar as suas probabilidades de sobrevivência.

A ciência tem sido usada para compreender o mundo e como este funciona. Para os cientistas, a única maneira de o fazer é através de processos de estudo racionais e credíveis, a que estes chamam de método científico. Existem portanto dois tipos de decisão: as decisões suportadas com racionalidade e análises credíveis, ou seja por um método científico, e as decisões suportadas com base nos sentimentos, intuição e experiência dos gestores.

Esta dissertação visa obter um maior entendimento acerca das decisões do mundo da gestão, e a presença ou falta de racionalidade nesse processo, ao analisar o tópico *business research methods* e a sua presença no mundo da gestão.

As conclusões desta investigação mostram que as decisões estão a tornar-se mais racionais, visto que a maioria dos gestores já está a usar ferramentas de base científica aquando das suas escolhas. O estudo sugere também uma falta de uso considerável de ferramentas matemáticas e estatísticas, o que remete para margens de erro das análises preditivas elevadas.

INDEX

INDEX OF TABLES

INDEX OF FIGURES

CHAPTER 1 – INTRODUCTION

1.1 Introduction

The starting point for this study is management and science, two of the most talked/discussed topics today with the exception of technology. The way we look to this subjects has changed over the years and today more than ever, it is important that they stop to be two different subjects, and start to be analyzed as a single one.

The world is changing faster than ever, and what is considered to be right/truthful today, could in the near future no longer be so. This is happening in all areas of knowledge and in all aspects of our lives. What we learn today in our university degrees or in our daily professional lives, could be obsolete in only three years. Off course the main driver for this increase velocity on changes is technology, and because of that we should expect this pace of change to keep increasing.

The question that rises from this facts is: How can businesses compete? This question has many answers, and all of them can be considered part of the solution. Some of them are: the adaptability of companies has to be fast and smooth, since managers have the responsibility to force their enterprises to constantly reinvent themselves. This for example means, that if companies are forced to completely change what they do in periods of three years, they should do so, in order to survive and to be able to compete against the world. Another solution for managers, is that they have to increase the success rate of their decisions up to a point where no bad decisions are made, since even small mistakes, could put at risk the survivability of an entire organization.

Because the world is changing faster than ever and becoming increasingly more complex, and all this two facts seems to even increase their pace in the future, managers have to find solutions and become more rational than ever, to be able to react to this fast and complex world. Due to this statements, this study aims to get deeper understanding to the use of science in management, more particular in the decision making processes.

CHAPTER 2 – LITERATURE REVIEW

The main goal of this study is to analyze the subject of Scientific Management Methods, and its importance to the way management is practiced. To support this analysis with literature, this chapter aims to look in depth to some of the theoretical concepts around the subject, such as science, management and its evolution, scientific management history, principles and modern theories and the importance of business research methods and examples of their existence.

2.1 Science

In prehistoric times with the invention of the wheel, discovery of fire and/or the development of writing, we find the very first signs of science. We all know the word science and the subjects that are more or less related to it, but what about the meaning of the world itself?

First its origin came from the Latin word *Scientia*, which means knowledge. Regarding the definition, there is not a universal definition accepted by everybody. Merriam-Webster Dictionary defines science as knowledge based on demonstrable and reproducible data. Feynman (1963) states that *"Science is a way to teach how something gets to be known; what is not known; to what extent things are known (for nothing is known absolutely)…"*. In 1996 during an interview, the author of *The Demon-Haunted World: Science as a Candle in the Dark* (Carl Sagan) said that *"Science is more than a body of knowledge. It is a way of thinking…"*. More related to those who practice science (the Scientists) Lévi-Strauss (1964) says that they are not responsible to give the right answers, but instead, their main goal is to ask the right questions.

Since what we call early science, where nature was defined by its four basic elements (earth, fire, water and air), through the discover of the concept of atoms, until the point in time where modern science defines knowledge progress has a two way cycle between evolution and revolution, the impact of it to management and organizations methodologies was almost residual. For example, as stated by Van Fleet & Yukl (1986), a century of research about the leadership field has offered complexity as a response to those who knew that, despite the large volume of leadership investigation, little has been learned.

Figure 1 – The Normal Development of Science (Source: Adapted from Beard and Van Fleet, 2013)
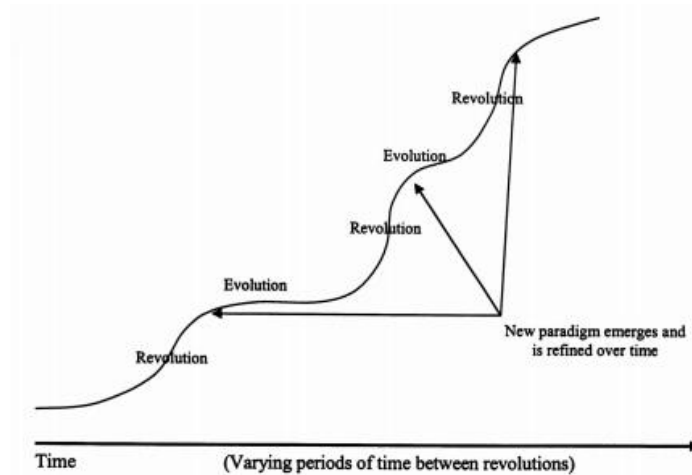
In more general terms, science has helped managers to understand that one model of organizations is not enough to fit all circumstances, therefore other models are forcedly developed to help on justifying the complexity and increase the environment understanding. This is however a never ending cycle, like the evolution-revolution concept, due to the fact that those initial models don't seem to be able to capture all the relevant aspects of the organizations, forcing scientists and managers to develop new models (Beard and Van Fleet, 2013).

2.2 Management

Even though we find the very first signs of management two thousand years ago, in papers such as The Art of War, written by the general Sun Tzu, which has some lessons that still managers today find very useful, or for example in the work done by the old cultures such as the Greeks and Egyptians, what we call Modern Management was defined and molded by the modern models and theories that were created in the last three hundred years.

First and foremost to help us understand what Management is, Rosemary Stewart (1967) said that a Manager is someone who accomplishes things by getting help from people and by using resources. Stewart extrapolates then that Management is the activity of getting things done by using the help of people and by exploring resources.

Management is a distinct process consisting of planning, organizing, actuating, and controlling performed to determine and accomplish the objectives by the use of people and resources.

-George R. Terry

Boddy (2008) states that managers are always looking for different ways to manage their companies with the ultimate goal of adding value to their business. He also states that this path of discovering the best management model, is done by making assumptions about what would be the best way to do things. Through trial and error managers are able to develop the best methods for their circumstances. Regarding this subject, Boddy ends by saying that there is no perfect model that is able to suit all conditions, therefore the decision of choosing the model/s to implement should be something done critically and selectively under different perspectives.

Since Management knowledge is grouped into what we have been calling theory or model, is imperative to understand its meaning. Boddy defines a model (or theory) as a representation of a more complex reality. This representation according to the author is only possible if we simplify knowledge, by focusing the essential elements and their relations, and how change may affect it. The writer goes further into the subject by alerting that "most management problems can be understood only by examining them from several perspectives, so no model offers a complete solution".

The majority of management theories started to appear in the beginning of the 20th century, however before that, some authors have written and talked about important subjects regarding management.

One of those examples is *The Wealth of Nations* (1776) written by Adam Smith. In this book, Smith described how it's possible to increase productivity by changing the entire production process, something he called division of labor. The example he used to explain this was the pin production process.

The pin production process can be divided into 18 significantly different operations. Regarding the process Smith states that "an unspecialized, inexperienced worker who had to perform every task…might produce no more than one or two good pins a day" (Smith, 2015). In opposite, the author defends that each part of the process should be executed by specialized workers, therefore, each worker would only be responsible for two or three different tasks. The results of this change were observed by Smith in a small workshop, where the production increased to 4800 pins per employee a day, which the author justifies by saying that "if the workers had been unskilled and unspecialized, their output would have been only a tiny fraction of that" (Smith, 2015).

As analyzed by Brue and Grant (2012) there are three reasons that justify the huge increase in the example of pin production:

- By performing only few tasks repeatedly, each worker is able to develop increase dexterity;
- "Time is saved if the worker need not go from one kind work to another." (Brue and Grant, 2012);
- It is possible to create machinery to increase productivity, as soon as each task is simplified and made routine.

According to Bose (2012) the evolution of management thought and theories during time can be divided into four groups:

- Pre-Scientific Management School (Before 1880);
- Classical Management School (1880-1930);
- Neo-Classical Management School (1930-1950);
- Modern Management School (1950-present)

Bose also states that the periods defined above are not exact and are only defined based on the dominance of the different schools during the periods.

Figure 2 – Evolution of Management Though (Adapted from Source: Bose, 2012)
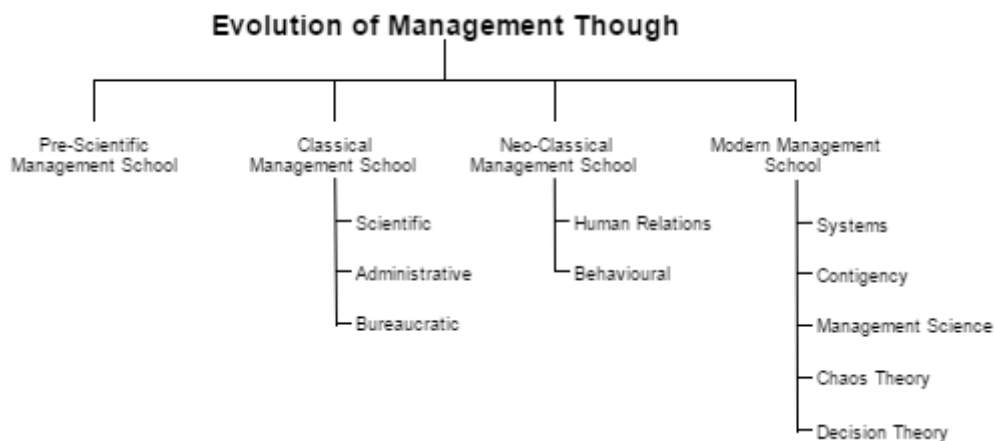
For the present investigation, Pre-Scientific Management theories will not be analyzed in-depth, due to the lack of literature, since most of the work done in that period is attributed to Churches and Military organizations. Regarding the theories itself, it was already cover the most important topics above (division of labor).

2.2.1 Classical Management School

2.2.1.1 Scientific Management

In the late nineteenth century industrial organizations started to grow in size and complexity, which have resulted in the increase difficult in organizing human effort efficiently and effectively (Rollinson, 2005: 9).

This complexity and size problem forced the creation of a systematic management, which consisted on using engineering background knowledge and discipline to organize the production processes, in order to increase efficiency and effectiveness (Barley & Kunda, 1992: 369). As a response to this trends, Scientific Management was created.

According to Bose, Scientific Management's meaning is easier to understand when looking to its words – scientific and management. Scientific means an analytical, objective and systematic approach, and management, as seen before, means getting things done through others. Therefore scientific management is the "art of knowing exactly what is to be done and the best way of doing it" (Bose, 2012).

Frederick Taylor is considered to be the father of scientific management because he was the first to suggest the need of scientific approach to the act of managing a company, when he released his publication *The Principles of Scientific Management.*

> *Scientific management means knowing exactly what you want men to do and seeing that they do it in the best and the cheapest way.*
>
> *-**F. W. Taylor***

For the authors of the article "*A review and critical analysis of the principles of scientific management*" (Huang, K. & Tung, J. & Chung, S. & Chou, M., 2013), Taylor saw the need of merging management with science, when he proposed that a business manager and an engineer should be one and still the same person.

The five base principles of scientific management are, as described by Boddy (2008), the following ones:

1. "Use scientific methods to determine the one best way of doing a task, rather than rely on the older 'rule of thumb' methods";
2. Select the best person to perform a specific job by matching task needs with persons physical and mental qualities;

3. The importance of training, teaching and developing the workers is imperative for the defined procedures to be followed precisely;

4. Use financial incentives as a way to motivate the workers to accomplish their goals and to perform their tasks precisely;

5. Shift planning and organizing responsibility from the worker to the manager.

This principles summarized, means that Taylor's management theory describes the creation of a true science, with the scientific selection of workers, their education and development and their well-defined relation with management (Huang, K. & Tung, J. & Chung, S. & Chou, M., 2013).

Taylor theory has some challenges that need to be solved to put scientific management into practice in our modern times. This challenges, as stated by the writers of *"A review and critical analysis of the principles of scientific management"* (2013), are:

*   The **lack of education** of the workers, that prevents them from understanding the 'big picture' of scientific management;

*   The **dehumanization of the workers,** since Taylor assumes that workers cannot think on their own. This could lead to motivational issues. It's also important to state that Taylor's theory only has one type of motivational tool, which is the use of financial incentives;

*   The **concept of task allocation**, which means splitting huge tasks into smaller ones. This can cause the creation of redundant positions, such as additional supervisors or indirect workers that are not able to generate value to the company, therefore increasing the cost of the management system.

Taylor's theory was also pursued and simplified by Henry Ford. Ford implemented some interesting ideas in industry. First he transformed the production line into an automatic process, where workers would stay without moving performing their tasks, and due to the fact that production line was automatic, managers were controlling the pace of the work. The next idea was to pay every single worker the same amount of money, because performing tasks on the moving production line didn't require much skill. Regarding the incentives, Ford defended that they were not needed and instead he increased the salaries. With this ideas, Ford was able to increase salaries and predict all his costs, since salaries were fixed and equal, and was also able to control the pace of production, therefore controlling every step of production, what he called mass production (Hoffman, 2009).

7

As a conclusion for this topic, it's possible to state that Taylor's Scientific Management is present in current management organizational practices to a great extent (Cardoso, 2014). All the principles enunciated seems to be already assimilated and rooted in our knowledge regarding organizations, and because of that, it becomes harder to identify and separate them from more modern managerial practices (Rousseau, 2012: 398).

2.2.1.2 Administrative Management

Some years after Taylor's theory, Henri Fayol developed his management model, which he called Administrative Management. Based on what he observed and lived as a professional, he inspired himself in the reality observed in the dynamic of companies and in Taylor's studies to formulate his work. Fayol's main goal was to use facts and with them create general rules, which he called principles or ground rules (Silva, 1960).

Regarding the differences between Administrative Management and Scientific Management, Fayol himself said: "Taylor's approach differs from the one we have outlined in that he examines the firm from the bottom up. He starts with the most elemental units of activity – the workers' actions – then studies the effects of their actions on productivity, devises new methods for making them more efficient, and applies what he learns at lower levels to the hierarchy." (Fayol, 1954). Concluding from Fayol's words, Administrative Management looks into management from a top-down perspective, whereas Scientific Management analysis it from a down-top perspective.

In Fayol's opinion, all organizations share some properties that are crucial to a management point of view, whether or not they are private or public companies, or even if they have completely different sizes. Further, he also states that a family is also an organization that should be managed by using the same principles as a large corporation (Karin, 2010).

The size of a company is crucial from an analysis point of view, since larger organizations give much more importance to management, and therefore, higher positions in hierarchy have management knowledge as a crucial requirement (Karin, 2010).

To begin, Fayol was one of the first persons to describe the main management elements. He called them: planning, organizing, command, coordination and control. All this elements together would represent what he called "the management process" (Wren & Bedeian, 2009). The description of this elements can be found in the image below:

Figure 3 – Fayol's five functions of management (Source: Kaplan Financial Knowledge Bank 2012)
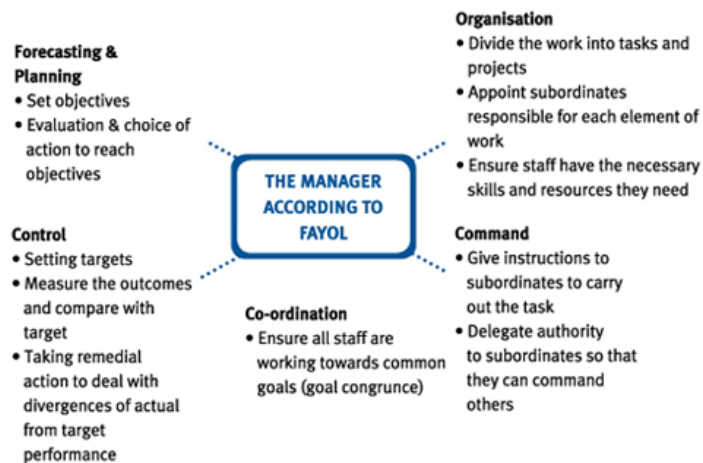
After defining management's elements, Fayol was able to evolve them into what he called the 14 principles of management:

1. **Division of work:** work efficiency and effectiveness can be increase by dividing tasks into smaller ones, and assigning this smaller tasks to specific workers (Rodrigues, 2001);

2. **Authority and responsibility:** having authority is the right to exercise power, to reward or sanction. Whereas responsibility is a corollary of authority, its "natural consequence and essential counterpart" (Shafritz & Ott & Jang, 2015);

3. **Discipline:** discipline is having obedience, behavior and respect towards the agreements between the company and workers (Shafritz & Ott & Jang, 2015);

4. **Unity of command:** this principle can be summarized in 'one boss, one man'. In other words, each worker should only have one line of command to respect (Rodrigues, 2001);

5. **Unity of direction:** each department or group with the same goal, should be directed by one manager only (Ioana & Marinică & Semenescu & Preda, 2014);

6. **Subordination of individual interest:** the interests of the company are more important than the individual interests of each worker (Ioana & Marinică & Semenescu & Preda, 2014);

7. **Remuneration:** remuneration derives from the fact that workers render services to the organization, therefore, the payment method to be used should be considered fair by both parts, the employee and employer, for the organization to function optimally (Gazendam, 1993);

8. **Centralization:** this principle refers that a high degree of centralization/decentralization can cause organization ineffectiveness, therefore, this choice should be a balance between both, depending on the company, in order to reach the optimal centralization degree (Rodrigues, 2001);

9. **Scalar chain:** every organization has superiors and subordinates, and between them there is what is called 'formal lines of authority' (NCERT, 2007);

10. **Order:** order in Fayol's theory means "right person on the right job and everything in its proper place" (Pal, 2010);

11. **Equity:** workers must be treated with respect and should exist equality of treatment among all workers within a company (Gazendam, 1993);

12. **Stability of tenure of personnel:** the basic thought here, refers to the fact that elevated employee turnover values is inefficient (Ioana & Marinică & Semenescu & Preda, 2014);

13. **Initiative:** workers should be motivated in developing and creating their own improvement plans in the company (NCERT, 2007);

14. **Esprit de corps:** the last but not the least important principle, is the promotion of team spirit within the company in order to create harmony among all the workers (Ioana & Marinică & Semenescu & Preda, 2014).

It's not discussable the importance of administrative management for organizations today, since studies show that some companies still follow Fayol principles (for example large steel makers, small organizations, etc.). Regarding the companies that don't follow all principles developed by Fayol, studies show that they for sure follow at least some of them, and regarding those, some principles are more applied than others (Rodrigues, 2001).

2.2.1.3 Bureaucratic Management

As soon as society became more complex, and companies start to grow and reach unthinkable sizes, management processes began to need new planning and organizing processes that would help on managing the enterprises. Companies' core activities started to be concentrated on specialized units, and more than ever, rules and regulations, hierarchy, precise division of labor and detailed procedures were needed. Max Weber, considered the 'father' of Bureaucratic Management, was one of the first persons to realize that bureaucracy was making office operations more routinized, like machines were in the production line (Boddy, 2008).

Described by Jaffee (2001), Weber's Bureaucracy theory has six key elements:

1. Well defined division of labor and authority through formal job descriptions and job titles which result on horizontal division of labor and specialization, which means that each worker has specialized and specific goals to fulfill (Henslin, 2014);

2. Offices organization follow the principle of hierarchy, where lower offices are under control and supervised by higher ones. These incentives vertical division of labor and means that authority is in positions within the hierarchy. In other words "each level assigns responsibilities to the level beneath it, while each lower level is accountable to the level above for fulfilling those assignments" (Henslin, 2014);

3. There are strict guidelines and abstract rules created to be followed in specific cases. This rules are applied to all the workers and follow the principles of standardization and uniformity;

4. The recruitment is based on meritocracy. Recruitment ground rules are based on individual merit and education (Olsen, 2007);

5. Authority, duties and responsibility are attached to positions and not to specific persons, which makes rules and any other types of controls impersonal (Wren & Bedeian, 2009).

6. A worker's main goal should be to have a fixed salary and to pursue a career within their fields (Wren & Bedeian, 2009). Webber also privileges the term life-long employment (Olsen, 2007).

For society today, bureaucracy is already naturalized in our organizations, however our relationship with it is a bit controversial and preconceived, either on our common sense language and understanding or in the theory itself. "In everyday language and 'for the man on the street', bureaucracy is a pejorative term, in many cases denoting a series of negative or frustrating encounters with authorities" (Styhre & Börjesson, 2006). For the academics, its reputation is portrayed as poor performance and pure budget maximization (Styhre & Börjesson, 2006).

Regarding Classical Management School, this three theories are the most impactful theories on management today.

Table 1 – Summary: The Classical School of Management (Adapted from Source: Chandra, 2013)

Scientific	Bureaucratic	Administrative
Concern for precise work methods	Impersonal view of organizations	Development of managerial principles

Best way for jobs to be done	Formal structure, legitimate authority and competence of management	Best way to organize all jobs in a business

2.2.2 Neo-Classical Management School

2.2.2.1 Human Relations

Still in the beginning of the twentieth century, some theorists such as Mary Parker Follet and Elton Mayo recognized the limitations of the classical management school (Boddy, 2008).

Follet main idea of management is getting things done through people. She wanted to replace bureaucratic organizations with organizations design based on the network concept, where workers have individuality to analyze and solve their problems, in order to implement themselves the solutions. Follet states that workers and managers should share power, and all have responsibility on the decision making process. She was one of the first writers to defend the concepts of empowerment, motivation and leadership (Boddy, 2008; Chandra, 2013).

Leaders don't create followers, they create more leaders.

-Tom Peters

In the first quarter of the 20th century, managers of the Western Electric Company started a study called Hawthorne experiments with the main goal of analyzing workers productivity based on the effects of changing the physical conditions. To do that, they've created a control group and an experimental group. Then they would change the level of illumination in the working place for the experimental group. Their results were interesting, since productivity increased, when illumination levels were increased or even decreased. Another interesting fact they observed, was that the productivity for the control group was also increasing. Besides the changes in illumination, it was also tested other types of changes, such as working hours, the length of breaks and so on. In all this tests, productivity increased, even if the variables were changed in a way that workers would not be benefited (Rose, 2005; Boddy, 2008).

Elton Mayo was the one who analyzed the output of this experience, where he concluded that the so called 'economic man' in scientific management, should be called instead 'social man' (Boddy, 2008). Mayo stated that the productivity increase, was not due to the fact that

illumination got better, but because was giving a special attention to workers (Coombs, & Smith, 2003). He also concluded that people have social needs to be satisfied, and that is why productivity increases when management shows interest in the well-being of the workers (Boddy, 2008). Last important conclusion, is that workers individual psychological needs being or not satisfied, also impacts group performance (Chandra, 2013).

2.2.2.2 Behavioral

The behavioral management theories are "a logical extension of the Human Resource School" and they can be summarized in four main points accordingly to Chandra (2008):

- Workers emotional needs are a key and crucial step to achieve greater economic results;
- As stated in Mayo conclusions, employers satisfaction and working conditions are directly related with productivity;
- Motivation is directly influenced positively when workers feel they are part of something (sense of belonging) and when they are empowered in the decision making process of companies;
- Providing constantly diversification and challenging work is crucial for workers' motivation.

A lot of authors tried to model human behavior into several theories. Some examples of this, are the work of Abraham Maslow, Frederick Herzberg, Douglas McGregor and David McClelland.

Maslow theory defends that individuals have a constant inner motivational drive that can justify and classify their motives. The writer has developed what he calls hierarchy of needs/pyramid needs. This so called Maslow pyramid is divided in five levels, where accordingly to Maslow the lower-levels needs must be satisfied first. In other words, and taking the first level as example, humans have physiological needs, such as, the need for water, food, warmth, etc., and this needs must be satisfied before the needs of the next level (safety needs). Therefore, in order to reach the last level of needs, the other four levels must have been satisfied (Pardee, 1990).

Figure 4 – Maslow's hierarchy of needs (Source: FAM99)

Herzberg theorized something different than Maslow in is theory called Motivation Hygiene Theory/Two factor theory, and defends the idea that motivation has two different sources. Therefore, being satisfied or unsatisfied could be a result of motivational factors (satisfiers) or hygiene factors (dissatisfiers). The motivational factors are responsible to directly increase satisfaction, and accordingly to Herzberg they are primarily intrinsic. In the other hand, the hygiene factors cannot motivate, and if they are used with the goal to do it, it can actually have negative motivational effects. Instead, the absence of this factors can provoke dissatisfaction, which makes them extrinsic causes (Pardee, 1990).

Table 2 – Examples of Satisfiers and Dissatisfiers factors (Adapted from Source: Pardee, 1990)

Satisfiers	Dissatisfiers
Achievement	Company policy
Recognition	Supervision
Work itself	Working conditions
Responsibility	Interpersonal relations
Advancement	Salary
Growth	Status
	Job security

A deprivation in hygiene factors can lead to job dissatisfaction, but their amelioration does not lead to job satisfaction.

*- **Frederick Herzberg***

Another well-known theory was developed by Douglas McGregor, where the writer was able to define two profiles/contrasting set of assumptions made by managers. This is called the Theory X and Theory Y. In theory X, McGregor assumes that all workers are unmotivated and

don't like what they do, and because of that this workers must be coerced, controlled and directed. The average worker would prefer to be directed than have responsibilities. On the other hand, the Theory Y describes workers that take responsibilities and that are motivated to achieve their goals. This workers also seek for challenges, are self-driven and consider work as a natural part of their lives, which makes them problem-solvers by nature (Bolden & Gosling & Marturano & Dennison, 2003).

Figure 5 – Theory X and Theory Y (Source: research-methodology.net)
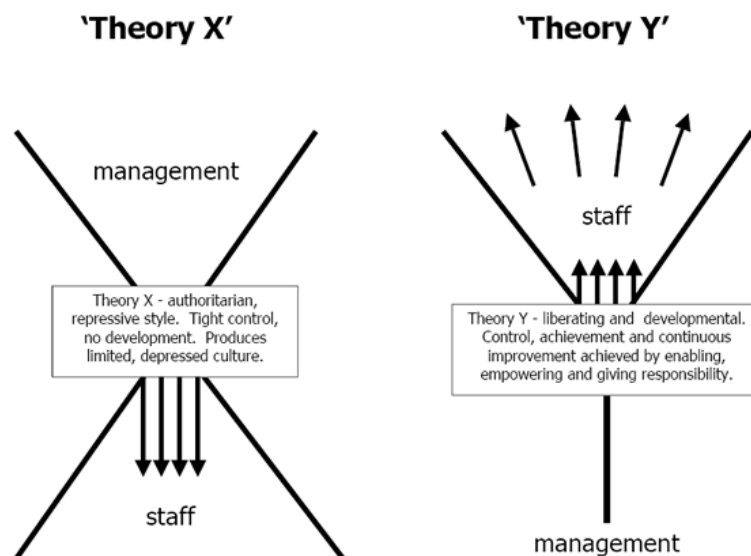
David McClelland approaches the motivation subject from another angle, where he proposes that having strong needs, can be used as a primary effect to motivate a person in order to satisfy those needs (Pardee, 1990).

Regarding this theory, McClelland divided the different needs into three groups: need for achievement, need for affiliation and need for power (Shanks, 2007). Shanks described both groups this way:

- Need for achievement: humans are driven towards success, reaching goals, mastering skills, etc.;
- Need for affiliation: desire of belonging to a group, family or society. Desire to establish relations and associations;
- Need for power: desire for control, authority, responsibilities, and positions of power.

2.2.3 Modern Management School

The modern management school theories appeared in a context where complexity is present everywhere. Companies, persons, environments, relations need to be understood, as well as the interactions between them (Chandra, 2013).

2.2.3.1 Systems Approach

The system theory in management, looks at companies as if they were collection of unified parts that have a similar overall goal. The nature of the entire system (company) is made by the integration of every single part that composes it. If some part of that system disappears, the entire nature of system also changes. In this theory, this parts are classified into four main areas: inputs, processes, outputs and outcomes. Inputs are related with resources and people. Processes are related with the main management elements, planning, organizing, motivating and controlling. Outputs are the products and services that companies provide. And outcomes is related with the customers/clients and productivity. This theory is not that easy to apply in practice, since managers have to look at it, and be able to spot and understand the numerous patterns and events related within their companies (Olum, 2004).

2.2.3.2 Contingency Approach

Writers that theorized the contingency approach state that there is no perfect way to manage people or work, since every situation is unique in its own way. The most important conclusion that this brings to managers, is that they have to study every single situation, decision, person, company, competitor, etc. (Raduan & Jegak & Haslinda & Alimin, 2009).

So when making a decision, what this management theory defends is that it's important to analyze every single aspect of it, since those aspects are key to the situation (Olum, 2004). A very important 'rule' is that something that worked in the past in a similar situation, will not necessarily work in a more recent situation (Thenmozhi, 2007).

2.2.3.3 Management Science

Management science theory has the premise of bringing to the decision making process in management the tools based on the scientific method. This tools can be statistics, linear programming, network analysis, decision trees, computer simulations, information models and/or mathematical models. The main goal of this theory is to rationalize every step and part

of the decision process, with the intent of reducing uncertainty and all risks associated (Raduan & Jegak & Haslinda & Alimin, 2009).

2.2.3.4 Chaos Theory

As the years passed in the 20th century, the world started to become more chaotic and less predictable, so as companies. Despite this change, managers for a long a time acted like organizational events were always predictable. The huge turnaround regarding this reality happened when managers recognized that this chaos was actually reality, which allowed them to start preventing and anticipating the chaos itself. This increased the importance on the so-called 'small decisions' or 'small actions', since managers realized that those decisions could have huge impact in the entire system (Olum, 2004).

2.2.3.5 Decision Theory

Probably, making decisions is one of the most important activities for managers, since it involves, uncertainty, complexity, risks, alternatives, interpersonal issues, etc. (Pomerol & Adam, 2004). Decision theory is about dealing with situations where it's needed to choose between alternatives, having in mind that each choice has always consequences, or what it may be called as outcomes (Rapoport, 2013).

There are three different approaches on decision theory: normative, descriptive and prescriptive. The way decisions are made is described by the approach descriptive; the way decisions should be made is analyzed in the prescriptive approach; and the best possible scenario, assuming maximum rationality and intelligence is described in the normative approach (Grant & Zandt, 2007).

Analyzing management theories evolution makes it possible to understand why theories were developed, and why they were forced to evolve in some particular moment in time. From the classical management school, where industry made theories look deeply into the processes, through neoclassical management school, that tried to solve the main problems related with the classical theories that discarded almost completely the concept of worker as a person and its need to be motivated, until the modern management school that tried to theorize about complexity, management theories evolution was forced to adapt to society evolution (Chandra, 2013).

Figure 6 – Summary of the Evolution of Management Theories (Source: Chandra, 2013)
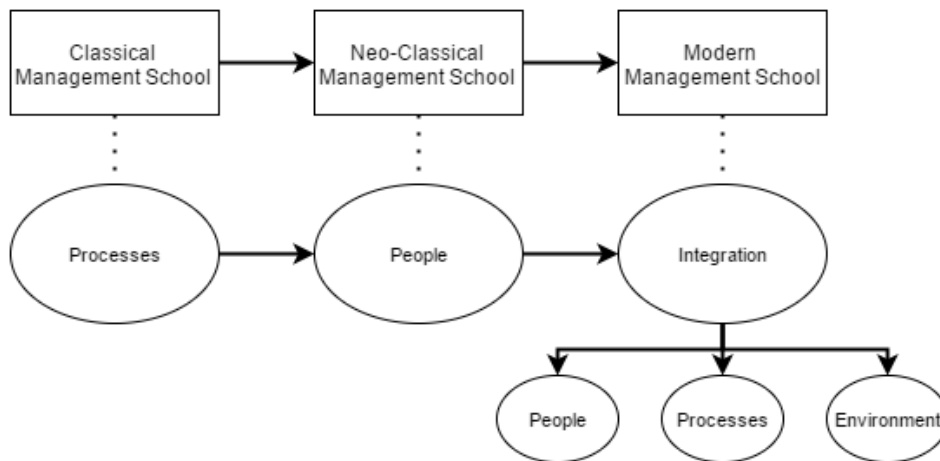
2.3 Business Research

For Managers today knowing about all aspects of their business is a crucial step that will dictate the success or failure of the entire management process. Doing business research is to increase awareness and understanding regarding business problems and opportunities, is to develop and execute alternative plans, and finally is to monitor business performance with factual data (Zikmund & Babin & Carr & Griffin, 2010).

Business research is more than conducting surveys.

- Zikmund & Babin & Carr & Griffin, 2010

It ain't the things we don't know that gets us in trouble. It's the things we know that ain't so.

- Artemus Ward

The entire goal of what we call business research is for it to be used as a support platform and facilitator to the decision-making, by providing crucial information in order to decrease risks of making wrong decisions, which will lead to the increase probability of success of the problem-solving and decision making activities (Zikmund & Babin & Carr & Griffin, 2010). Another definition for business research, is that it provides a systematic way of getting information into the managerial decisions (Cooper & Schindler, 2013).

Knowing where the finish line is situated and what needs to be done to get there is imperative for an organization strategy. Business research's job to this matter is to provide information about what is happening within a company and in the environment that surrounds it (Zikmund & Babin & Carr & Griffin, 2010).

For Cooper and Schindler (2013), good research happens when data is generated from well conducted practices, which then can be used for decision making. In opposite, there is bad research, which means a research that was carelessly planned, resulting in information that is not usable to reduce decision-making risks. One key element of the entire research method, is the use of the standards present in the scientific method, which makes the entire analysis reliable and rational.

To support the process of getting data and analyze it, there are a lot of tools and techniques that provides to the entire process the rationality and rigor needed. Some examples of this tools are: Benchmarking, Focus Group, Interview, Regression/Correlation Analysis, Control Group, Observation, Simulation, Market Study, Survey/Questionnaire, Expert Judgement, Historical Reports/Reports (Cooper and Schindler, 2013), Gap Analysis (Ritchey, 2013), Operational Risk (Samad-Khan, 2008), Trend Analysis (Greener, 2008), Wisdom Crowd (Yi & Steyvers & Lee & Dry, 2012), Prototyping (O'Leary, 1988), Hall Test (Dumas, 1999) and Three Points Estimate (Rothschild, 2011). This list is not complete, and it'll never be, since this are merely examples of business research tools and techniques. In the following table I'll describe each tool/technique enunciated before:

Table 3 – Business Research Tools & Techniques Description (Adapted from Multiple Sources)

| Business Research Tools & Techniques	Description
Benchmarking	To benchmark is to compare ourselves with others, and from that comparison we are able to extract data. This comparison, can be made between processes, people, programs, etc. (Cooper and Schindler, 2013)
Focus Group	A focus groups refers to the involvement of a small group of people (8 to 10) that interact with each other in order to generate data regarding a specific topic. This interaction is moderated by the researcher or researchers' team (Cooper and Schindler, 2013)
Gap Analysis	Method used to analyze the difference between two elements. This elements can be an organization, activity or knowledge base. This comparison is normally used to compare the current state of an element with its desired future state (Ritchey, 2013)
Interview	An interview is a communication approach to collect data. It can be done by phone, in-person, video conference, etc. (Cooper and Schindler, 2013)
Operational Risk	Operational risk is used to model the uncertainty of a process. Operational risk is characterized by the possibility of process's failure and execution errors (Samad-Khan, 2008)
Regression/Correlation Analysis	It refers to the use of simple or multiple predictions, in order to predict Y from X (Regression). Correlation analysis refers to the study of the relation between multiple variables that by changing

	together can positively or negatively change the entire system (Cooper and Schindler, 2013)
Reports/Historical Reports	Gather data from the knowledge present in historical reports. This data repositories are quite often used in the exploratory phase of the research (Cooper and Schindler, 2013)
Three Points Estimate	Technique used to probabilistic calculate the expected value of a variable (Rothschild, 2011)
Trend Analysis	This analyze is made to forecast the future increase/decrease of a variable. In other words, to perform this analysis is to generate data in order to predict the evolution of a particular variable (Greener, 2008)
Wisdom Crowd	This method refers to find and get data/thoughts from a group of individuals, instead of getting it from an individual. It is perceived that making a decision based on data collected from what is called 'crowd', has much better results than base decisions in data provided by an individual (Yi & Steyvers & Lee & Dry, 2012)
Control Group	Control group is a group of participants that are not exposed to the variables in study, in order to use them as a base comparison measure with groups that are exposed to the independent variable (Cooper and Schindler, 2013)
Hall Test	Type of usability testing, where random people are gather with the purpose of testing a product or service (Dumas, 1999)
Observation	To observe is to monitor behaviors, activities and conditions. Some examples could be an linguistic analysis, extra linguistic analysis, physical conditional analysis, spatial analysis, etc. (Cooper and Schindler, 2013)
Prototyping	Prototype is to produce what is called 'proof of concept' or an approximate 'draft version' of a product in order to test out its design, scalability characteristics, etc. (O'Leary, 1988)
Simulation	Simulate is the act of replicating the conditions and characteristics of a process or system multiple times (Cooper and Schindler, 2013)
Expert Judgment	Expert judgement is gather data provided by someone knowledgeable about a topic that is recognized by others by having the necessary credibility to express such data (Cooper and Schindler, 2013)
Market Study	A market study is a particular type of survey for gathering and evaluate data regarding consumers preferences, behaviors, ideas, etc. (Cooper and Schindler, 2013)
Survey/Questionnaire	A survey is a structured interview with the purpose of gathering data. Surveys are composed by measurement tools, such as questionnaires, measurement instruments, etc. (Cooper and Schindler, 2013)

2.3.1 Scientific Method

The steps of discovering and generating factual and objective information to the decision-making in management, have particular steps that are extremely important to the credibility and reliability of the research data. The cycle starts with the historical knowledge and present knowledge that analyzed together will help the formulation of Hypotheses in the research process. This Hypotheses then need to be tested and validated against reality, what can be done through experimentation. By the end of the entire cycle this methods will either support or

contradict the Hypotheses defined, which will lead to the creation of knowledge (Zikmund & Babin & Carr & Griffin, 2010).

Figure 7 – A summary of the scientific method (Adapted from source: Zikmund & Babin & Carr & Griffin, 2010)
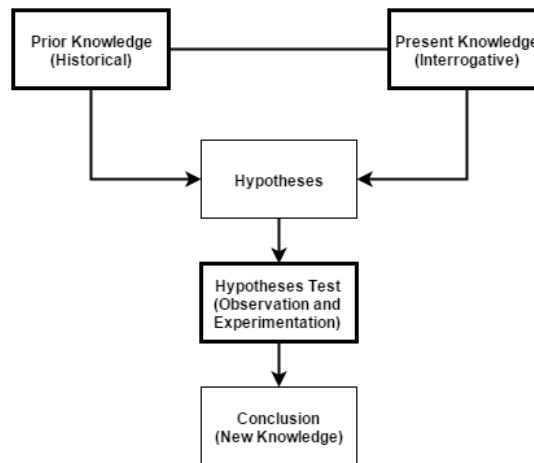
Cooper and Schindler (2013) defined what they believe to be the most important characteristics that the scientific method should have:

- **Purpose clearly defined:** the first big step is the definition of the problem itself, which may appear easy to do, however it's a very complex step since it's crucial that the problem defined is the actual research problem and not a perception of it. The main goal is to create a problem that is not ambiguous, therefore understandable by all;

- **Research process detailed and planned:** the research tools and techniques that are going to be used must be defined in detail, and the entire process planned with rigor, to make possible for another researcher to start/continue/end the process;

- **High ethical standards applied:** participants, clients, organizations and researchers should be safeguarded against possible harms provoked by the research process;

- **Limitations revealed:** almost everything in life, is still yet to achieve perfection, and the same happens to the research studies. Researchers should reveal the problems with their studies and their possible impacts on the final result in maximum honesty;

- **Adequate analysis for decision makers' needs:** the tools and techniques used to gather and analyze data, should be appropriate and adequate to the needs and specific characteristics of the research;

- **Findings presented unambiguously:** the conclusions reached should be presented in the most objective way possible, to be clearly understood by the decision makers and not to influence their final decisions;

21

- **Conclusions justified:** when we reach the step of making conclusions, we are entering again in a world of deduction/induction based in our personal opinions and life experiences. A good researcher when presenting his conclusions, should specify all the conditions and variables that he has defined to make his conclusions seems valid;

- **Researcher's experience reflected:** Cooper states that is also very important for the quality of the research study, the experience and integrity of the researcher, therefore the final report should contain information about the qualifications of the researcher.

Academic research itself is already made with rationality and based on science. Business research is one of the first approaches that science and rational processes are making towards the managerial decisions (Greener, 2008). Business Research is used to "understand what motivates people and organizations, and understand processes and machines." (Cooper and Schindler, 2013). This research process is based on planning, acquiring, analyzing and providing relevant data and information to managers (Cooper and Schindler, 2013).

CHAPTER 3 – METHODOLOGY

This chapter will describe how the investigation is going to be made in order to raise understanding about the research problem defined. The methodology delineated will take into consideration the literature review made before, in order to maintain a perfect alignment between the theory involved with the subject and the methodology used to study it.

3.1 Research Paradigm and Context

The problem to be researched has to do with the decision making of managers today. As described in the literature, the world is becoming more and more complex, so do companies. Managers are towards questions increasingly more difficult than before, and their analysis has to contemplate not only every single element in the entire system, but also the relations between those elements. In this increasingly complexity it's becoming harder to predict decisions impacts and risks, since even a small decision can have huge repercussions in the entire environment. It is possible to summarize the research problem here identified with the following question: **How do managers decide today?**

Possibly, the only tool available to man besides technology, that is able to transmit integrity and reliability to the decision making process today, is science. So the context for this study, as shown before in the literature, will be the business research methods, because it's the only 'bridge' known and defined, that can connects Management decision making process with Science. Because of it, the context of this study will take into consideration the tools and techniques of business research methods (described in Table 3). For the context of the study to be completed, are going to be added the three main steps of the scientific method, that are responsible to formulate the hypotheses and reaching the conclusions (described in Figure 7). This steps are the **Interrogative** (Observation), **Historical** (Prior Knowledge) and the **Experimentation** (Hypotheses Test) steps.

For the context defined it is possible to state that managers can only make decisions based on two types of tools. The science tools, which would be the use of business research tools and techniques. Or in the opposite side, by using their personal tools, such as intuition, feelings, experience, rules of thumb, etc.

In God we trust; all others must bring data.

*- **W. Edwards Deming***

Feelings are the fine instruments which shape decision-making…

- Willard Gaylin

3.2 Research Questions

Based on the context defined before, it's possible to define four questions to be posteriorly tested. The main question is:

Q1: Do the majority of Managers frequently make decisions based on science, as opposed to the use of feelings and intuitions?

To help on validating this first inquiry are also going to be tested three secondary questions:

Q1.1: Are Historical research methods used frequently by the majority of managers?

Q1.2: Are Experimentation research methods used frequently by the majority of managers?

Q1.3: Are Interrogative research methods used frequently by the majority of managers?

The objectives for this study are directly related with the questions raised, which are:

- Understand in which degree science is present in the decision making process of managers.
    - Evaluate which steps of the scientific method are contributing more to managers' decisions today.

3.3 Research Approach

To define the research approach is imperative to understand what the problem involves and which studies have been made regarding this subject. The study problem is related with the daily life of managers and their main task: decide. And due to the fact that in literature nobody has yet looked into the presence of the scientific method in managers' decisions, and that some work has been done in the area of business research methods this study will be consider a descriptive study.

The goal of this types of research is to explore and explain newly explored fields (Kowalczyk, 2015). As newly explored fields, is being considered Business Research Methods' impacts on Management Decision Making processes. The research tools for this type of study, is advised to be based on quantitative techniques that can generate simple descriptive statistics (Patricia, & Rangarajan, 2013). So, the research technique that is going to be used to collect primary data will be the survey, since it's the most suitable giving the characteristics of the study. If this

study was in an exploratory phase, interviews would be the best technique to use, but because the study is descriptive, the goal is only to get simple quantitative data, therefore the use of a survey is the option to go.

3.4 Research Technique

The survey was chosen as technique to pursue this investigation, and due to the fact that the goal is to evaluate the scientific method presence in management decisions, the survey was built based on the theory described before: scientific management methods steps and business research tools. For each technique a scientific method step was matched. The following table explains the structure of the instrument:

Table 4 – Survey description (Self constructed table)

Survey Page	Scientific Method Step	Business Research Tools and Techniques	Questions Validation
3	Historical Methods	• Benchmarking • Focus Group • Gap Analysis • Interview • Operational Risk • Regression/Correlation Analysis • Reports/Historical Reports • Three-Points Estimate • Trend Analysis • Wisdom Crowd	Q1.1
4	Experimentation Methods	• Control Group • Hall Test • Observation • Prototyping • Simulation	Q1.2
5	Interrogative Methods	• Expert Judgement • Market Study • Survey/Questionnaire	Q1.3

Regarding the survey pages 3-5, it is asked in a scale from Never to Always (4 levels) the degree of use of each business research tool. Besides the three survey pages described above that will be responsible to validate or not, individually each secondary research questions, and together the primary inquiry, it were added three more survey pages. The first page was created with the purpose of explaining this study to the participants, and its goals. The second page was created to characterize the sample, which has questions regarding each individual: their industry,

company size, company department, job role and country of work. Finally, the last page of the survey asks to people who are going to participate in the survey, if they are interested in receiving it by the end of the research.

For the survey not to be ambiguous, it was also added a small description to each tool and technique (referred in Table 4), and an option per technique for people that are not familiar with them (option 'Don't know'). The final version on the survey can be found in the appendix (annexes A).

3.4.1 Research Technique Pre-Test

As stated by Cooper and Schindler (2013), it's extremely important to conduct a pre-test to the research technique chosen, in order to discover ways to captivate and keep the participant's interest and to discover errors and ambiguous situations that could exist.

Based on this recommendation, I've done pre-test to a group of 5 managers, which allowed me to receive their recommendations, suggestions and opinions. With that information the survey was improved and another pre-test was realized to a group of 5 different managers, which allowed me to conclude that the survey was ready to be released to the target population.

3.4 Research Target Population

This study intends to analyze managers' decision making, and whether or not science is part of that process. Because of that, the target population intended for this study are middle-top managers.

3.5 Final Considerations

The survey created to support this research was released between May 2015 and September 2015, and because the target population are middle-top managers the survey was sent through private messages in LinkedIn and by email to specific contacts that have the profile defined in the target population. In total were sent 193 private messages.

From the 193 private messages, was possible to collect 105 answers, however only 96 were considered valid answers, since the other 9 were incomplete. This numbers represent a final response rate of 49.74%.

CHAPTER 4 – RESULTS

In chapter four of this investigation paper, the main goal is to make a thorough analysis and provide the respective conclusions regarding the data collected from the surveys sent. The expectation is that the proposed research questions of this dissertation can be validated or not. To simplify the analysis all values are going to be rounded.

4.1 Sample Profile

To begin with the sample characterization, are going to be analyzed the answers to the **Company Information** survey questions group (page 2 of the survey). This includes, Organization's Industry, Company Size, Working Department, Job Role and Country.

4.1.1 Industry

In order to understand if the use of business research tools and techniques is influenced by the industry/sector, it was asked to the participants their industry of work.

Table 5 – Industry (% responses summary)

Industry	Responses
Telecommunications, Technology, Internet & Electronics	23,96%
Other (please specify)	21,88%
Education	9,38%
Finance & Financial Services	7,29%
Construction, Machinery, and Homes	5,21%
Business Support & Logistics	5,21%
Airlines & Aerospace (including Defense)	4,17%
Entertainment & Leisure	4,17%
Retail & Consumer Durables	3,13%
Automotive	2,08%
Nonprofit	2,08%
Food & Beverages	2,08%
Government	2,08%
Manufacturing	1,04%
Insurance	1,04%
I am currently not employed	1,04%
Advertising & Marketing	1,04%
Utilities, Energy, and Extraction	1,04%
Healthcare & Pharmaceuticals	1,04%
Real Estate	1,04%
	100%

In what regards to the industry we can state that most of the responses were related to the Telecommunications, Technology, Internet and Electronics (**24%**), and the second most responded industry was answered in other category (**22%**), which makes it imperative to study it in detail. Besides this two options, Education (**9%**) and Finance & Financial Services (**7%**) were respectively the third and fourth industry most answered.

Related to the other category that got 21.88% of the responses, the specified responses were:

Table 6 – Industry - Other Category detail (% responses summary)

Industry	Responses
Consulting	16,67%
Tourism	2,08%
Hospitality	2,08%
Law	1,04%
	21,88%

As shown in table 6, the other category responses were Consulting, Tourism, Hospitality and Law. To simplify this analysis, some of the other responses were converted to respective generic term. One example is Management Consulting being converted to Consulting. If we now use this values, instead of the other category, the final result and analysis would be:

Table 7 – Industry with other category specified (% responses summary)

Industry	Responses
Telecommunications, Technology, Internet & Electronics	23,96%
Consulting (other)	16,67%
Education	9,38%
Finance & Financial Services	7,29%
Construction, Machinery, and Homes	5,21%
Business Support & Logistics	5,21%
Airlines & Aerospace (including Defense)	4,17%
Entertainment & Leisure	4,17%
Retail & Consumer Durables	3,13%
Tourism (other)	2,08%
Hospitality (other)	2,08%
Automotive	2,08%
Nonprofit	2,08%
Food & Beverages	2,08%
Government	2,08%
Law (other)	1,04%
Manufacturing	1,04%
Insurance	1,04%
I am currently not employed	1,04%

Advertising & Marketing	1,04%
Utilities, Energy, and Extraction	1,04%
Healthcare & Pharmaceuticals	1,04%
Real Estate	1,04%
	100%

By making this analysis, the only change to the results already discussed is that the second most answered option has now 17% and is the consulting industry.

4.1.2 Company Size

With the goal of understanding if the company size is a determinant factor in the degree of science present in the decision making process, was asked to the participants the size of their company.

*Figure 8 – Company size (% responses)*
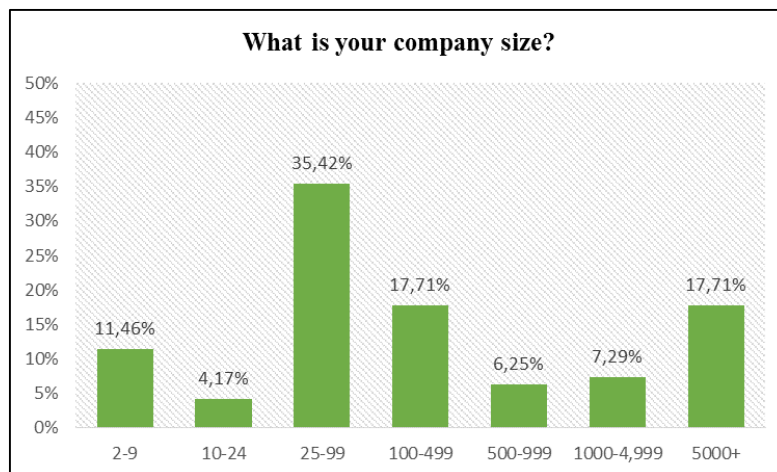
Clearly the majority of the responses were by participants who work in companies which have more than 25 employees and less than 99 employees (**35%**). Regarding other company's sizes, **18%** of the participants work in companies where the number of employees is between 100 and 499. For companies with more than 5000 employees, the number of participants is the same (**18%**). We can also state that **49%** of the participants work in enterprises which have more than 100 employees.

4.1.3 Department

Another interesting variable to take into consideration, and try to understand if can justify the use or not of business research tools is the work department.

Figure 9 – Department (% responses)
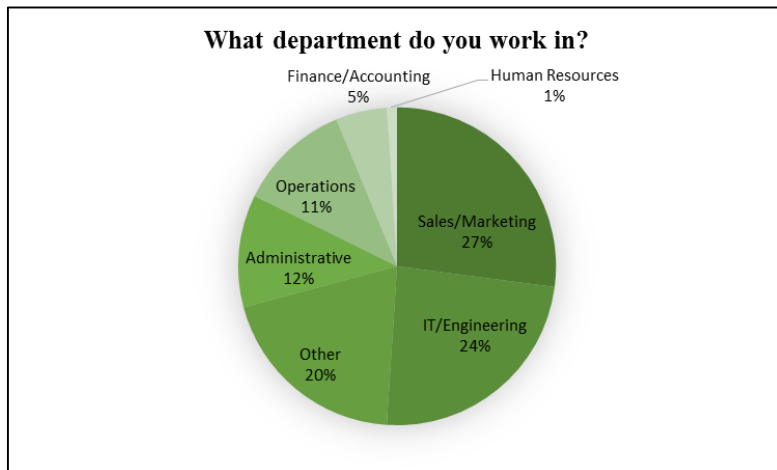
As we can see in figure 9, **27%** of the participants work in the department Sales/Marketing, **24%** in IT/Engineering, **20%** provided an alternative question, **12%** work in Administrative department, **11%** in Operations, **5%** in Finance/Accounting and **1%** in Human Resources. For those who provided another answer, some of the responses were: Administration, All of the above, Business Development, Direction, Management, Procurement, etc. All the provided answers are unique, which means all the participants who have chosen the other option provided a unique department as their answer.

4.1.4 Job Role

In order to understand if in different vertical positions of companies' hierarchies, the use of business research tools varies, it was also questioned the job role of the participants.

Figure 10 – Job Role (% responses)
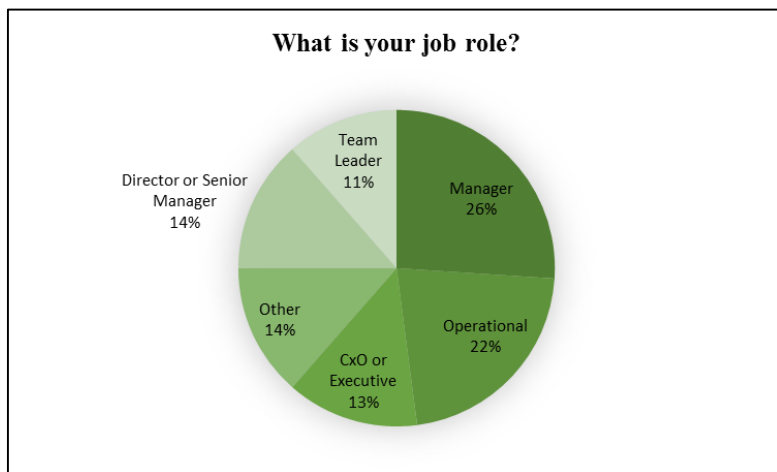
Accordingly to figure 10, **26%** of the participants have the job title Manager, **22%** have the role Operational, **14%** the role Director or Senior Manager, **14%** specified a different answer,

13% the role CxO or Executive and **11%** the role Team Leader. Regarding the specified answers, some of them were: Partner Account Manager, Project Manager, Service Manager, Professor, etc. We can also state that **64%** of the participants have management responsibilities, by excluding the job role operational and the specified answers (other), which means more than half of the participants are directly involved with the decision making process.

4.1.5 Country

Figure 11 – Country (% responses)
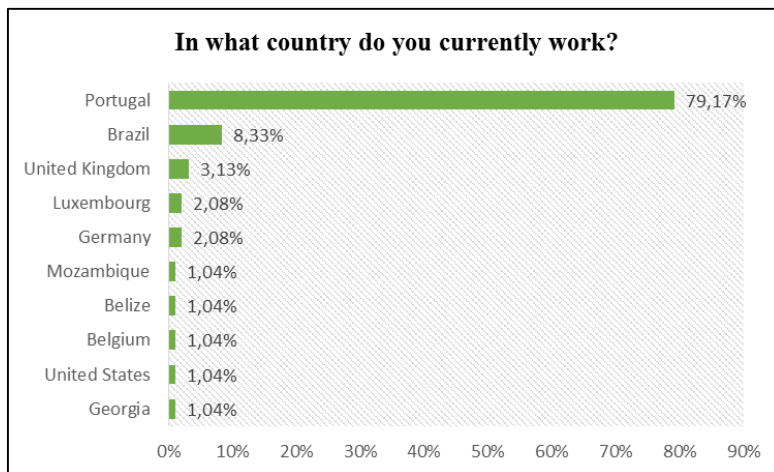
Related to the country of origin of the participants, Portugal represents **79%** of the sample, **8%** of the answers came from Brazil and there were also answers from Unite Kingdom, Luxembourg, Germany, Mozambique, Belize, Belgium, United States and Georgia.

4.2 Results Analysis

After analyzing the sample profile, it's time to analyze the results itself (page 3, 4 and 5 from the survey). This analysis is going to be organized in three parts, where each part is going to have a global analysis and a more detailed critique per tool. Regarding the business research tools questions, it is going to be attributed values to the answers in the following format:

- Answer Never: Value of 1
- Answer Rarely: Value of 2
- Answer Frequently: Value of 3
- Answer Always: Value of 4
- Answer Don't know: Value of 0

4.2.1 Historical Methods

The group historical methods in the survey contemplates 10 different business research tools and techniques, which are used to gather historical data. The following analysis' goal is to understand which tools are most used and which are less used, and to understand if there is some pattern that could be detected in the results.

Figure 12 – Historical Methods (average analysis)
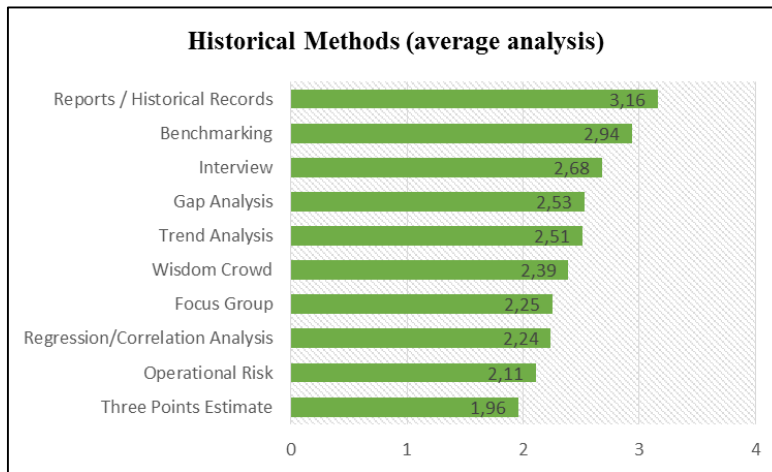
From analyzing figure 12 is possible to conclude that half of the historical methods are in most cases rarely used, since they got an average value superior to 1.50, and in the other half of the cases are at least frequently used, since they got an average value superior to 2.50. Reports/Historical reports is by far the most used historical method with an average score of 3.16, which means that in most cases is a frequently used tool. This method is followed by Benchmarking with a score of 2.94, then by Interviews with 2.68, then by the Gap Analysis and Trend Analysis, with respectively 2.53 and 2.51. With lower values, we have the Wisdom Crowd with 2.39, the Focus Group with 2.25, and at the end of the table the techniques of Regression/Correlation Analysis, Operational Risk and Three point estimate, with the values 2.24, 2.11 and 1.96 respectively.

Interesting enough, is the fact that the top 3 historical methods are simple methods that involve almost none mathematical calculus. In the other hand, the less used tools/techniques are related with mathematical calculus and statistical models. We can also extrapolate that the use of this methods could be related with their complexity or simplicity, where simple tools seems to be more frequently used than the more complex methods.

The fact that mathematical and statistical methods are the least used could be an indication of the inexistence of data to be serve as an input to this methods. This data could be business metrics and company indicators, which probably is only available and used when the decision to make is considerable and worth's the time effort and investment to use more complex methods.

4.2.1.1 Benchmarking

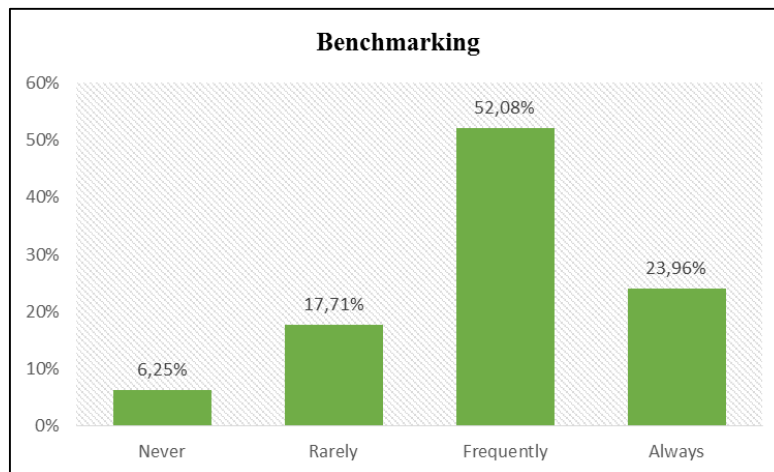*Figure 13 – Benchmarking (% responses)*

Figure 13 shows that **6%** of the participants never use the Benchmarking technique, **18%** rarely use it, **52%** use it frequently and **24%** have Benchmarking in their business tools list always. This results mean that all participants know this tool, since nobody has answered otherwise, and that **75%** use it at least frequently. As opposite to the **25%** of managers that in a best scenario use it rarely.

The results show that this a very used technique, that probably is helping out companies on their survivability. By doing benchmark, companies can analyze their competitors in order to know what needs to be done to overcome them. What participants are probably doing with this technique is to use it to get ideas and define their goals based on the external environment.

Quite often we are in a position where there is someone that is performing better than us, and that is probably why benchmark is very used. However, those who are not using it, probably don't want to be influenced by the results of benchmark, showing that they are better than their competitors. The problem could be the sentiment of complacency and the start of taking everything for granted. Benchmark is also only part of the analysis, therefore it needs a considerable investment, since after it, there is the need of creating a plan and implement it.

4.2.1.2 Focus Group
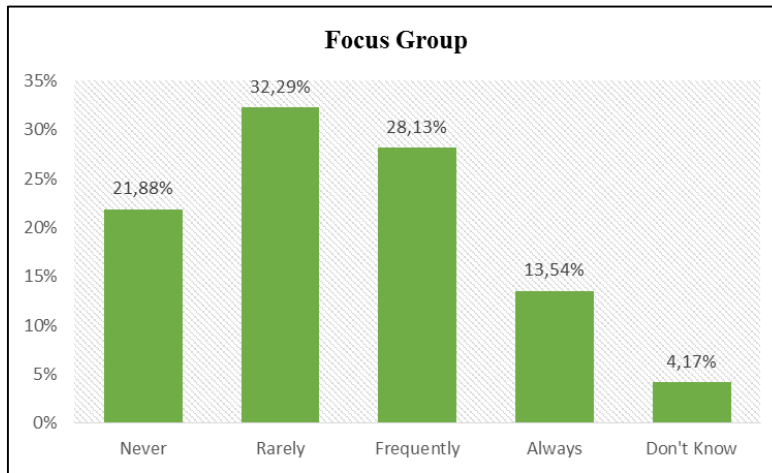
Figure 14 – *Focus Group (% responses)*

Figure 14 summarizes the results for the Focus Group technique, where **22%** of the participants admits to never use it, **32%** to rarely use, **28%** to frequently use it, **14%** to always use it, and finally **4%** state that they don't know this tool. Clearly, about 50% of the participants state that they never or rarely use the Focus Group technique, whereas the majority of the participants that apply the technique more often, only do it in a frequently regularity.

The focus group can be a great tool to easily measure customer reaction and opinion, and that is why some of the participants are using it. Some of its problems can be the cost, and the lack of in-depth knowledge, that for example in one-to-one interviews would be higher, and this justifies why probably it is only used in considerable projects/decisions, that worth the time, cost and high level analysis. The high numbers of rarely regularly use could be justified by the facts stated, since that, this is sometimes a tool that is not meant to be used all the time, but only when the decisions justify it. There are also those who believe that the moderator could influence the outcome of this sessions, and that could justify why some managers don't use the technique a single time.

4.2.1.3 Gap Analysis

Figure 15 – Gap Analysis (% responses)
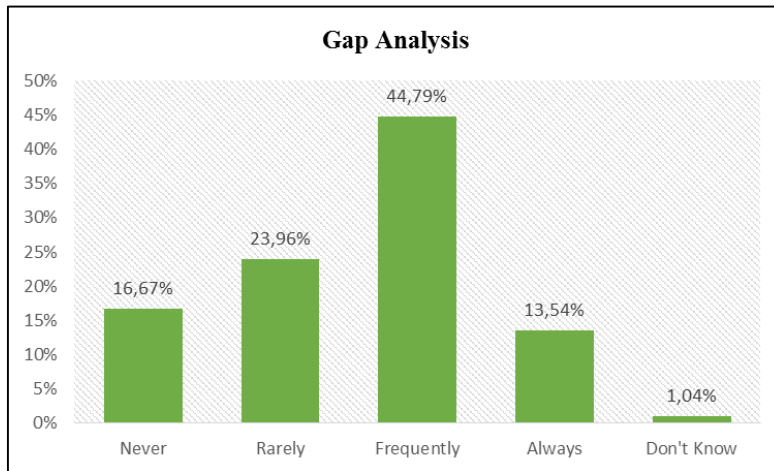
From the numbers present in figure 15 it is possible to state that **17%** of the participants never use the Gap Analysis, **24%** rarely use it, **45%** frequently use it and **13%** always use it. Regarding the knowledge about the technique **1%** admits not to know it. If we add the numbers we can conclude that **58%** of the participants values the gap analysis in their decision's process, since they at least use it frequently.

To perform a gap analysis is to compare the goals of a company and their actual performance, for example. This could happen in the accounting department, IT department, etc. Can also be, to compare future needs of the company and their actual competencies, and from that understand what is missing and what needs to be improved. The study as shown that the majority of the participants use it at least frequently, probably because it is a very powerful tool that helps on getting a complete overview of the actual state of a company in a particular department or situation. This overview will help on establishing priorities or goals, in order to reduce the gap between the variables of the analysis. These are probably the reasons why managers rely on this analysis, since it provides a very powerful summary between the current state of their companies and their goals in time.

It is also true that this analysis have considerable costs, since it's very demanding in terms of data gathering and data analysis. Another fact is that performing gap analysis frequently could reduce, in some situations, the motivation of the workers, because it means to scrutinize their goals and their performance. This reasons could justify why some participants never perform this types of analysis.

4.2.1.4 Interview
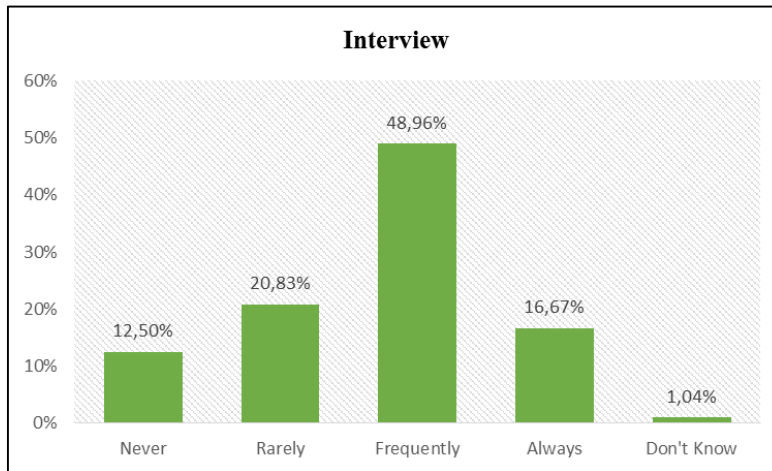
Regarding the interviews, **1%** of the participants admits not to know the technique, whereas **12%** states never to apply it, **21%** to do it rarely, **49%** to frequently do it and **17%** to always do it. The numbers show that more than half of the participants (**66%**) use this technique at least in a frequently regularity degree.

The interviews are used for multiple purposes by managers, for example in the recruitment process, in establishing partnerships, in creating a new business relation, in understanding customer needs, etc. Figure 16 shows that the technique is frequently used by the majority, and even some of the persons use it always. For a manager there is probably not better technique to develop a relation, since it helps on increasing mutual understanding between two sides. Also, to select a candidate it is much easier to know a person by talking with her, instead of reading their history in a piece of paper, or having someone describing her. This are only some possible reasons that justify the use of the technique by the managers that rely on face-to-face conversations to know someone, to motivate their workers, to establish relations, to close out deals, etc.

There are no perfect techniques, which makes the interviews to have some weaknesses too. To start, the process is time consuming (before, during and after the interview), then it has its costs, which depend on the cost of the interviewer and the quantity of persons to interview. Could also be considered an incomplete process regarding data gathering, since it is not possible to extract all the data in an interview. This reasons could justify for it not to be used in some sectors and by some managers.

SCIENTIFIC MANAGEMENT METHODS

4.2.1.5 Operational Risk

Figure 17 – Operational Risk (% responses)

Figure 17 shows another history from what we are observing regarding the historical methods. For **27%** of the participants Operational Risk technique is never present in their decision making process. **38%** of the answers state that this technique is rarely used, **28%** points to a frequently use and only **6%** of the deciders use it always. Also, **1%** of the participants state that they are not familiar with the tool. Summarizing the numbers, we can see that **65%** of deciders have a very low use regularity of Operational Risk analysis.

The operational risk tool helps companies to understand that, because they are not perfect and will never be, there is a risk associated with that imperfection. This is related with people, processes and systems in a company, where companies have to balance the costs of solving their operational problems and the expected benefits of it, in order to define their risk tolerance. The data gathering shows that the majority doesn't use this technique a lot, and that is probably because it is very expensive and time consuming. This is not a one-time analysis, since it is imperative to gather large quantity of data continuously, which makes the use of qualified workers, specialized software and the help of everybody to be imperative factors for the analysis to be credible and possible. This reasons justify why operational risk is probably only used in big companies and sectors where operational effectiveness and efficiency are crucial for the success, since it makes companies to continuously pursue perfection, reducing their operational risks in order to prevent unexpected costs and losses (such as internal/external frauds, system failures, clients dissatisfaction, etc.).

37

4.2.1.6 Regression/Correlation Analysis

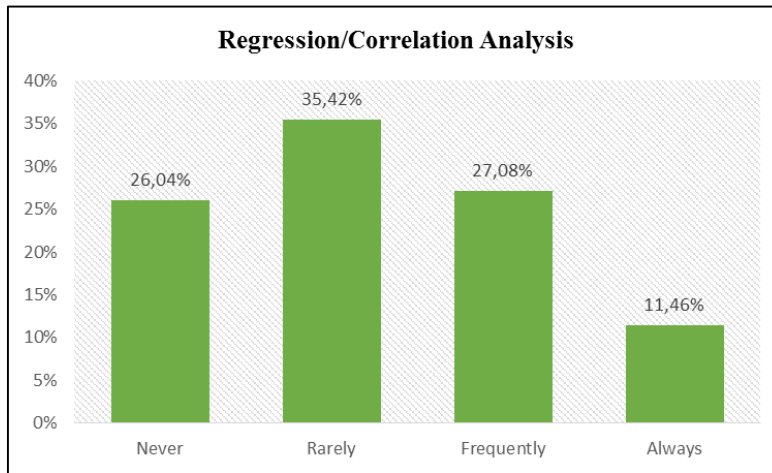*Figure 18* – *Regression/Correlation Analysis (% responses)*

Figure 18 illustrates that **26%** of the deciders never use regression/correlation analysis, **35%** use it rarely, **27%** use it frequently and **12%** always use it. Besides, the majority (**61%**) is not used to take advantage of this technique in the decision making process. Another fact is that all the participants knew this tool.

To perform regression/correlation analysis is to understand how variables/factors influence each other and how they are correlated. This help managers in understanding the present and what the future could be if changes in the variables happen. For example, if managers conclude that client's satisfaction is positively correlated with their sales, they will assume that if they are able to improve client's satisfaction, they will also improve their sales.

The data in figure 18 shows that in more than half of the cases, this technique is not very used, probably because it is very expensive, since it demands the knowledge of qualified workers in the field (mathematic and statistics) and because in complex situations it is very difficult to analyze the entire scenario, due to the fact that the number of variables could be immense. Managers also like to understand deeply their sectors and environments, and this analysis only helps them understanding how all the variables are related, but it lacks on providing knowledge regarding the causes and the 'why's' of those relations.

Some participants however, state that they frequently use it, and this are probably not very complex situations, where knowing the impact of decisions regarding some variables could dictate the success of the decision-making and improve managers confidence.

4.2.1.7 Reports / Historical Records

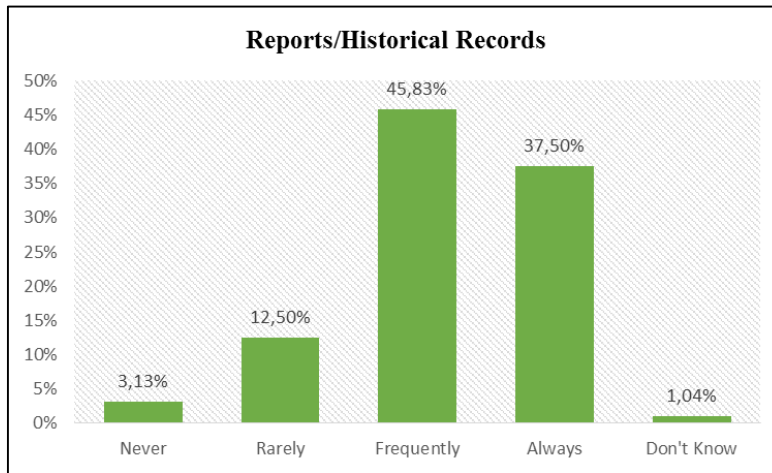*Figure 19 – Reports/Historical Reports (% responses)*

Figure 19 shows that in **3%** of the cases, Historical Reports are never used, in **13%** are rarely used, in **46%** are frequently used and in **37%** are always used. **1%** of the participants states not to know the concept of historical reports. From the techniques already analyzed this is the most used one, due to the fact that in **83%** of the cases, historical reports are at least frequently used.

Written data is probably one of the more common methods for managers to gather data and justify their decisions, and that is why the large majority of the participants state to use it at least frequently. Reports and historical data quite often provide the necessary information that is needed and 'tell' to managers what they need to know, and what the key factors are. This tool is considered one of the easiest ways of preserving data and their longevity, and it helps the effectiveness of the communication process. The reliability and confidence that reports give to managers, makes it one of the most used tools.

There are however some disadvantages such as: it can delay the decision making, since it takes time for the information to reach all parties concerned, it also represents a non-direct relation, which means persons are not directly communicating, and it is not the most flexible tool, since changes in the reports or the way they are spread, takes time to make. This are probably the reasons for some managers not to use it has much, since they probably prefer more flexible methods.

4.2.1.8 Three Points Estimate

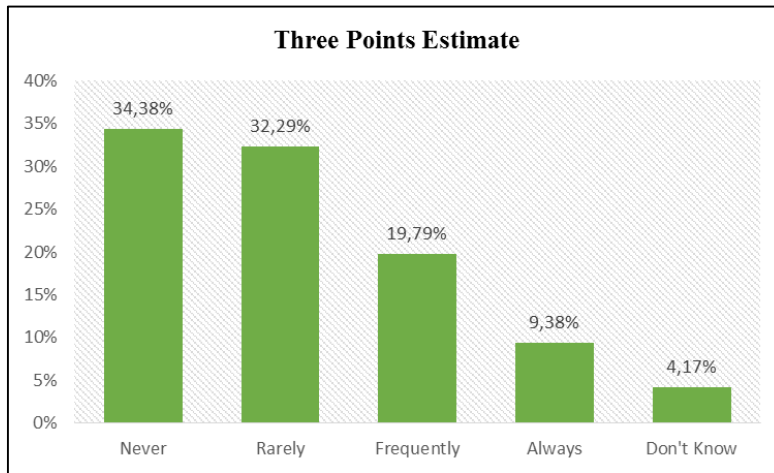*Figure 20* – *Three Points Estimate (% responses)*

Figure 20 answers, indicate that **34%** of the individuals never use Three Points Estimate method, **32%** rarely use it, **20%** frequently use it and **10%** always use it. Some of the participants (**4%**) admit not to know the technique. The numbers show that this tool is actually not used a lot, since **66%** of the cases use it less than frequently.

Doing estimations today is becoming harder, since predicting a value it is almost impossible when using a deterministic approach. For managers to have a simple, and yet powerful tool that is able to contemplate multiple scenarios in the estimation process is extremely valuable, and that is when 3-points estimate could be used. The results show that only 30% of the participants use this tool at least frequently, which can be justify by what was stated before. Regarding the rest of the answers that admit to rarely use the tool, that probably happens because of the knowledge needed to do it, where qualified workers and systems are needed to perform this statistics analysis. This could also be justified by the fact that the majority of managers are taking advantage of more simple tools, that don't require mathematic and statistical analysis.

4.2.1.9 Trend Analysis

Figure 21 – Trend Analysis (% responses)
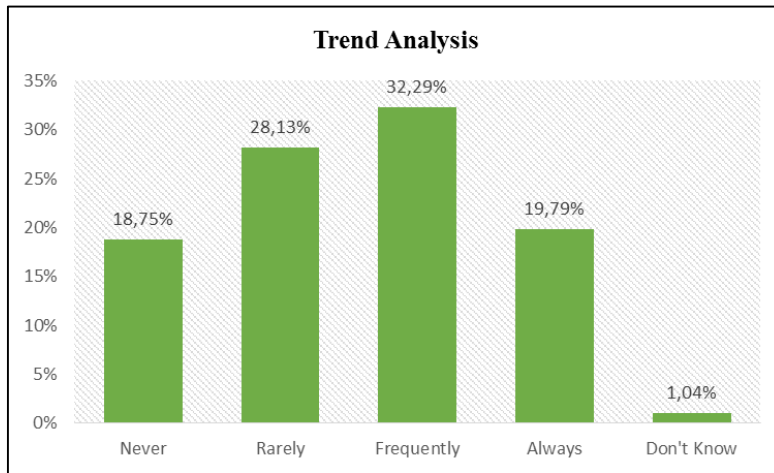
For the trend analysis technique, the results show that **19%** never use it, **28%** rarely use it, **32%** frequently use it and **20%** always use it. **1%** of the sample has admitted not to know the tool. The values are quite divided, since half of the answers indicate that the method is at least frequently used (**52%**) and the other half states that is rarely used in the best regularity situations (**47%**).

Manager's ultimate dream would be for them to be able to fully predict the future and the impact of their decisions, and this is when trend analysis appears to help. To make a trend analysis is to look into historical data and try to predict the future by analyzing how data has evolved and how it is going to evolve in the future. The results of the study made, show that more than half of the participants make this type of analysis at least frequently. This can be justified by the fact that it is not a very complicated analysis to make, if the historical data needed exists. Managers' way of thinking also corroborates the technique itself, since one of their first thoughts is about how things have evolved in the near past. Knowing this, helps them to intuitively try to predict the future, which makes this analysis to be well received by them, since it represents a more rational method of what they intuitively already do.

There are also some managers that rarely use this technique as the results show, therefore it is also important to understand the disadvantages of it, since it may justify why some persons are not using the method. One of the main disadvantages is that trend analysis could be hiding the turning points in the evolution of variables, which means that the analysis is probably using data from the time when variables where only increasing/decreasing. As economist defend, almost every variable's evolution is defined by cycles of ups and downs. In other words, it is

41

almost likely that a variable like sales, is not going to increase forever, and will in some points in time decrease, and that is why making trend analysis only based on a single part of the evolution cycle, could lead to wrong predictions.
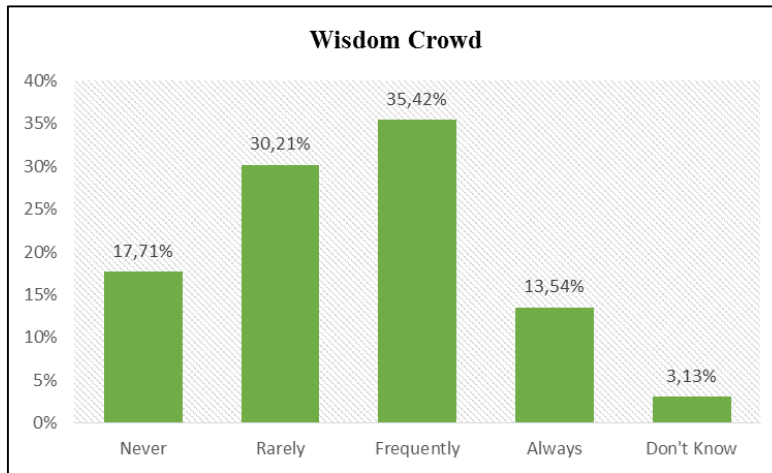
4.2.1.10 Wisdom Crowd

Figure 22 shows that Wisdom Crowd is never used in **18%** of the situations, in **30%** of the cases is rarely used, in **35%** frequently used and in **14%** is always used. Also, **3%** of the deciders tell that they don't know the tool. The number are also quite balanced, since **48%** of the answers indicates a usage no higher than rarely, and **49%** states a use not less than frequently.

Wisdom crow could be define with the following question: What better way to decide, than using everybody's knowledge instead of the knowledge of a few? The results show that the use of this technique divides opinions, where half of the managers admit to frequently use it, and the other half to rarely or never use it. The managers who frequently apply this method are probably doing it because of the low costs that it has, the time that it takes (low amount) and the amount of data that they can gather.

The other half is probably more reserved on using the method because of the confidentially issues that are difficult to protect in this situation. There is also another disadvantage that is related with misleading information, since data is coming from everybody, and unbiased opinions are not filtered in the process.

4.2.2 Experimentation/Experience Methods

The group experimentation/experience methods in the survey contemplates 5 different business research tools and techniques, which are used to test data. The following analysis' goal is to understand which tools are used by managers and in what degree of regularity they do it.

*Figure 23 – Experimentation/Experience Methods (average analysis)*
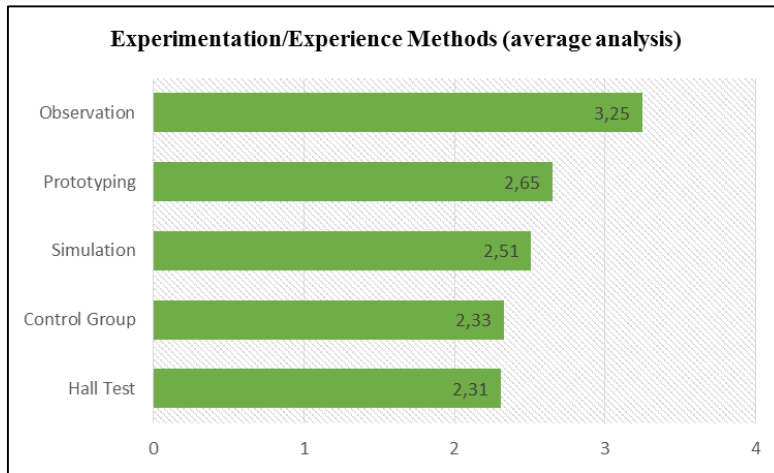
From analyzing figure 23 is possible to conclude that all experimentation/experience methods, are in most cases at least frequently used, since they got an average value superior to 2.50. Observation is by far the most used tool (3.25), and the only one that in average is frequently and in sometimes always used. It is followed by prototyping that scored 2.6, then by simulation with 2.51. The last two tools scored 2.33 (control group) and 2.31 (hall test).

An interesting fact, is that the less used tools in this group (control group and hall test), are tools related with group interviews or discussions, which involve using people's knowledge and opinion to gather data. Then we have prototyping and simulation that besides being different techniques, have the concept simulating in common, because prototyping also represents a simulation of what is going to be the final product (for example). With this we can conclude that for managers to test data, it is easier to do it by the simple technique of observing, followed by simulating and afterwards by using clients/stakeholders inputs.

4.2.2.1 Control Group
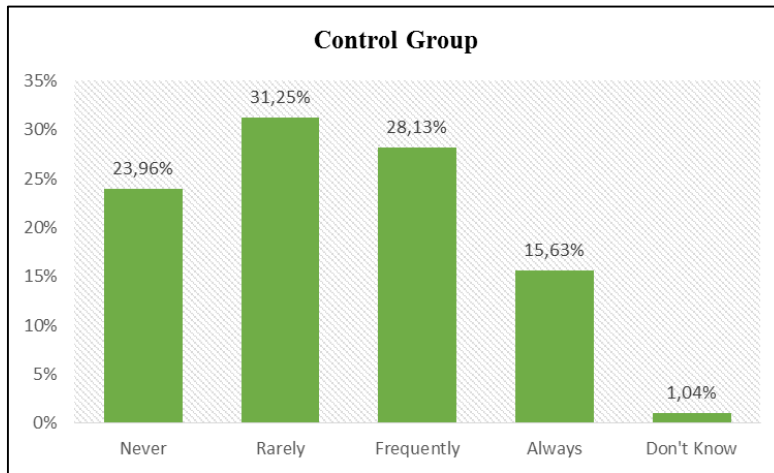
Regarding the Control Group technique, and as shown in figure 24, **24%** states never to use it, **31%** to use it rarely, **28%** to use it frequently and **16%** to use it always. Also, **1%** admits not to know the technique. **56%** of the answers points to the fact that Control Group technique is not used that regularly.

Control group technique could be used by managers to create a comparison basis between something where the independent variable is being changed, and something of the same type where nothing is being changed. The results for this method show that half of the participants use it at least frequently, which can be justified by the fact that it is a very powerful tool when the situations are complex and the conditions are hard to isolate. The other half of managers that don't use this technique a lot, probably don't do it because this is a very expensive and complex process, where the majority of situations don't even justify its use.

4.2.2.2 Hall Test
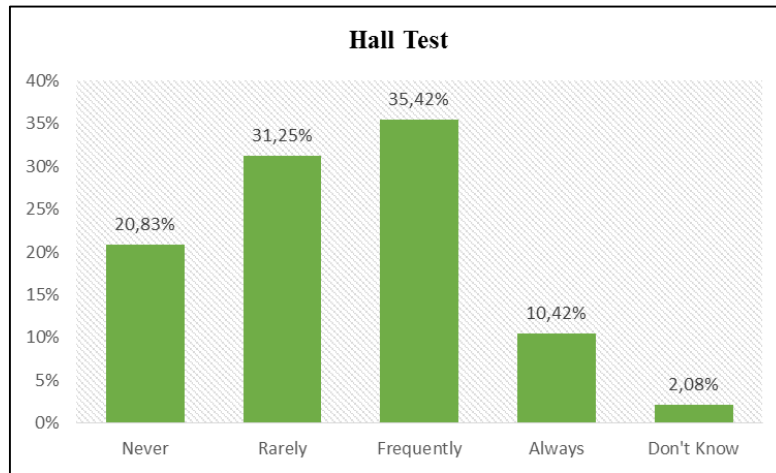
Figure 25 – Hall Test (% responses)

Figure 25 has the results for the Hall Test method, where **21%** admits to never use it, **31%** to use it rarely, **36%** to frequently use it and only **10%** to always use it. Some participants don't know the technique (**2%**). **46%** of the participants use Hall Tests at least frequently, and **52%** use it no more than rarely.

The type of usability tests where random people are selected in order to test out products/services/concepts are called Hall Tests. Figure 25 shows that the use of this method is also very balanced, where half of the managers use it at least frequently and the other half never or rarely use it. For managers who frequently use it, they probably do it because it is a fast, easy and reliable process that provides to them important information, that is able to reduce risks, provide direct feedback and to show potential issues and problems that were not identified.

The main disadvantage that probably justify the use of a different technique is regarding with the test itself, that in most cases could not be 100% representative of a real life scenario. This can happen if the selected individuals are not the final targets of the product, or if they only represent one profile in many types of profiles that the clients could be divided into.

4.2.2.3 Observation
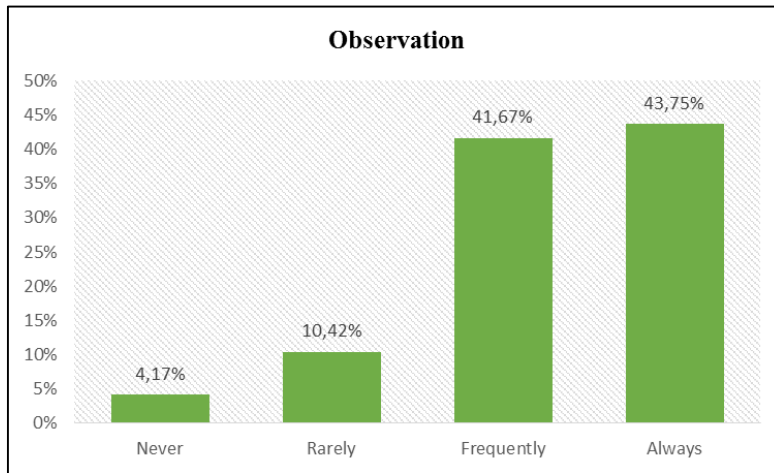
Figure 26 – Observation (% responses)

Figure 26 shows probably the most used technique so far, where Observation is never used only by **4%** of the cases, is rarely used by **10%**, frequently used by **42%** and always used by **44%**. This means that **86%** of the participants at least use Observation frequently, and that all of them know this method.

Observation is so far the most used technique, and its definition it is pretty much self-explanatory. Almost all the managers use it at least frequently because it is a very direct method to obtain data, which is very reliable and accurate. The main problems for this tool is that problems of the past cannot be analyzed, and trying to understand and solve a problem by only using observation is not possible. For managers that decide in sectors/industries where the information flows faster than humans' capability to observe it, this technique is also not the most useful one.
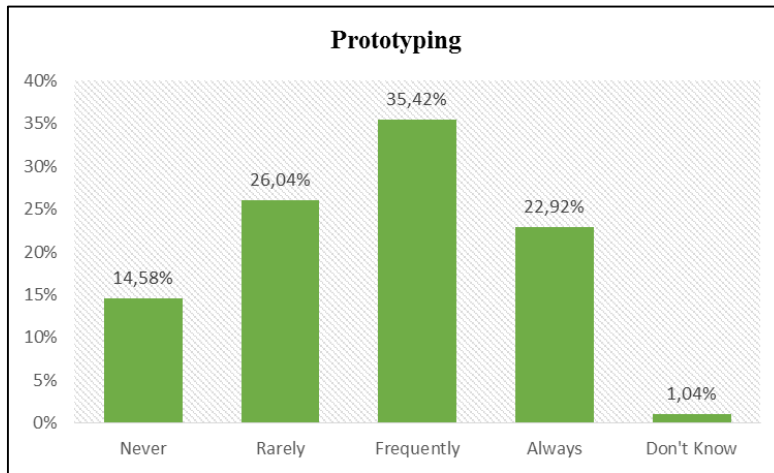
4.2.2.4 Prototyping

Figure 27 shows the results for the Prototyping technique, and in a high level analysis we can see that half of the participants use it at least frequently (**57%**). For **15%** of the participants it is never used, for **26%** rarely used, for **35%** frequently used and for **23%** it is always used. Also, **1%** is not familiar with the technique.

Prototyping is one more tool that divided opinions and that is used at least frequently by some, and rarely or never by others. To prototype is to create an early approximation of what is going to be the final product or system. The managers who frequently use it, rely on the facts that it helps to detect errors in the process earlier, helps to solve issues and problems much faster and helps on improving the quality of the final product.

In the opposite side, managers who avoid the use of this technique probably do it because it is an expensive process, which can consume a lot of time just on the creation of the prototype itself, and could also lead to loss of focus, since the attention could shift from final product/system to the prototype.

4.2.2.5 Simulation
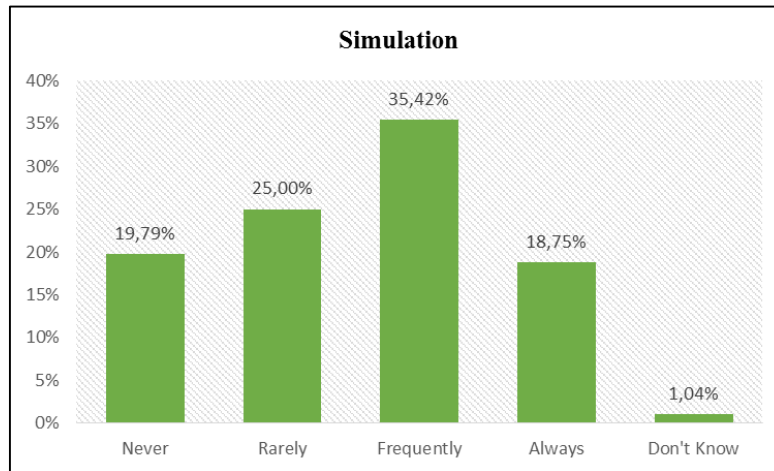
The simulation technique, as stated by figure 28, is never used in **20%** of the cases, rarely used in **25%**, frequently used in **36%** and always used in **19%**. Also, 1% of the cases is not familiar with the Simulation methods. For **55%** of the participants this technique is regularly used at least frequently.

To simulate is to replicate a situation innumerous times under different circumstances randomly. The main advantages of it that probably justify why half of the participants have admitted to at least frequently use this technique are: it makes it possible to forecast situations under scenarios characterized by uncertainty, it doesn't require a lot of data and it allows managers not to be forced to replicate real life situations for testing purposes, which will lead to cost avoidance.

The disadvantages that could justify the low regularity use of simulations are: the simulation errors, which could mean that a simulation has created a completely wrong scenario that has nothing to do with what is going to happen; the lack of standardization approach, since there are a lot of ways to make simulations, making managers to question themselves about the best approach to use, and the high costs and qualified knowledge that may be needed if the approach chosen depends on the use of specific tools and on mathematic and statistics' knowledge.

4.2.3 Interrogative Methods

The group interrogative methods in the survey contemplates 3 different business research tools and techniques, which are used to 'question' data. The following analysis' goal is to understand the importance of each tool for managers and how they are being used.

Figure 29 – Interrogative Methods (average analysis)
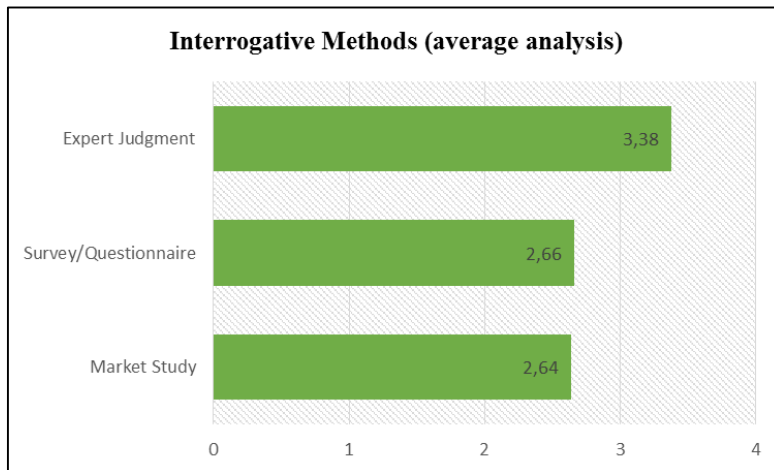
From analyzing figure 29 is possible to conclude that all interrogative methods are frequently used, since they got an average value superior to 2.50. Expert judgment is by far the most used tool (3.38), and the only one that in average is frequently used and in sometimes always used. It is followed by the surveys/questionnaires that scored 2.66 and then by market studies with 2.64.

We can conclude that the most used interrogative method is the technique where it's faster to obtain data, and that the other two tools have almost the exact same use/importance, and need more time to be implemented.

4.2.3.1 Expert Judgment

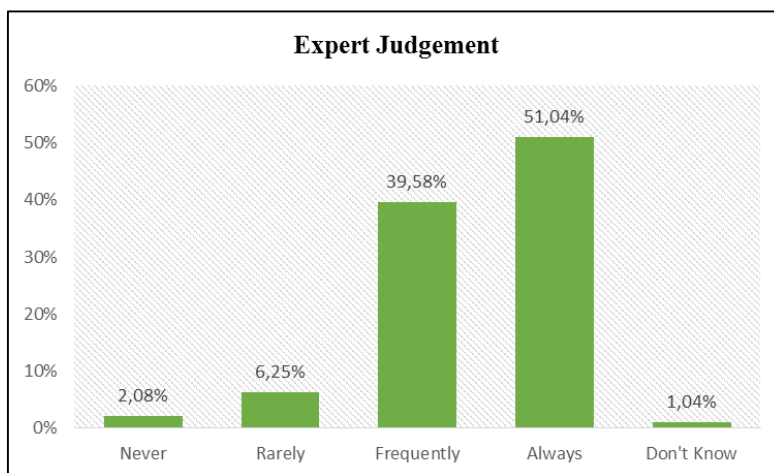*Figure 30 – Expert Judgement (% responses)*

Figure 30 shows the first results regarding an interrogative technique, the expert judgment. **2%** of the participants admits to never use it, **6%** to rarely use it, **40%** to frequently use it and **51%** to always use it. Besides the fact that **91%** of the cases, expert judgment is at least frequently used, **1%** of the participants admits not to be familiar with the concept.

The expert judgment is characterized by the use of experience and knowledge of persons who are considered by the majority as 'experts' in a particular field. The results are simple to analyze, since the large majority use the expert judgment as a way to obtain data and information to the decision making process. The main advantages are: it is a very fast way of obtaining information; by using the experience of someone/group of people it is possible to prevent errors and accelerate the success of the decisions; and experts also helps the decision making process to be proactive instead of reactive. We can also observe that managers today like to be surrounded and work with persons that have years of experience.

There are also some disadvantages to state, such as the difficulty of using expert knowledge in situations/scenarios that are new, and where nobody as yet been able to explore and gain experience, and the fact that 'experts' experience is based on the past which may by useless for very dynamic scenarios.

4.2.3.2 Market Study

*Figure 31 – Market Study (% responses)*
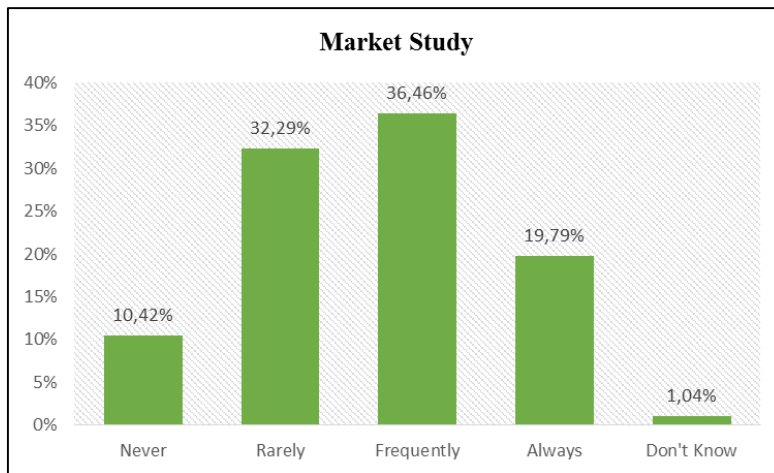
Regarding market studies, the numbers show a different regularity of use (Figure 31). For **10%** of the cases this technique is never used, for **32%** rarely used, for **37%** frequently used and for **20%** it is always used. Also, **1%** admits not to know this technique. In **57%** of the situations, the market studies are used at least frequently.

A market study is a technique used by managers to gather customers' information, such as preferences, ideas and behaviors. This is another case where the results seems to be almost divided in half. For managers that at least frequently use this tool, they probably do it because: it helps on identifying the key factors, which helps on reducing the use of resources on non-essential activities; it increases the knowledge regarding the environment, more specifically the customers, which makes it easier to analyze decisions; and it is a very cost and time effective process.

On the other hand, the disadvantages that probably justify the use of another technique are: the data analysis could be complicated and if done wrong could lead to conclusions that distorts reality; and the success of the method could be dictated by the size of the sample and the respondents' availability.

4.2.3.3 Survey/Questionnaire

Figure 32 – Survey/Questionnaire (% responses)
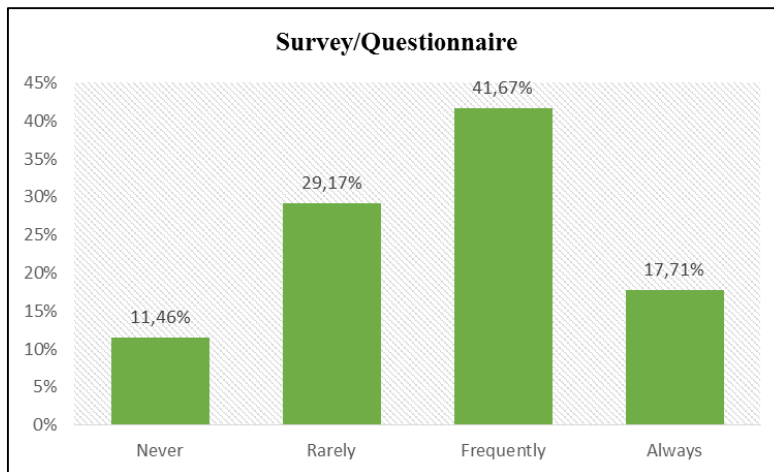
The last technique is related with the surveys/questionnaires. Figure 32 states that **11%** of the participants never use it, **29%** rarely use it, **42%** frequently use it and **18%** always use it. All the participants know this technique, and **60%** of the situations use it at least frequently.

The participants' results show that surveys are also, like the market studies, used at least regularly by half of the sample, and never or rarely used by the other half. The definition of the technique is pretty self-explanatory and its main advantages that probably justify the high regularity use are: it is easy to implement and manage, since it doesn't require much time to be developed; it is cost-effective; it helps managers to collect high quantities of diversified data;

and the advanced data analysis could increase and prove the reliability and validity of the information, which would lead to the reduction of risk and uncertainty of the decisions.

As opposite, the disadvantages that could justify the technique not to be used are: it is not possible to guarantee that respondents' answers are honest and accurate; if the sample size is not considerable the survey doesn't provide reliable data; and it is not an ideal technique to gather data about controversial subjects, since respondents could feel uncomfortable to provide written answers about this type of topics.

4.3 Comparison Analysis

To increase the richness of the analysis, in the following topics there is going to be made a cluster study, where are going to be compared the results between two industries and between to different company sizes. This is going to be a high-level analysis made for each method group (historical, experimentation/experience and interrogative).

4.3.1 Industries Comparison

The first variable selected to the comparison study is industry, where were chosen the industries with more answers - Telecommunications, Technology, Internet & Electronics and Consulting (answered via others' option).

4.3.1.1 Historical Methods

Figure 33 – Telco vs Consulting (Historical Methods)
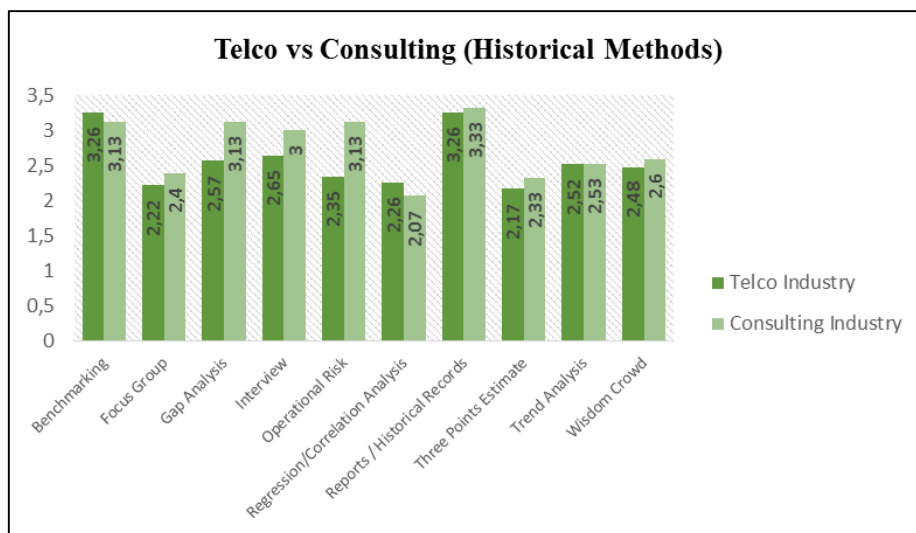
Regarding both industries, the results show that related with Historical methods every technique is used in average more than rarely. The most used techniques (average uses higher than 3) are

benchmark and historical reports for both cases, and for the consulting industry also the gap analysis, interviews and operational risk.

In the majority of the techniques there are not very distinct differences between Consulting and Telco industry, with the exception of three techniques, already mentioned before. These techniques are the gap analysis, interviews and operational risk, which are used in average 20% more in the consulting industry. Two of the techniques involve mathematic and statistics knowledge, and the other one is related with direct communication. Consultants quite often use interviews to gather information from clients in order to understand their pains and needs, and when implementing their plans and analysis, mathematical and statistical tools are used to support their explanations and actions, which in this case could be the justification for this disparity.

Even if the differences are small, it's possible to conclude that historical methods are in average more used in the consulting industry than in telco industry, probably because consultants use historical knowledge in their daily professional life to find patterns, problems, awareness, etc.

4.3.1.2 Experimentation/Experience Methods

Figure 34 – Telco vs Consulting (Experimentation Methods)
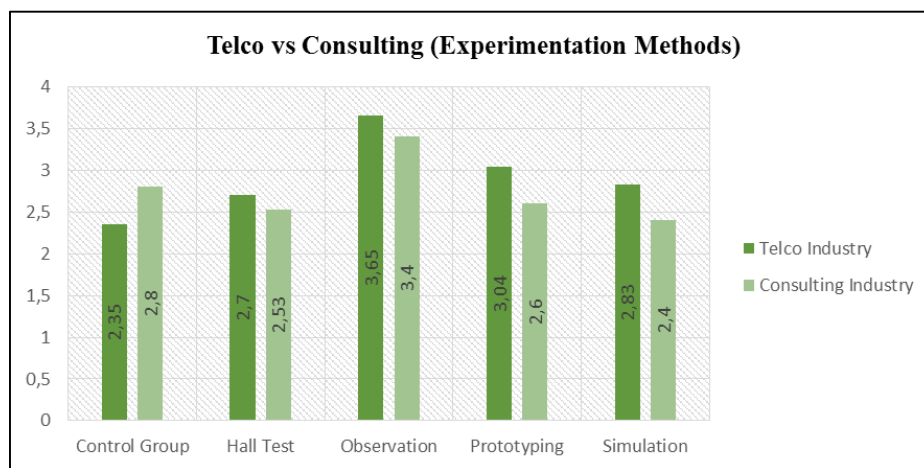
For the experimentation methods, both industries use all the techniques in average more than frequently with no exceptions. The control group is the only method more used by consultants than telco professionals, and that probably happens because consultants' main tasks are related to help their clients in understanding and solving their problems, which can be done through the use of control groups.

The other four techniques are more used by telco professionals, which can be justified by the fact that are techniques used to support the development and testing of products, something that consultants don't have, since their product is a service.

For the experimentation methods we can conclude that they are more used in telco industry, possibly because this techniques are very helpful for the decisions related with products.

4.3.1.3 Interrogative Methods

Figure 35 – *Telco vs Consulting (Interrogation Methods)*
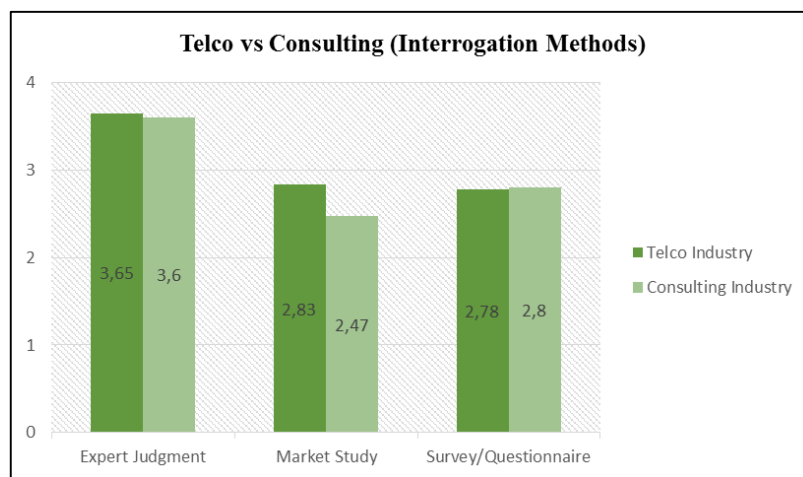
The last business research method group is probably where techniques are more balanced between both industries. All three techniques are very used in consulting and telco industries, since average values are higher than 2.50.

Both expert judgment and survey/questionnaire techniques are very important to the two industries and because the differences are so residual it is not possible to state which industry is using them more. This results are understandable, since surveys are becoming a very important tool on gathering high quantities of information and expert judgment is becoming more crucial in an increasingly complex world.

The only considerable difference is related with market studies, which telco professionals are using much more than consultants. This can probably be justified by the same reasons already discussed, that has to do with the fact that consultants' main product is a service, and its clients are generally other companies, which makes market studies a not so suitable analysis.

For the interrogation methods we can conclude that they are more used in telco industry, just because of the technique market studies, since the other two tools are equally used by both industries.

4.3.2 Company Size Comparison

The last comparison analysis to be made is related with companies' sizes, which in this studied was measured by the number of employees. Therefore, are considered small companies those who have less than 100 workers, and big companies the rest (more than 100 workers).

4.3.2.1 Historical Methods

Figure 36 – Small Companies vs Big Companies (Historical Methods)
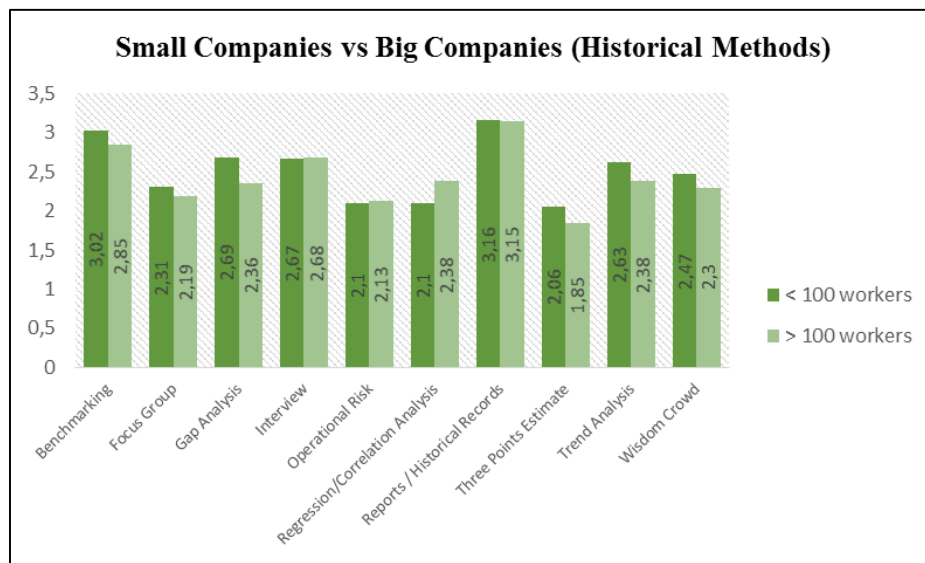
The results are quite interesting to say the least. Figure 36 shows that small companies actually use more the historical techniques, than the big enterprises. Are only a few exceptions to this statement, such as the tools, interviews, operational risk and regression/correlation analysis, which big companies use more. This can probably be justified by what we call big data. Operational risk and correlation/regression analysis demand for large quantities of data to serve as input, and big companies are able to generate and get this amount of data easier than smaller companies. Related with interviews and because big companies have more workers, and in most cases more clients, it's normal that this technique is used more in bigger enterprises, since face-to-face formal communication probably doesn't happen as often in smaller companies, which probably use more informal communication channels.

Regarding the other historical techniques, smaller companies actually use it more, and probably the main reason is due to competition and need of adaptation. The task of survivability for small companies is probably more challenging and competitive than it is for bigger companies, because they have to compete with a large number of small companies, they also have to

compete with some bigger companies, and also the fact that their financial capacity and political power is reduced. These facts make it imperative for smaller companies to be constantly comparing themselves with others (benchmark), to compare their results with their expectations and goals permanently (gap analysis), to predict what the future may be and how things are probably going to evolve (trend analysis) and to use society in order to gather data (wisdom crowd).

Generically speaking, historical methods are more used by smaller companies since they have to reduce the risks of their decisions to the maximum, because a bad decision could mean a threat to their survivability.

4.3.2.2 Experimentation/Experience Methods

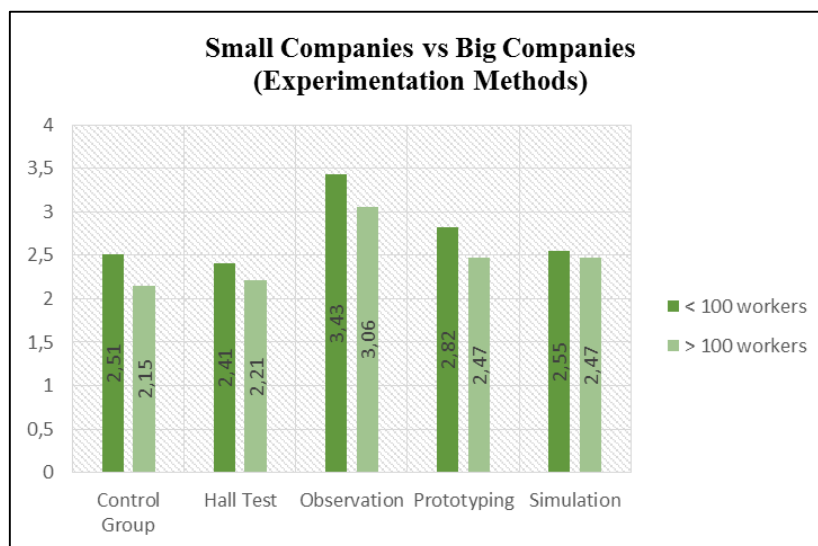*Figure 37 – Small Companies vs Big Companies (Experimentation Methods)*

Figure 37 continues the comparison analysis regarding big and smaller companies, and we can observe that companies with less than 100 workers use more, all the experimentation techniques. The explanation for this topic could be the fact that smaller companies don't have the luxury of making bad decisions (for example the launch of a bad product), because their financial capacity is smaller than big companies' capacity.

Because of the facts enunciated it's normal that small companies have to prototype all their new products to test them out and to not make any mistakes what so ever. It's also normal that they have to use simulation techniques in order to replicate scenarios, in order to reduce risks. Usability tests, observation and control group techniques can also be used to reduce the probability of a decision to provoke negative impacts to the companies.

Summarizing, smaller companies attribute more importance to experimentation techniques, because every decision made must be experimented rigorously to decrease the risks that could threaten the success of the decision making process.

4.3.2.3 Interrogative Methods

Figure 38 – Small Companies vs Big Companies (Interrogation Methods)
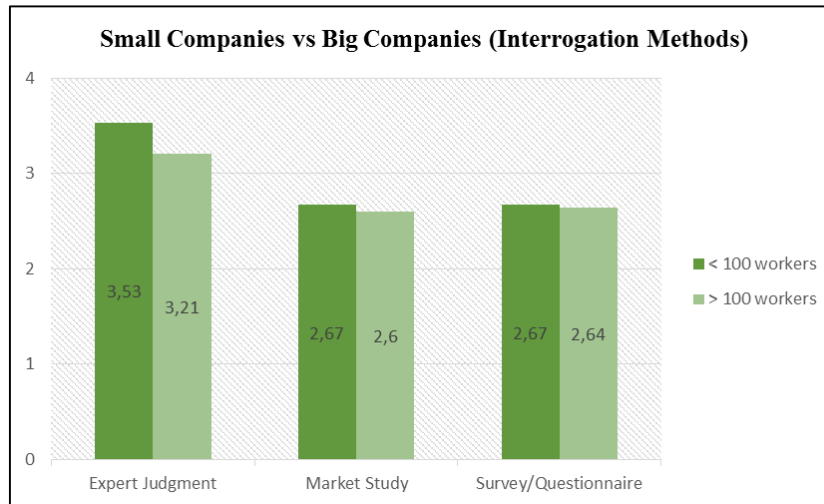
To finalize the analysis between large and smaller companies, figure 38 shows that again smaller companies user more interrogative techniques. There is not a high disparity in the results regarding the market study and survey/questionnaire techniques, which makes us conclude that the importance of this tools are the same for all company sizes.

The only noticeable difference is related with expert judgement, that is used by both company sizes at least frequently, however smaller companies use it a bit more regularly. This could be justified by the fact that using expert judgment in most cases means to get help from outside the company, for example with consulting firms. Still in the same line of thought, and because big companies have more workers, they probably don't need to quite often use external persons, since the probability of not finding internal experts is more reduced than it is for the smaller companies.

And again, it seems that smaller companies use more interrogation techniques, specially due to expert judgment, that small companies are more likely forced to use, since their internal 'experts' are less.

4.4 Overview Analysis

The last analysis to be made is an overview look to the results, with the main goal of trying to understand the overall use of the business research techniques and the importance of each technique type (historical, interrogation and experimentation) to the companies.

4.4.1 Top 3 Most Used Techniques

Table 8 – Top 3: Most used Techniques

Technique	Average Use
Expert Judgement	3,38
Observation	3,25
Reports/Historical Reports	3,16

Table 8 shows the three more used techniques by companies, which are expert judgment, observation and historical reports. All three techniques are used by companies frequently (average use higher than 2.5), which mean they are present in almost every decision making process. Another very interesting fact is that each technique have a different type. Expert judgment is considered to be an interrogative technique, observation an experimentation technique and reports an historical technique. This means that in the top 3 more used techniques all the technique' types from the scientific method are present (historical, experimentation and interrogative).

**4.4.2 Top 3 Less Used Techniques**

Table 9 – Top 3: Less used Techniques

Technique	Average Use
Three Points Estimate	1,96
Operational Risk	2,11
Regression/Correlation Analysis	2,24

Table 9 shows the three less used techniques, which are three point estimate, operational risk and regression/correlation analysis. All this techniques are in average rarely used by companies, which means that managers don't support their decisions, in most cases, by using this techniques. There are two facts that should be stated: the first one is that all this techniques are considered to be historical methods and the last one is that the three less used tools by managers are related with statistics and mathematic, which can probably be justified by difficulty on getting big data (necessary to the use of the techniques) or by the fact that it could be more complex to use this techniques than the others, since the mathematical/statistical knowledge is quite often more limited inside the companies.

4.4.3 Aggregate Results per Business Research Method Type

*Figure 39 – Summary Results per Business Research Method Group*
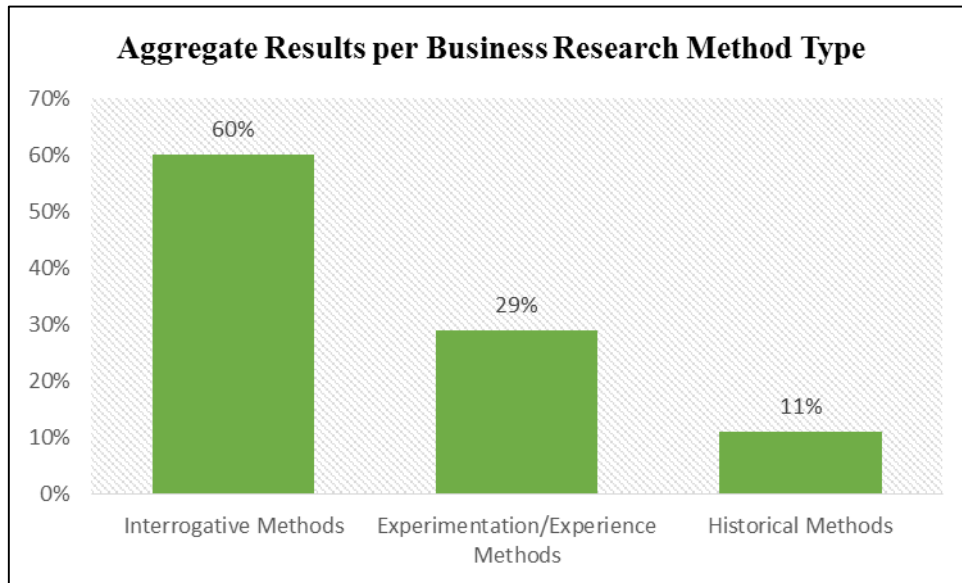
To finalize the study analysis was calculated the aggregated results per business research method type. The results show that 60% of the companies use more interrogative methods, than other types of methods. 29% of the enterprises use more experimentation/experience methods. And 11% of the companies give more importance to the use of historical methods.

This means that the majority of the companies prefer to use interrogative methods to support their decisions, such as the techniques of expert judgment, market studies and surveys.

4.5 Research Questions Validation

Figure 40 – Use of business research methods (average %)
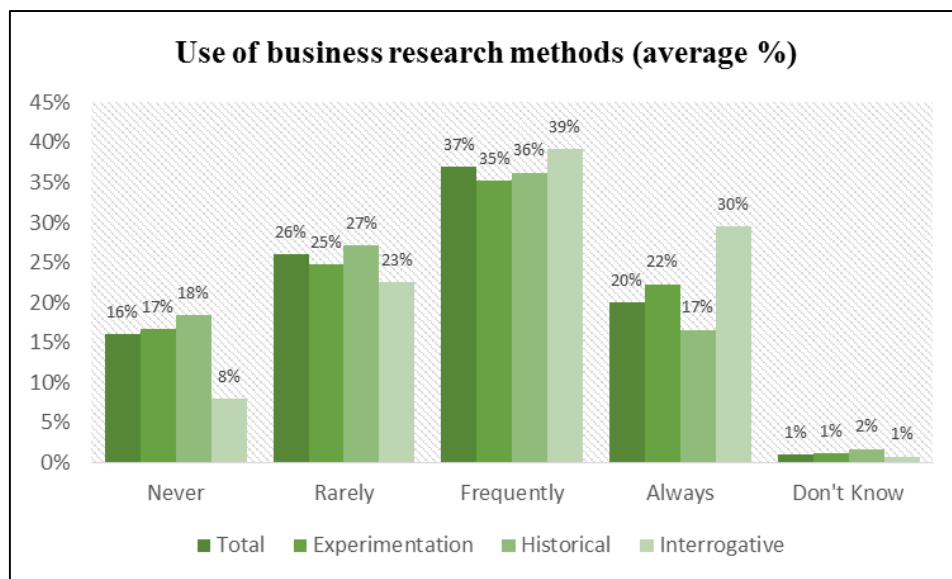
With the results already calculated it's time to validate or not, the questions that were created. In order to understand the primary inquiry we need to analyze the secondary ones, and see if they can be considered to be valid or not.

The first secondary question is: **Are Historical research methods used frequently by the majority of managers?** If we analyze the average use of historical methods with the values of figure 40, we can conclude that historical methods are frequently used by the majority of managers (36% frequently use and 17% always use it, making the total of 53% of the managers), which makes it possible to consider the question **Q1.1 to be true**.

The second secondary question is: **Are Experimentation research methods used frequently by the majority of managers?** If we calculate the average use of experimentation methods with the values of figure 40, we can conclude that experimentation methods are frequently used by the majority of managers (35% frequently use it and 22% always use it, making the total of 58% of the managers), which makes it possible to consider the question **Q1.2 to be true**.

The third secondary question is: **Are Interrogative research methods used frequently by the majority of managers?** If we calculate the average use of interrogative methods with the values of figure 40, we can conclude that interrogative methods are frequently used by the majority of managers (39% frequently use and 30% always use it, making the total of 69% of the managers), which makes it possible to consider the question **H1.3 to be true**.

With all the secondary questions validated we can also conclude that the primary question (**Do the majority of Managers frequently make decisions based on science, as opposed to the use of feelings and intuitions?**) is also **true**. We can also validate it by looking to the total numbers present in figure 40, which show that 37% of the managers frequently use the tools present in the study, and 20% always use them. This means that 57% of the managers, the majority, are using at least frequently the business research tools referred.

CHAPTER 5 – CONCLUSIONS

5.1 Main Conclusions

This dissertation aimed to provide a deeper understanding about the presence of science in the decision making process of managers. According to the two types of decisions defined earlier, the decisions based on science, and the decisions based on feelings, the goal is to understand which type of decision is more common among the managers.

Based on the results gathered and their analysis, the main conclusions and findings can be summarized on:

- The study states that the majority of managers (53%) use at least frequently historical methods in their decision' processes, which means that it's important for them to understand the past and how it may evolve;

- Another finding is that 58% of the managers are frequently supporting their choices with Experimentation/Experience tools, which states the importance of testing and replicating scenarios for managers' decisions;

- In making decisions, 69% of the managers use at least frequently interrogative methods with the main goal of gathering data that will help on understanding better the situations and variables involved;

- Regarding the entire process of making a decision, we can state that for the majority there are already traces of rational and scientific thinking, since 57% managers admits to at least frequently use business research tools;

- This study also helped to understand that managers most used tools are expert judgment, observation and historical reports. Regarding them, each tool belongs to a different method type;

- Another interesting finding is that the less used scientific tools are related with mathematical/statistical methods, such as the operational risk, three points estimate and regression/correlation analysis, which managers rarely use. This could be justified by the difficulty on gathering big data or by the lack of qualified persons in the areas;

- Regarding the different type of methods, 60% of the managers attribute more importance to the interrogative methods, making the gather of knowledge regarding their situations an important factor;

- Small companies rely more on using science in their decisions, since they don't have the luxury of making bad choices, since it could threaten their survivability;

- Companies with a main activity related to products, use much more experimentation methods, than companies with core activities related with services.

Summarizing the conclusion, everything points to the fact that science is becoming more important to managers and their decisions, as a way to 'fight' the increasingly complexity of the world. As a final statement, I would like that this study would be a starting point for future researches regarding this topics.

5.2 Limitations

It is possible to consider that this descriptive study has the necessary methodology qualities to produce viable and valid conclusions. However, and because there is no perfect study, there are some limitations that should be mentioned.

The first limitation is the sample method used, which was a convenience sample. In other words, only managers with LinkedIn account or present in the researcher' network would be possible to participate in this study, fact that doesn't guarantee the sample to be representative.

The second limitation is the sample size, which is justified by time and geographic constraints. The number of participants makes it impossible to extrapolate conclusions to the universe of management in the entire world.

5.3 Future Research

This is what we can consider a very preliminary study on this subject, therefore I would like to present some suggestions about what could be interesting to explore regarding this topic in the near future:

- This study has analyzed the presence of science in the decision making process of managers, through the concept of Business Research Methods. It would be interesting to analyze it by using other perspectives (like technology);

- Another suggestion is to make this analysis using a larger survey to generate data that would make possible to understand the topic at a global scale;

- Increasing the number of techniques present in the study would also provide a deeper understanding about the decision making process;

- Studying the custom technologies, such as software and systems, built by companies to support their decisions, would also increase our knowledge regarding what managers are doing regarding their decisions.

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APPENDIX

APPENDIX A – SURVEY FORM

Scientific Management Methods

HOW DO YOU DECIDE?

FEELING vs SCIENCE

"FEELINGS ARE THE FINE INSTRUMENT WHICH SHAPE DECISION-MAKING..."
WILLARD GAYLIN

"IN GOD WE TRUST, ALL OTHERS (MUST) BRING DATA"
W. EDWARDS DEMING

Know your answer in only 5 minutes.

To whom It may concern,

I am currently developing my thesis regarding Scientific Management Methods ("scientific methods and a holistic approach forces individuals at all levels of the organization to look at the big picture when developing any solution in their area and mitigating some of the natural tendencies and political motives that present themselves in an organization. - Cassone and Tillman 2013"). The goal is to understand the importance of this type of tools in the daily life of managers and organizations as opposed to the rules of thumb, intuition, tradition and simple financial analysis. ("All decisions, whether they are personal, public, or business related, are based on the decision maker's beliefs and values. Science can and should help decision makers by shaping their beliefs. (...) science can and should be important for all major decisions in life." - Winterfeldt. 2012)

Your participation is crucial and is very much appreciated. This online survey should take you about 5 minutes. Your survey responses will be strictly confidential and data from this research will not be disclosed in the final report.

If you have any doubts, questions or even if you want to discuss this subject with me please do not hesitate to contact me.
Thank you very much for your time and support.
Best Regards,

Ricardo Santos
Master Student at ISCTE Business School

Scientific Management Methods

Company Information

* 1. Which of the following best describes the principal industry of your organization?

[dropdown]

[text field]

* 2. What is your company size? (total number of persons who work there)

◯ 1

◯ 2-9

◯ 10-24

◯ 25-99

◯ 100-499

◯ 500-999

◯ 1000-4,999

◯ 5,000+

* 3. What department do you work in?

◯ Administrative

◯ Finance/Accounting

◯ Human Resources

◯ IT/Engineering

◯ Legal

◯ Operations

◯ Sales/Marketing

◯ Other (please specify)

[text field]

* 4. What is your job role?

◯ CxO or Executive

◯ Director or Senior Manager

◯ Manager

◯ Team Leader

◯ Operational

◯ Other (please specify)

[   ]

* 5. In what country do you currently work?

[▲▼]

Scientific Management Methods

Historical Methods

Historical Methods in research are the process of systematically examining the past with an interpretation attempt to recapture nuances, ideas, facts, and conclusions.

* 1. In the following list, select how regularly do you use each method to support your business/management decisions.

	Never	Rarely	Frequently	Always	Don't Know
Benchmarking (wiki) *Comparing yourself with others*	○	○	○	○	○
Focus Group (wiki) *Researching with a multidisciplinary perspective*	○	○	○	○	○
Gap Analysis (wiki) *Analyzing yourself against standards*	○	○	○	○	○
Interview (wiki) *Getting information from stakeholders*	○	○	○	○	○
Operational Risk (wiki) *Modeling the uncertainty of a process*	○	○	○	○	○
Regression/Correlation Analysis (wiki 1 2) *Analyzing cause-effect relation*	○	○	○	○	○
Reports / Historical Records *Getting information from the past*	○	○	○	○	○
Three Points Estimate (wiki) *Modeling the uncertainty of a phenomenon*	○	○	○	○	○
Trend Analysis (wiki) *Analyzing the movement over time*	○	○	○	○	○
Wisdom Crowd (wiki) *Getting the perspective of a group*	○	○	○	○	○

If you/your company use any other methods, please list them and tell how regularly do you use them.

Scientific Management Methods

Experimentation/Experience Methods

Experimentation Methods in research are the process in which user-experience concept is used to generate data that will be used as an input to the decision making process.

* 1. In the following list, select how regularly do you use each method to support your business/management decisions.

	Never	Rarely	Frequently	Always	Don't Know
Control Group (wiki) *Experimenting and testing new concepts*	○	○	○	○	○
Hall Test (wiki) *Involving clients in new product/service definition*	○	○	○	○	○
Observation (wiki) *Collecting facts from reality*	○	○	○	○	○
Prototyping (wiki) *Conceptualizing new idea/process/service*	○	○	○	○	○
Simulation (wiki) *Analyzing and modeling effects and behaviors*	○	○	○	○	○

If you/your company use any other methods, please list them and tell how regularly do you use them.

74

Scientific Management Methods

Interrogative Methods

Interrogative methods in research are a dynamic process of inquiry with the main goal of increasing understanding in the decision-making process.

* **1. In the following list, select how regularly do you use each method to support your business/management decisions.**

	Never	Rarely	Frequently	Always	Don't Know
Expert Judgment (wiki) *Asking opinion from subject matter*	◯	◯	◯	◯	◯
Market Study (wiki) *Questioning market regarding product price or characteristics*	◯	◯	◯	◯	◯
Survey/Questionnaire (wiki) *Getting opinion from the community*	◯	◯	◯	◯	◯

If you/your company use any other methods, please list them and tell how regularly do you use them.

Scientific Management Methods

Survey Conclusion

1. Do you want to receive the results and the final report? (confidential is assured)

◯ No, I'm not interested.

◯ Yes, I'm interested. My email is:

[   ]

Thank you very much for your time and support,

Kind Regards,
Ricardo Santos