Louvain School of Management

Quantitative study of the impact of telecommuting on employee satisfaction: the case of Cerence.

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Abstract:

The objective of this paper is to analyze one of the components of business performance, the employee satisfaction, in a telework context, as well as to identify divergences and convergences between different groups of employees. This Master's thesis is articulated around two parts: a literature review and an empirical analysis of Cerence, an IT-oriented organization.

The literature review aims to identify the challenges of digital transformation on organizational performance defined according to 4 components (customer satisfaction, employee satisfaction, internal process quality and financial performance). It was found that digital tools could undeniably improve 3 of these components. However, the effects of digital tools on employee satisfaction were more mixed. This allowed us to build our empirical analysis on one of the contemporary drivers of employee satisfaction: teleworking.

The empirical analysis consists of a quantitative survey that was built in order to understand employee satisfaction with telecommuting. The results show a divergence of perceptions between men and women, particularly in terms of motivation and maintaining social contact. Also, it appears that the observations can be classified into 3 distinct clusters which have different perceptions about teleworking, and that about 75% of the observations seem to adapt and be satisfied with telework.

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Introduction

This thesis is the conclusion of our Master's Degree in Business Engineering at UCLouvain and its objective is to define the link between digital transformation and organizational performance.

For many years, we have seen the rise of digital tools around the world. Although we are still at the beginning of this growing curve, it seems clear that future companies will all be interconnected through these digital tools. This digital transformation also represents an opportunity for organizations in terms of business models. It is clear that "born digital" companies have a fundamentally different business model than "traditional" ones.

Moreover, organizations are evolving in an uncertain environment. They need to reinvent themselves to avoid becoming irrelevant. Finally, it could be thought that only technology-oriented companies will have to redesign their business model to benefit from this new economy. But in reality, all businesses are affected in some way by this digitalization.

We can therefore say that digitalization is a universal phenomenon that will affect everyone at some point. It is consequently imperative to analyze all the challenges associated with it.

Thesis Structure and Scope

This master thesis will be divided into two parts. There will be a theoretical part (literature review) and a more analytical part (empirical analysis). The objective will be to compare the literature with the results obtained through a survey. It will then be possible to construct convergences and divergences between what the literature asserts and what we will obtain as result in our analytical research.

As far as the literature review is concerned, the different elements of the challenges (digital transformation and performance) will be examined. On the one hand, it will allow us to have a clear view on what digitalization is, how it came in our societies, what are its characteristics, etc. On the other hand, we will investigate, beyond our knowledge of the economical one, what performance is. Finally, we will analyze whether there is a link between those two. For the literature review part, an intensive desktop research has been conducted, in order to mobilize reliable and relevant scientific articles obtained on ProQuest. This part of the thesis is imperative for the development of it. After that, we will analyze the perception of the employees regarding telecommuting. The case study will focus on companies that are facing the technological advance (IT sector). Information will be collected from a representative sample of an average employee in an IT-oriented organization. Once these results are obtained, a statistical study will be conducted in order to analyze whether the link between digital technology adoption and employee satisfaction is significant. If so, we will see which mediating variables explain this relationship.

The next step of the empirical analysis will be to compare concepts and data and to provide a potential mitigation of the results. Nevertheless, it will be necessary to be vigilant and identify whether the discrepancies are organization-specific or industry-specific.

As a Master’s thesis is personal, we will conclude this study by presenting the limitations of this thesis and we will then summarize this one.

Part 1: Literature Review

The objective of a literature review is to gather a set of scientific articles with the aim of answering a precise problematic. Thanks to this literature review, it is possible to determine the state of progress of knowledge on the defined subject. The section below will bring together selected articles concerning information about digitalization and information about organizational performance. This part will be concluded with the potential link between those two variables.

1. Digital Transformation

1.1. Contextualization

1.1.1. Origins

The first element of our problematic is the term "digitalization". Digitalization has different definitions according to literature. In reality, all the authors seek to define the same reality: the transition from one technology to another. Each major shift from one technology to another was characterized by an industrial revolution. We can identify 4 of them over time:

The *first industrial revolution* was marked by the advent of the steam engine and coal mining. This revolution has enabled the production of objects on a large scale. This revolution marked the transition from a craft company to a commercial company. It also was the first step from a Malthusian equilibrium economy (Leite *et al.*, 2020) to the Modern Growth era. A Malthusian economy is one in which production is only used for subsistence, i.e. the strict minimum viable. We can see that at that time, the economic stakes were not the same as today and capitalist societies did not yet exist. The Modern Growth Era is marked by a steady growth in terms of technology and per capita income (Galor & Weil, 1999). It should also be noted that agriculture has evolved enormously thanks to the industrial technologies that emerged during this period. This was also the case for the level of education, which increased to meet the demand for industrial work. This period corresponds to the first step towards globalization.

The *second industrial revolution* (at the end of the 19th century) was characterized by the extraction of oil and gas but also the evolution in terms of electricity, mechanic and oil. This revolution was the first step towards the connected world in which we are living nowadays, as it was the first time that telecommunication really took off. At that time, it could already have been foreseen that other improvements would follow in terms of electronical technologies. We could also mention the fact that this revolution brought about a deep change in the way work was organized in enterprises, otherwise known as Taylorism. The aim of Taylorism is to make tasks easier to perform. Each worker becomes a specialist in the task assigned to him. There is thus a separation of work (Lee *et al.*, 2018). Marx then denounced that this assembly line work leads to the alienation of workers (lack of meaning in life).

The *third industrial revolution* was at the end of the 20th century, when computing and communication were introduced in wealthy institutions. At that time, having a processor that could understand computer languages was a real bargain. Technological advances exploded and made it possible to connect the world thanks to the Internet (using cable). This is also when we realized the environmental issues at stake. This is the reason why some scientists alerted institutions to encourage them to opt for low-carbon solutions. It is also at this time that Fordism lost its importance, because society rejected any form of organizational hierarchy. The 5 pillars of this industrial revolution were: the shift from carbon-based energy to renewable energy (1), the reconfiguration of energy storage buildings into smaller ones in order to have decentralized electricity production (2), the installation of means of storing intermittent renewable energy in all these buildings (3), the development of Smart grids, i.e. the fact of being able to share the energy surplus of a particular power station to areas where demand is greater (4) and the transition of transport fleets to electric vehicles (Rifkin, 2012). The conditions for this third industrial revolution were the consequence of (electronic and communication) innovations. This revolution brought the oil and nuclear age to an end.

Finally, it is 2022 and we are now talking about a *digital revolution* or *Industry 4.0*. This is, of course, a consequence of the digitalization and interconnectivity between devices. The advent of the Internet has already brought a radical change in the way that organizations build their processes. People have been able to be interconnected and a lot of opportunities have been seized. From that moment on, automation in companies has become more and more present and this revolution corresponds to a new way of organizing the means of production. It is, at this point, that digital technology took over from mechanical technology. Products will no longer be mass-produced but will generally be adapted to the specific needs of each customer. This is also called "late differentiation", i.e. the fact that the basic products are mass-produced and then are customized for each of the customers. This makes it possible to keep productivity in the factories while adapting to the needs of the customers (Semal, "Supply Chain Management", UCLouvain, Louvain-la-Neuve, 2020). In particular, "smart production" is making its appearance in the business world. In this method, machines are equipped with sensors (temperature, pressure, etc.). Then, it is translated into an electrical signal. This allows the machines to communicate with each other to perform their tasks in the best possible way. What differentiates this revolution from the last one is also the advent of artificial intelligence and machine learning. These new technologies will offer an endless supply of opportunities for organizations. Those concepts will be discussed later.

It should be noted that each of those revolutions has really transformed the way in which things work. Nevertheless, the digital revolution could radically metamorphose the way in which everyone will live in the future. Take, for example, the case of intellectual but repetitive tasks that need to be performed in a factory. Artificial Intelligence (AI) could totally replace humans to perform those tasks as it could be more productive and cheaper. In addition to the environmental issues being denounced during the third industrial revolution, political and social issues will also be included. The human being is once again central to Industry 4.0. For example, Taskin and Dietrich (2016) mention 'Human Management', a form of human resource management in which people are central.

In short, we live in an industry where machines are interconnected and human-machine interactions are each day easier (Rossini *et al.*, 2021). The interactions between devices will be discussed in a following section.

1.1.2. Definition

Before we can analyze the characteristics of digital transformation, it seems necessary to define this concept. In fact, the digital transformation has several synonyms such as "digitalization", "numeric transformation", "digitization", etc. However, Roth (2019) put some words on this concept, as digitalization is marked by the *transition from an analog to a digital environment*. Feng (2020) stated that digital transformation is built to fight the digital disruption that we are currently facing. Digital disruption refers to the fact that organizations' business models need to be reformulated in the presence of new digital technologies, without which a company can quickly become irrelevant. Kodak (an American company of photographic products and services), for example, has experienced it, as they have not been able to renew themselves in the face of digitalization.

1.2. Principles of the digital transformation

1.2.1. Opportunities

Technological evolution has been changing the world since several decades. The first step of this evolution was the invention of the microprocessor by Intel. On that purpose, it seems to be crucial to argue that the capacity of microprocessors duplicate approximately every 2 years (Moore's Law). As a result, the use of these computers can be exploited by firms in their digital solutions. We could take the example that we mentioned above, where a machine can replace a human. Let's assume that this machine has artificial intelligence with a powerful microprocessor. The use of Big Data can clearly help this machine to be more and more efficient as long as Moore's Law is respected. It is also worth noting that digital transformation is booming because the barriers to entry are very low and the sector benefits from huge venture capital (Schrekler & Steiger, 2017).

1.2.2. Disruptive technology

We could ask ourselves the question of what are the consequences of this development for organizations? It is clear that Internet makes everything faster and more efficient, but it also makes the competitive environment much more unpredictable. Operations are faster and it is therefore much easier for a company to radically change a strategy. This is why the term "disruptive technology" can be used, i.e. technology that radically changes the way of operating. In this respect, Brunetti *et al.* (2020) have argued that a digital transformation within an organization necessarily generates a significant technological disruption. Also, the business models of organizations must be reviewed because the opportunities offered by digital transformation imply a radical internal change.

Finally, it should be noted that the economic environment in which companies operate is very volatile and it has been estimated that is impossible to establish a precise strategic plan in advance. Also, it was estimated that a failure or malfunction in the implementation of a strategy can cause a company to cost 40% of its potential strategy value (Mankin, 2017). In the same scope, we could talk about the difficulty that "born digital" companies have. Indeed, they are under constant pressure from disruptors who will seize any opportunity to capture market share from the giants of the digital industry. We can add to this the SARS-CoV2 pandemic which has further accelerated this trend to go digital. However, this disruption happened so fast that it forced many organizations to move quickly to digital without even having time to be prepared. In this regard, it has been estimated that 70% of digital transformation programs have failed (Reeves *et al.*, 2018).

1.2.3. Digital transformation & innovation

As mentioned above, digital transformation offers companies an unlimited range of opportunities in terms of products, infrastructure and business models (Dreschler *et al.*, 2020). Therefore, they have opportunities for innovation. According to Nambisan *et al.* (2017), digital innovation refers to "the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology". A technology is composed of several characteristics that create this digital innovation. First, once a technology is made digital, it is storable, transformable, transmittable and traceable (Yoo *et al.*, 2010). Also, these technologies are editable through reprogramming (Kallinikos *et al.*, 2013). This is a major innovation for a company if it is in a non-static process, i.e. in a continuous development perspective. Finally, a digital technology necessarily needs another digital technology to work (Yoo *et al.*, 2010). This will be called the "interdependence" between technologies. Let us take again the example of a machine that will perform repetitive intellectual tasks thanks to artificial intelligence. Upstream of this machine, another digital technology will be necessary to collect the data that will be used by the artificial intelligence. Therefore, we can clearly see how digital technologies are linked together.

We can also characterize these digital technologies with the following two adjectives: *convergence* and *generativity*. The first term means that a digital technology can bring together a set of separate digital technologies (e.g. a new smartphone with different functionalities). The second term highlights the fact that a technology is extensible and can consequently evolve continuously (Yoo *et al.*, 2012). In conclusion, a developed technology solution can be a starting point for another solution or an end point, i.e. a technology intended to be used by the markets. Finally, it seems interesting to point out that a technology can be the combination of several digital modules. It can be said that boundaries are almost non-existent in terms of innovation (Ciriello *et al.*, 2018).

1.2.4. A new business model

For this section, we will refer to the definition of business model given by Morris *et al.* (2005). According to this author, "a business model represents an integrated set of decision variables in the strategic, operational and economic areas, and it is directed to generate sustainable competitive advantage in defined markets.”. No matter the chosen definition, a big part of them refer to the element "strategy" and the articulation of activities in order to create value (Sordi Schiavi & Behr, 2018).

Earlier in this thesis, we mentioned the fact that business models need to be redesigned in the presence of new digital technologies. In this section, we will investigate in more detail how digital transformation impacts contemporary firms. We can state, based on the study conducted by Lozic (2019), that digital transformation is in fact a business model transformation. This transition from one business model to another is influenced by the following factors: business strategy, technological innovation, customer behavior and expectations, as well as other external factors (Gilchrist, 2018)

Also, companies cannot simply implement internally a new digital technology to make everything work like oiled gears. Indeed, Bacquet and Riemenschneider (2017) argued that these digital tools need to be fully exploited and integrated at different stages of the strategy. This avoids having a set of powerful technologies that do not create value to the business strategy (lack of synergies).

We can assert that the components of the organizational business model need to be redesigned. New technologies impact business models as they bring new opportunities to companies (Sordi Schiavi & Berh, 2018) and the organizations therefore have to adapt their business model to be in alignment with their new value proposition. Indeed, these disruptive technologies imply a change in the value proposition and in the same way all related activities. The adoption of a digital technology can also change the business environment. This is due to the fact that the characteristics of digital technologies are not common and are aimed at a specific market segment (often non-customers). As a result, a "new market" can be created from a new technology and a quasi-monopoly organization can quickly be forgotten (Sordi Schiavi & Berh, 2018). It is for this reason that Jeff Bezos has stated that Amazon is bound to disappear one day (Kestenbaum, 2018). This statement shows how an organization must constantly renew itself and adapt its business model to remain competitive in the digital world we are moving towards.

1.2.5. Internet of Things

One thing is sure: the term "Internet of Things" is becoming increasingly common in our inter-connected societies. However, it dates back to 1999 when Kevin Ashton popularized it in one of his presentations. Nevertheless, there is no consistent term defining this concept. According to the Gartner Glossary, the Internet of Things (IoT) "is a network of physical objects that contain embedded technology to communicate and understand or interact with their internal states or the external environment". To make it easier to understand, it means that a device is connected to the Internet. The main objective of those devices is to communicate with the external environment and to share information with it (Nowińska, 2020). It can be understood from this information that the IoT can also enable the collection of data without the need for human activity. Everything can be done autonomously. There is therefore an economic opportunity behind this concept, as those devices do not need to be paid for a performed task.

In addition to this, there is an answer to the growing ecological and environmental challenges, as connected objects would avoid a large number of environmentally harmful activities.

1.2.6. Data: driver of digital transformation?

We are in the midst of a digital revolution and the focus is no longer on tangible resources. This was the case in the past, when having a high-performance machine was synonymous with competitive advantage. Nowadays, the focus is more on intangible resources in order to capture promising market segments (Candelo *et al.*, 2018). One of these intangible resources is Big Data. But what does "Big Data" mean? Big Data is an abstract concept defined by Candelo *et al.* (2019) as a "complex of tools for supporting firms' decision-making process by using technology with the aim to rapidly analyze large amounts of variegate data from a variety of sources to produce a stream of actionable knowledge". To simplify this definition, Big Data is a very large dataset from which information can be extracted and used in the strategic decisions process of a firm. Studies conducted in recent years have shown that Big Data contributes to the discovery of opportunities for companies. The term Big Data can refer to 2 related concepts but different in the form. These 2 concepts are artificial intelligence (AI) and business intelligence (BI). Artificial intelligence refers to a technology that will learn by itself by using information from old data in order to perform a process autonomously. Artificial intelligence is designed in order to replace the human intelligence. Business intelligence refers to all the technologies and applications that use data to help an organization in its decision-making process (Ortiz *et al.*, 2021).

The statements made by the different authors mentioned above seem to be justified by the increasing demand for data scientists in companies (TechTarget, 2019). Indeed, the data scientist position seem to be more and more wanted.

Since the 21st century, big data seems to be so important that some authors make the metaphor that big data is the contemporary oil. Oil has become the number one energy resource since the 1950s. A large part of the economy is still depending on it, which poses a number of problems as it is not an inexhaustible resource. The metaphor linking big data and oil means that big data could be the driver of the 21st century economy, as the oil was in the past. This metaphor can be taken a step further, by analyzing the methods of extracting oil and big data. In the first instance, we have a raw material whose purpose is to refine it in order to fuel certain activities. The case of oil goes through extraction, refining, etc. Finally, we arrive at a final product that is valued, rare and exploitable. It is exactly the same case for big data. In the first instance, there is a stock of data, which will be extracted and recorded in a database. In a second step, this is screened and the outliers are removed. Finally, the database is exploitable by any digital technology and this is what will make it useful to a company. We are still in an era where many organizations are not able to exploit their data but know that one day or another, they will be able to benefit from it. This data can be used by new technologies such as Artificial Intelligence and more particularly machine learning. However, in addition to the functional aspects that these data can bring (for machine learning in particular), these data can also be resold to another organization. In particular, customer data can be captured to be able to adapt an offer that best targets the customers. This is problematic from an ethical point of view, as users have had their data used without their knowledge. For this reason, websites necessarily ask for the customer's approval to use their data to respect the user privacy (Krewer, 2018).

1.3. Digital behemots

Some organizations have succeeded in seizing the opportunities that digitalization has offered them. This has certainly exposed them to risk during their transformation, but one thing is clear: they all have a sustainable competitive advantage. In this section, the case of five firms that have exploited business models in line with digital disruption will be discussed. These five organizations form together the "GAFAM" group and are the companies Google, Amazon, Facebook, Apple and Microsoft. The culture of these companies is the search for disruptive innovations. The turnover of these organizations reflects how they have seized the opportunities offered by digitalization.

The graph below shows the growth curve of the turnover of these companies compared to other companies that have not (yet) been able to make their digital transformation:

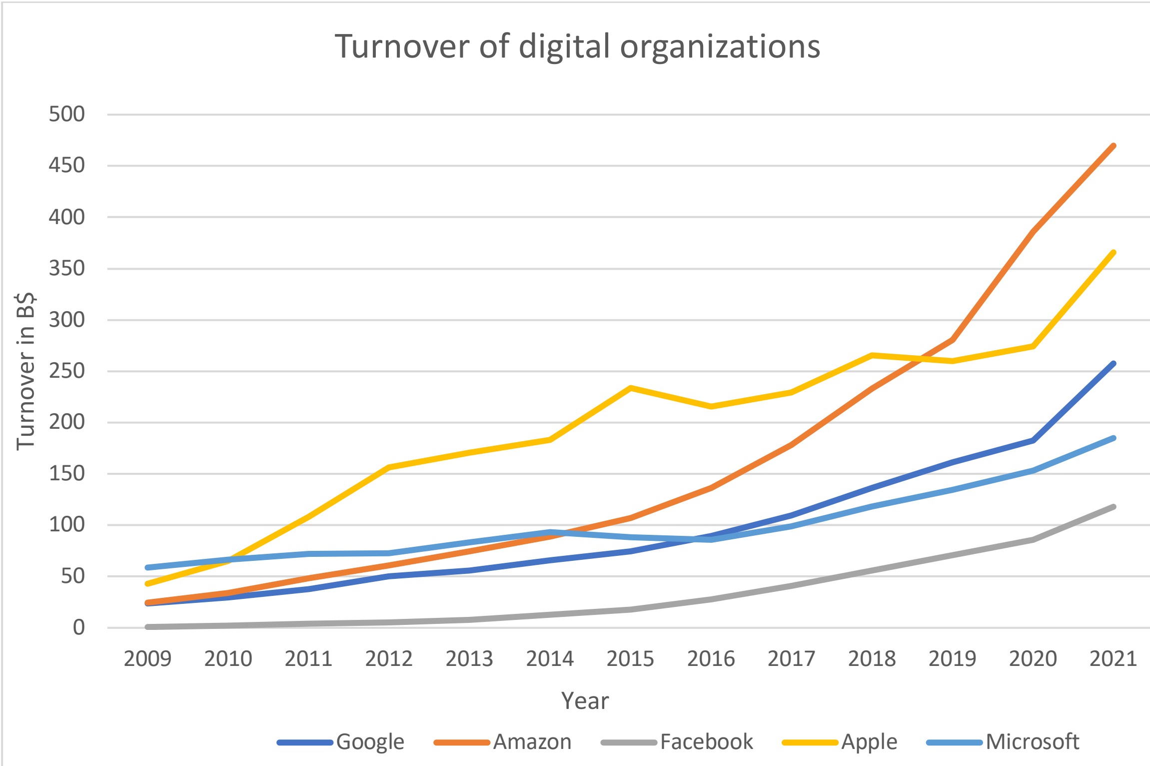


Chart 1 - Yearly turnover of the GAFAM in billions of $

Those curves clearly show the exponential evolution of the turnover of these companies. There is every reason to believe that opportunities seized in the right way are necessarily beneficial for companies going digital. The growth average of the GAFAM for this period is 4658%. The lowest growth is the one of Microsoft with 215%, which is still very impressive compared to firms that failed their digital transformation. Nevertheless, care should be taken when drawing conclusions from these curves. Growth is not only due to the contribution of digital transformation. Indeed, markets have evolved and we are now in a consumer society. Moreover, the world population has been growing for decades, so it seems logical that demand increases and with it, the turnover of the companies.

The chart below displays the evolution of turnover of companies that did not manage their digital transformation properly:

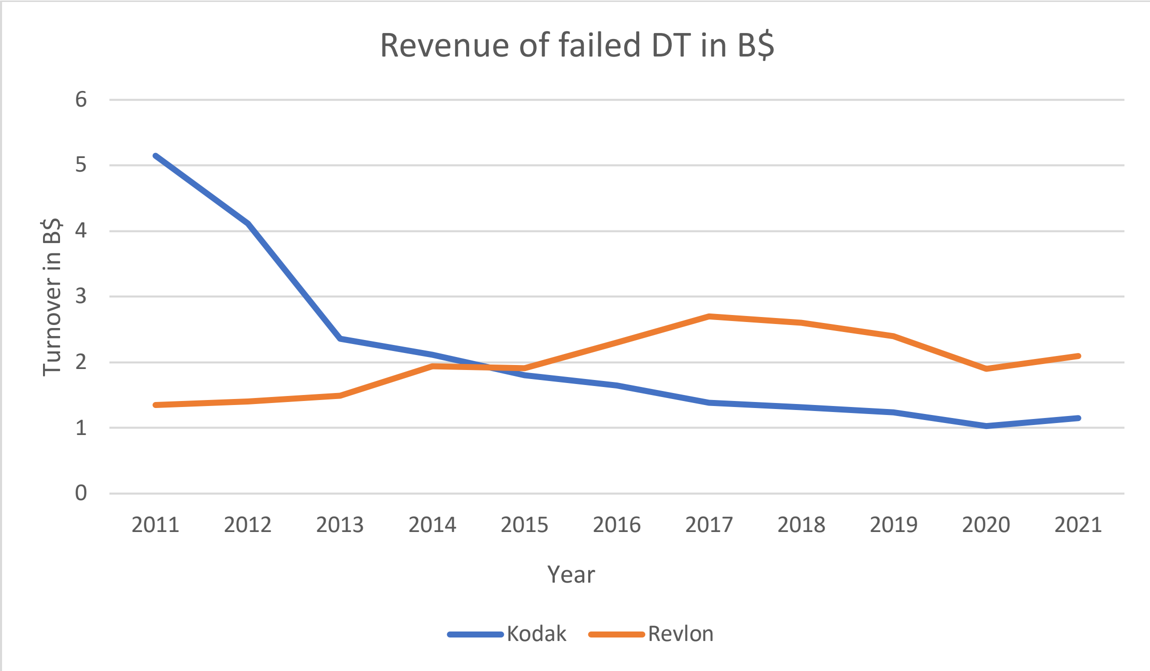


Chart 2 - Yearly turnover of failed digital transformation organizations in billions of $

This chart shows the evolution of the revenues of companies that have not succeeded in their digital transformation. We can easily see that the revenue does not follow a stable evolution or even tends to decrease over the years. As said above, digital transformation allows companies to reach new markets and even to support their position in an existing market. It is only necessary to ensure that the digital transformation is carried out in the best possible way.

1.4. SARS-CoV2 pandemic

Another element has accelerated the concept of digital transformation. This pandemic has plunged all the world economies into a recession, which has had consequences for work situations (Adams-Prassl *et al.*, 2020; Beland et *al.*, 2020; Bick and Blandin, 2020; Coibion *et al.*, 2020). The European Commission has stated that the debate on the impact of digitalization on the economy and society has gained momentum (Nagel, 2020). The COVID-19 pandemic prevented close contact between workers for many months. UNIDO (2020) also stated that the COVID-19 pandemic was a real catalyst for digital transformation. The example of students who were faced with having to take their theoretical courses at a distance can also be taken. Educational institutions therefore had to use tools such as Microsoft Teams, Zoom, etc. Organizations have seen great opportunities that they have not hesitated to seize.

We talked earlier about the Internet of Things and connected devices. Here, the pandemic forced people to keep a certain distance from each other and forced companies/institutions to find solutions. In particular, Simon (2020) explained the opportunity seized by hospitals in terms of robots. Also, robots were able to go and distribute food to the inhabitants. These robots communicated with each other to organize the optimal distribution.

At present, the question arises as to how this trend will develop. Will companies adopt this hybrid working method (telework and face-to-face work)? It should be noted that government regulations have obliged companies to offer employees the possibility to work remotely (Beland *et al.*, 2020; Spurk and Straub, 2020; Stürz *et al.*, 2020). It is clear that companies will continue to operate in this way. First of all, it would reduce the costs of the organization (e.g. no longer paying for petrol, staff at the workplace, office facilities, etc.). Secondly, ecological issues are putting pressure on companies to limit their ecological footprint. Therefore, teleworking can help companies in their environmental efforts. Finally, Davidescu *et al.* (2021) have shown that this flexibility contributes to the level of employee satisfaction. We can see that this pandemic has offered financial and human opportunities to organizations around the world.

1.5. Customer experience

Now that the different themes related to digital transformation have been discussed, we should also ask ourselves how the relationship between the customer and the organization will change. For example, more and more people make their shopping mentioning it is simpler, cost saving, etc. How should companies adapt to this new way of shopping? The world is busy transforming and digital technologies are only evolving. These technologies directly impact consumer behavior (Shrivastava, 2017). For this reason, companies must redefine their customer experience management policy so that it is as consistent as possible with what the customer expects. In order to maintain customer retention, an enterprise will have to review its value proposition (as mentioned in a previous section) in order to maintain collaboration with the customer (Berman, 2012). Other studies have shown that it is not more needed to focus on customer satisfaction itself, but rather to include customer data (Big Data) in the organization to focus on the customer experience (Kozina & Dusper, 2020). The idea is to find new ways to engage customers and communities. This is why firms need to maintain interactions with customers at all phases of activity (Berman, 2012). We could take back the example of online shopping: the firms need to maintain contact with their customers, especially with the help desk and even for tracking packages functionality. It is an example of how the firm have to adapt to the digital technologies.

It can be concluded that the customer/organization relationship has changed enormously and that is why they must constantly redefine their strategies in order to remain customer-centered (Berman, 2012).

1.6. A human approach in a numeric world

The challenges and opportunities of the digital transformation within the organizations were mentioned above. We could therefore think that digitalization only brings positive benefits to companies and that they should only use numerical tools. However, Westerman (2016) has argued that this approach to management should not be taken to extremes. In such a situation, employees could be paid only when the company needs them. Furthermore, we have seen that Big Data can be used for strategic business decisions. From this point of view, a company could be tempted to implement data-driven management and employees would be evaluated solely on the basis of numbers. We would then be back to a situation where an employee is considered as a part of the chain. Finally, automation is a consequence of digitalization, and we could ask ourselves what place an employee will have in a situation where he or she is replaced by a machine. It is clear that this approach is financially interesting for companies, but it will necessarily affect them negatively in the long term. It is in a company's best interest to turn to digital, but workers and technology should be used in a collaborative and not mutually exclusive way. A company that keeps its employees is a company that creates employee loyalty, and that loyalty will be of paramount importance when this company goes through time (Westerman, 2016).

1.7. Some Figures

In this section, we will look at some of the figures relating to digital transformation, in order to identify the challenges of this concept. These statistics come from a variety of sources and are all listed on Statista.

Earlier in this thesis, we talked about the opportunities of digital transformation. Research & Market (2020) has estimated that the market for digital transformation (artificial intelligence, Big Data, etc.) will grow from \$469.8 billion in 2020 to \$1,009.8 billion in 2025. Another alarming figure in this regard is that it has been estimated that digitally transformed companies will account for more than half of the global gross domestic product (IDC, 2020). McKinsey (2020) stated that 38% of executives intend to invest more in technology in order to create a competitive advantage.

In terms of investment, CIO conducted a study in 2018 and found that 40% of technology spending is on digital transformation. Nevertheless, it was pointed out that competition is stronger in a digital economy (Ansong & Richard, 2019). At the same time, 90% of jobs will require digital skills (European Commission, 2017).

We discussed earlier in this thesis about how workers and technology need to be complementary for a company to survive over time. This is also reflected in the facts, as 68% of executives believe that collaboration between workers and artificial intelligence will be key to the success of an organization in the future (Fujitsu, 2018).

2. Performance

2.1. Contextualization

2.1.1. Origins

To begin with, it is important to clarify that in our thesis we will be talking about business performance. If we go back in time, and although companies were very different from today, performance has always been of crucial importance in business management. From the small farmer of the Middle Ages through the industrial revolution to modern times, performance has always been an important purpose. During the industrial revolution, for example, people were replaced by machines, always with the purpose of performance. In the same way, our ancestors developed the use of the horse and plough. Again, this was to achieve maximum performance. Hundreds of other examples would be easy to illustrate, so it is trivial to understand that the search for performance is not a new concept.

Nevertheles, performance has evolved over time. For most of human history, many civilizations, and what we might call their enterprises, have been solely concerned with financial performance. However, with the industrial revolution, things started to change. As a result of disastrous working conditions, often ridiculous pay and numerous, often fatal, accidents at work, the situation was about to change. Indeed, movements were set up in different countries with the purpose of making changes. Following fierce struggles and numerous human losses during bloody workers' revolts, the first workers' rights were established. These workers will then, over time, fight to gain many more rights. At first, children should not work before a certain age. After that came compulsory paid holidays and improved working conditions.

Over time, human was substituted by the machine for the more arduous tasks. The middle class changed from manual workers to office employees. Office work increasingly began to be the norm. The middle class underwent a transformation. It changed from a standard, easily replaceable pawn to an employee who has to be attracted. An employee who has requirements, who must be kept if one is satisfied with his work. An employee who will potentially receive offers from other companies. For companies, it is then necessary to be able to convince the employee that he or she is better off in your company than elsewhere, and to provide better conditions. The employee no longer does a simple and repetitive job that can be replicated by anyone else but has become a real resource for the company. They acquire the knowledge and experience that enables them to offer real added value to the company for which they have decided to work.

It is on this basis that, decades later, performance is also measured on the basis of employee satisfaction. Nowadays, work has become less arduous for the vast majority of jobs. This is also partly due to the fact that employee satisfaction has become an important factor for workers. People no longer choose their company solely on the basis of salary or benefits, but also on the basis of other options such as the working environment, the atmosphere or the amount of pressure perceived by them.

2.1.2. Some definitions

These last-mentioned factors are factors that increase employee satisfaction. In order to attract the best workers, companies must therefore perform well in this area as well.
However, performance is a very vague, catch-all term that can mean many things at once. For that reason, it is very important to define it clearly and precisely. Regardless of the field of research, McAuley (2001) and Franco-Santos *et al.* (2007) agree that performance is a difficult principle to explain or categorize. McAuley (2001) defines performance from an art perspective as "a category through which something else is being explored". Franco-Santos and Bourne (2005) explain that there are a multitude of domains in which performance can be measured such as strategy management, operations, human resources, accounting, various informatics systems and many other areas. Nevertheless, few of these factors are used and analyzed in every essay in the literature.

In an attempt to address this problem, several authors have focused on performance measurement. A regularly cited definition is the one provided by Neely *et al.* (2002), where they define performance measurement as 'the process of quantifying the efficiency and effectiveness of past actions'. Moulin (2007) emphasizes that although there is some mention of effectiveness and efficiency, this does not provide managers looking to evaluate the performance of their division with any guidelines on what to quantify or when to do so. Moullin recommends his definition, which is: 'evaluating how well organizations are managed and the value they deliver for customers and other stakeholders' (Moullin 2002). The latter gives more guidance on the appropriate direction to take when measuring performance. Moreover, the fact that it refers to evaluation as opposed to quantification indicates that there is also a part of analysis as well as interpretation. In this definition, a key aspect that was not included in the first definition emerges. This is the value created for customers and other stakeholders. These stakeholders include the employees mentioned earlier in this introduction. This definition is particularly interesting because of the loop it creates. Indeed, the definition takes into account the way an organization is managed. However, the measurement of performance is itself part of the management of that organization. This performance measurement must therefore itself provide value to customers and other stakeholders. Moullin (2007) also explains that for him, his definition can be fairly well associated with four major criteria. The financial dimension, the customer, the internal process and learning and innovation.

2.2. Business performance management

2.2.1. Definitions

A new term that has emerged, which refers to the same point, is the term Business performance measurement (BPM). However, Franco-Santos *et al.* (2007) explain that the problem still persists. According to them, there is a lack of clarity in the definition of this term. As a result, a large number of authors refer to this term without explaining its implications. Thus, although the authors have their own interpretation of the term in mind, it cannot be equivalent for the readers. This leads to some confusion for someone trying to generalize or compare two articles. It will be rather difficult to find a certain consensus on a given subject when two authors are not talking about the same matter. This may then prevent any attempt at generalization or the development of new papers trying to build on those of previous ones. For example, Neely *et al.* (1995) described the term BPM as a "set of metrics used to quantify both the efficiency and effectiveness of actions". This definition is seen in a way that focuses on the operations of a company. In contrast, others such as Ittner *et al.* (2003) use a definition based on a strategic control perspective with the following definition: "a business performance management system is the system that not only allows an organization to cascade down its business performance measures, but also provides it with the information necessary to challenge the content and validity of the strategy".

2.2.2. Differences in use

Although close, it is easily noticeable that the second definition offers us an additional dimension. Indeed, it is necessary, according to them, that this performance system is able to provide companies with the keys to resolve any failures detected. It can be seen here that the second definition includes the elements of the first but that the reverse is not true. This is a concrete example of a problem that could appear in the context of a literature review. Furthermore, Franco-Santos *et al.* (2007) indicated that out of 300 articles discussing business performance management, only 17 of them defined the concept. They conclude that there is no point in creating a general consensus, but that it is more appropriate for each author to explain what they mean by it.

We can see here that, whatever the term chosen as a performance measure, there are always differences, sometimes major, sometimes minor, between interpretations of the words. In our case, the performance will be measured in the same way as Neely *et al.* (1995). That is, we will use a number of measures to gauge how effective and efficient a company's actions are.

2.3. Performance measurement factors

According to Bernard Marr (2021), a specialist in KPIs (Key Performance Indicators) and a business analyst for Forbes magazine, there are four KPIs that can be used to measure this performance. These are *customer satisfaction*, *internal process quality*, *financial performance results and employee satisfaction*. We can see that these four criteria are quite similar to those chosen by Moullin in our introduction. There are then two rather minor differences. The first is that employee satisfaction becomes one of the criteria, whereas Moullin had included it in his definition. The other difference is innovation and learning. Marr will therefore consider innovation and learning as part of each one of his four criteria. So, there will be innovation in internal process management, learning in customer satisfaction management and so on.

For many reasons, we decided to choose these four criteria for our analysis. Firstly, they are easily applicable to a large majority of companies. Indeed, some authors put forward other approaches, including for example the quantity of goods sold, or its growth. However, this cannot be applied to all companies. Some firms sell a fixed quantity of products and have no interest in increasing the quantity, or else they lose an advantage. This is the case for many luxury brands, which keep a limited stock even though demand exceeds supply. This allows them to maintain their luxury brand identity. On the other hand, there are companies that offer services that are difficult to count. For example, a company whose sole purpose is to advise a single company will not count the amount of advices given.

Nevertheless, for companies where the quantity of products or the increase in products is a real factor, it should be noted that this figure can be found, highlighted if necessary, in the financial performance section. It can also be seen that with these criteria, all the important aspects that the different authors propose to evaluate are always found in one category or another.

Furthermore, although they are all related to each other in different ways, these four characteristics are quite distinct. While they may influence each other, none of them alone can determine the results of another, rendering its analysis meaningless. Finally, these four characteristics are proposed in an almost similar way by two authors, each of whose job was to propose performance indicators. And this almost consensus, which was explained above, was found without consultation between the two authors, at least not officially.

2.3.1. Customer satisfaction

2.3.1.1. Definition

To begin with, there is the customer satisfaction. Ferrentino and Boniello (2020) define customer satisfaction as "the measure of the degree of customer satisfaction". They tell us that satisfaction is a measurement of the differences between the customer's expectations and desires and what they actually perceive. The latter includes the use of the product or service, but also the feelings before and after using it. It equally includes all the services or secondary goods that complement the main one. According to them, this satisfaction also measures the capacity of a company to organize itself in order to know as well as possible or even to anticipate the expectations and needs of its various customers in a more or less precise way.

It goes without saying that a company, except in the case of a complete monopoly, can only be successful if it has satisfied customers. This is essential for the survival of the company. Customer satisfaction is the main factor that will increase the retention of existing and new customers. According to Ferrentino and Boniello (2020), there is no company that can survive in the long term without placing a high value on customer satisfaction.

Conversely, a good customer-company relationship that lasts over the long term has become one of the best ways to ensure stable, healthy and sustainable profitability. According to Gruca and Rego (2005), companies that increase in value each year are those that are able to invest a large part of their revenues in the purpose of increasing customer satisfaction and thus loyalty. The loyal customers should enable the company to increase its net cash flows and stabilize them. This would then allow the consolidation of revenues. This is mainly due to the reduction in the level of variability. Thus, a stable and loyal customer guarantees a stable and loyal source of revenue. This loyalty would then no longer make them attractable by other companies. One can easily take as an example some Apple customers who only buy iPhones. They don't even look at other products in shops, on TV, in discussions and other moments when they might consider it. They are and will remain loyal to Apple and will only consider buying their products. They will then hesitate between the two varieties of the new iPhone or perhaps with the one from the previous year. Buying elsewhere is no longer an option, and this is thanks to Apple's immense loyalty work.

2.3.1.2. Benefits of the client loyalty

According to Oliver (1999), customer loyalty, if high enough, can in many companies become the primary driver of financial performance in the long run. Based on this observation, Busacca and Bertoli (2009) add that for many companies, the importance of customer satisfaction can then pass a milestone. Indeed, it moves from a technique, a way of operating, to a real philosophy. For these companies, it becomes the main point of their strategy.

2.3.1.3. Strategic adaptation

As a result, we are seeing more and more companies that adapt their marketing accordingly. Where traditionally, through advertising, communication or other marketing techniques, companies had a strategy of promoting their product or service, this has moved away. Nowadays, companies' marketing is increasingly focused on their relationship with the customer. The customer is therefore no longer seen as an individual to convince, but rather really as a partner, a real element of the marketing function. Ferrentino *et al.* (2016) analyzed precisely the relationship with the customer in terms of the durability of the current relationship and its stability and no longer in terms of the number of transactions. In other words, in the past, one tried to sell as much as possible and as quickly as possible to the customer, in order to secure the transaction and the profit acquired by this or these transactions. Nowadays, more and more companies are doing the opposite. They are trying to secure as many customers as possible and to keep them as loyal as possible and as quickly as they can. And this is in order to sell more in the future and in the long term.

2.3.1.4. From product life cycle to customer life cycle

We are no longer talking about a product life cycle, but rather a customer life cycle. Ferrentino (2016) describes the life cycle of a customer as “a series of transactions between the firm and its customer over the entire time period during which the customer remains in business with the firm”. This lifecycle will naturally be very different depending on the nature of the business, the frequency of purchase, the type of customer or the age of the customer. It is obviously easier to retain a customer in the electronics sector such as phones and computers or in the chain shop sector through frequent purchases. On the other hand, it will be much more difficult to retain a customer in the real estate sector due to the low level of company-customer interaction. It will also be harder to retain a younger customer, who will be more willing to change than an older person who will tend to stick to their habits. A company will therefore have to make more effort to retain them.

This means that many companies are obliged to change the direction of their strategy management. It will be necessary to do everything possible to align the expectations and results perceived by the customers with those they initially expected. It is also necessary to arm oneself with new, state-of-the-art tools in order to get as close as possible to the actual expectations of the customer.

2.3.2. Internal process quality

2.3.2.1. Definition

There is additionally the quality of the internal process. Siddh *et al.* (2018) explain that this internal process contains the totality of the operations carried out within the company, whether we are talking about the operations actually carried out or the logistics that allow this quality to be optimized. Sturm, Kaiser and Hartmann (2019), on the other hand, see the internal process as the totality of the services and products created.

2.3.2.2. Internal process regarding client expectations

Of all the factors mentioned above, and on condition that the quality of the products or services is adapted to the customers' expectations, it is the easiest to link to the performance of a company. Adapted to the customer means that it is not enough to try to obtain the best possible product, but a product that meets the expectations of each customer without exceeding them. Not all customers are looking for the most perfect product. Some of them are only looking for a functional product, and at a reasonable price. If you exceed the customer's expectations, he will be satisfied but not sufficiently satisfied for the effort involved. They may not be willing to pay the extra money for it. However, if you provide a top-quality product for a lower price, customers who normally buy the higher range will also buy the cheaper product and losses will be incurred. In order to be able to offer the best possible internal process quality, it is therefore necessary to know the expectations and requirements of the customers. It appears that these two factors are closely related. Siddh *et al.* (2018) tell us that, knowing the expectations that customers have of services, enables organizations to maximize the well-being of these customers. They will do this by optimizing the efficiency of their work in different ways. This will then allow them to reduce defects at key points, but also to optimize the development of processes, products, and services.

Finally, Siddh *et al.* (2018) informed us that the quality of human resources and generally information, also improves the social and environmental economic performance of the company.

2.3.3. Financial performance

2.3.3.1. Definition

Afterward, comes the financial performance results. Suvvari *et al.* (2019) define economic performance as follows: 'the term performance represents the potential and the capacity of a firm to achieve a target or goal which involves a concept of measurement'. They then inform us that financial performance has become a major factor in corporate strategy. Under constant pressure from shareholders, management boards need to achieve demonstrable goals. And the easiest targets to demonstrate are financial results. It has therefore become vital for companies to show their customers, investors and all stakeholders that they are doing the right thing.

2.3.3.2. Financial performance measurement

In order to measure this performance, multiple ratios such as ROA (return on assets) ROE (return on equity) and ROI (return on investment) can be used. These are, according to Aliabadi *et al.* (2013), the most relevant and reliable measures on average. According to Almehdawe (2021), factors influencing financial performance can be internal and external. Internal factors include company size, revenue diversification, past or future mergers, current market penetration and competition. External factors, on the other hand, are variables at the macro level.

2.3.3.3. Finance as driver of performance

Furthermore, Prasad *et al.* (2018) explained that, managing financial resources adequately, is as important as managing the company's activities. Indeed, to operate, a company always needs cash. For example, it is necessary to have cash to pay suppliers when customers have not yet paid us, to get out of an exceptional situation or other reasons. However, a company that keeps too much cash without investing it is missing out on a profit. Indeed, keeping money in a bank account without investing it, especially because of inflation, is a waste. In order to optimize the performance of a company, it is necessary to be able to manage its financial resources in an optimal way. For example, a company that invests too much of its money may not be able to pay for a new machine. This could then create a big hole in sales, which would create a big loss from which a company might not recover. It is always important to remember that bankruptcy occurs when a business runs out of cash to pay its creditors. Poor financial management can therefore endanger or even bankrupt a business that is actually profitable.

However, a company that is able to manage its finances well can increase its profitability and performance considerably. According to Prasad *et al.* (2018), this may allow it to increase its market share or diversify into other businesses. In this way, we see more and more large companies diversifying into dozens of sectors. Good management of their financial resources has enabled them to become worldwide powerhouses in a short period of time. As a result, a number of companies find themselves making more profit through good financial management and investment than they do from their core business. These companies prove that good financial management has become a key aspect in the search for performance.

2.3.4. Employee satisfaction

Employee satisfaction is also one of the pillars of performance defined by Marr (2021). Indeed, this employee satisfaction can have a direct impact on his motivation and thus on his personal performance. Employee satisfaction can also be compared to a fully-fledged element of performance. In this section, we will develop the extent to which employee satisfaction can be impacted by the digital transformation of a firm.

2.3.4.1. Definition

Finally, the fourth and last factor is employee satisfaction. As stated in the introduction, employee satisfaction is more of a new phenomenon than the other factors. Nevertheless, it is becoming increasingly important in companies, especially when there is a lack of employees in the sector.

Markovié Pavlovié (2014) is one of the first to define the term employee satisfaction. For her, it can be defined like this: “employee satisfaction is seen as a combination of psychological factors and environmental factors that affect employee satisfaction with his or her performance”. Locke (1976, p.1297), on the other hand, preferred to analyze the matter without giving it a real definition. According to him, it was "a pleasant or positive emotional state which is the result of performing a job or a whole work experience".

2.3.4.2. Employee satisfaction on employee behavior

According to Perić *et al.* (2018), employee satisfaction is highly correlated with positive behavior, regardless of their workplace. This satisfaction is also related to the difference between their expectations and what they actually perceive, in relation to their work, their rewards and other factors that may impact their feelings.

At first sight, it is clear that an employee who is satisfied with his or her working conditions will obviously be more inclined to work. This is also what Sagger, Rafat and Agarwal (2012) argue. They explain that organizational factors have a great impact on employee satisfaction. As employees spend a large part of their time at work, it is understandable that these factors greatly influence their satisfaction. This satisfaction can be improved through various factors, including the reward system, moving up the work ladder and a better working environment. But it can also be improved by a good relationship with management, good teamwork or a well-developed organization (Đokić, Pepur, Arnerić, 2015, p.55).

2.3.4.3. Reward system

Taiwo *et al.* (2020) do explain that a good reward system is a very effective tool to increase employee satisfaction. But he also explains that it becomes a very good way to motivate people to increase their performance. Thus, despite the potential negative effects that a reward system can create, such as overly aggressive competition, it would be beneficial to use this system, which can also be combined with a group reward system. This reward system also makes the work done by employees more meaningful. Indeed, if in many jobs employees cannot always see their results, a reward can help to compensate. Although the employee will not fight to do a better job because they see the results of their work, they will fight to do a better job to get those famous rewards. This reward system can also be applied to achievements other than results. For example, it can be applied when carrying out various training courses. When training is necessary, it is sometimes difficult to convince individual employees. Forcing them to do so would reduce their job satisfaction. Instead of coercion, offering a reward to all employees who voluntarily choose to train will increase perceived employee satisfaction. Taiwo *et al.* (2020) also explain that a new type of reward can be given. This type of reward will be given to employees who help, support and treat other employees well. This reward is supposed to create a more pleasant working environment for everyone. This will make the work environment happier and more enjoyable. This reward should not be given only to one person, who would be considered the best in the field. But it could be given to every person who makes a visible effort to make the place more pleasant and to increase employee satisfaction.

2.3.4.4. Relationship with management

Another way to increase employee satisfaction is through a good relationship with efficient management. For example, Babu and Thomas (2021) explain the benefits of total quality management (TQM). According to them, it is a management strategy that successfully increases the organizational performance of companies that apply it. They argue that this form of management makes it possible to develop a positive image of the way the company is organized by the management itself. Each stakeholder necessarily develops a different image of the company based on his or her own feelings and experiences within the company. Previous studies have shown that a positive image of the organization and thus employee satisfaction has many benefits. It can give a competitive advantage in order to be seen as a more valued company. As a result, it helps to attract more qualified and talented people into their position (Liu and Liu, 2014). The practice of TQM increases the involvement of employees. It also enriches their work experience and helps them to develop their position. As a result, the quality of work life is improved and employee satisfaction is significantly enhanced (de Menezes, 2012). Furthermore, the fact that employees can improve their job by changing it, through more opportunities to solve new problems, will greatly improve the feeling of a job well done. This feeling is obviously an important driver of employee satisfaction. Finally, Babu and Thomas (2021) tell us that it is widely accepted that having tasks that are standardized through the TQM process reduces the risk of error and increases efficiency. The latter two points in turn reduce job stress and thus increase employee satisfaction.

2.3.4.5. Promotions

Furthermore, the possibility of getting a promotion is also a factor influencing employee satisfaction according to Chukwu (2019). He even explains that a large proportion of employees will tend to resign when they feel that, despite all their efforts and intellectual abilities, they will never be able to get promoted. They will then quickly tend to look for work in another organization, in the hope of finding a place where this promotion will be possible. However, a promotion is not necessarily a synonym for a higher salary. It can also be an honorary benefit such as a title, more responsibility or any other non-financial benefit.

And this hope of promotion, whether monetary or not, can improve the motivation of employees and thus enable them to perform better. It will also improve the morale of the employees. Their motivation and hard work will also create better results, in turn improving employee satisfaction Kim (2012). Parker *et al.* (2011) state that to ensure a correct perception of fairness and to ensure employee satisfaction, it is essential that there is a strong correlation between performance and promotions received. It is therefore essential to be fair and equitable when awarding these different promotions. Otherwise, the final result on employee satisfaction will certainly not be positive. The result will be less motivation and certainly more departures. Chukwu (2019) also explains that employee satisfaction is also higher when promotions are received on a regular and explained basis and the criterion for deciding on promotions is transparent.

2.3.4.6. Teamwork

Finally, Gopalan (2019) indicates that the correlation between teamwork and employee satisfaction is well and truly high, across various statistics. He indicates that millennials have a clear preference for teamwork for several reasons. Not only do they find it more enjoyable, but it also reduces the risk of individual errors. Moreover, working regularly with colleagues or managers creates a good relationship. This good relationship, more pleasant work and the risk of individual error greatly improve employee satisfaction.

Nathwani (2021) also confirms that employee satisfaction has a strong influence on employee performance in an organization. He adds that if employees are satisfied with the type of work they do, they will perform even better.

2.4. Conclusion

To conclude on performance, it is clear that it is a term that encompasses a very wide range of notions. We also know that it is a long-standing term and has always been a goal, regardless of time and place. In our thesis, we will focus solely on performance from a business perspective. We will therefore rely on data received from a variety of people working in these companies.

Although we focus on the performance of companies, so-called economic performance, there is still a deficiency. Whether it is the term 'performance' used by most people, the term 'performance measurement' or the more precise 'business performance measurement', none of them has a consensus and accepted definition. It was therefore necessary, before beginning, to state this difficulty, and to explain our approach to dealing with it.

We decided to base ourselves on an analysis of performance as seen by Neely *et al.* (1995), i.e. to base ourselves on a certain number of factors that can be measured. These factors, once measured, analyzed and aggregated, will allow an analysis of how effective and efficient a company's actions can be. Here again, a problem has emerged. This is because there are dozens of factors, of varying degrees of relevance, for each sector or company. And although each company may have its own analysis factors to measure its performance, the authors have put together several factors that are somewhat general.

After reading the different articles proposing their analysis factors, four of them were chosen: *customer satisfaction, internal process quality, financial performance results and employee satisfaction*. These factors have been brought forward by two authors, Marr (2021) and Moullin (2002). The former is a specialist in KPIs and the latter skimmed a considerable amount of literature before settling on his choice. It is important to note that Moullin's choice was slightly different. He still considered the four criteria chosen by Marr, but he did not integrate employee satisfaction as a separate criterion. However, we explain in the paragraph on employee satisfaction why it is appropriate for it to be one of them. He then adds innovation and learning as criteria. Marr argues that this factor can be integrated into each of the four factors mentioned above. These factors together encompass the majority of the other criteria proposed by the various authors. In addition, they have the important advantage of being adaptable to the vast majority of modern companies.

3. Relationship between digital transformation and organizational performance

In this section we will investigate whether any relationship exists between digital transformation and performance. We will therefore investigate to what extent digital tools affect the four aspects of performance (defined in section 2.3.).

3.1. Customer Satisfaction

3.1.1. Digital marketing

Digital marketing refers to all " strategies that are carried out in that media platform to provide an interactive, focused and measurable way of reaching consumers" (Isidro *et al.*, 2017). One of the principles of digital marketing lies in the use of a platform as a communication tool (Isidro *et al.*, 2017). The digital transformation has completely disrupted the markets and the marketing of companies has had to adapt to this situation. In this section, we will analyze the marketing mix, i.e. the set of areas in which an organization will develop strategies. The components of the marketing mix are the *products, place, promotion* and *price*. In this section, it will be developed how a company reviews its strategies among these components because of this technological disruption.

3.1.1.1. Product

Before digital transformation, organizations offered similar products and differentiation was much less present than in Industry 4.0. This customization is made possible by new technologies that allow for more efficient production. This is due to the fact that digital technologies are more productive and reliable than when the production or service steps had to be performed "manually". In addition, data management offers the opportunity to segment the market more precisely and thus to adapt a product to one customer or another. Finally, the IoT has enabled organizations to autonomously and automatically monitor a step in the value creation process. As a result, we have a product that meets the needs of a customer and their satisfaction is positively impacted by this (Brunetti *et al.*, 2020; Caliskan *et al.*, 2021).

3.1.1.2. Place

The second element of the marketing mix to be analyzed is the "place", i.e. where the products will be sold, how the means of transport will be used, etc. The digital transformation has completely disrupted the economy and in particular the distribution channels have completely changed. This evolution has taken place in two stages. Initially, digital transformation came to help organizations in delivery. But this has evolved further and now the objective of companies is to offer customers the possibility to access products/services everywhere and all the time. There is therefore a combination of optimal delivery and accessibility. This meets the increasingly demanding needs of customers. Of course, delivery and inventory management optimization are one of the necessary conditions to satisfy customers. Those customers have implications in the supply chain management that will be detailed in the section 3.2.1 (Verhoef *et al.*, 2015; Caliskan *et al.*, 2021).

3.1.1.3. Promotion

Marketing promotion has also changed significantly with the digital transformation. In the past, the idea of communicating with customers was done in a massive and impersonal way. Search engine optimization (SEO) has allowed organizations to target their audiences more accurately. This is done in particular on social networks with social media optimization. In this way, organizations can target their marketing campaign and is in line with the idea of offering personalized services (Jara *et al.*, 2012; Başyazıcıoğlu & Karamustafa, 2018; Caliskan *et al.*, 2021).

In addition to the elements mentioned above, we could also talk about social media, which is one of the main challenges concerning the communication between a service provider and a final customer. Social media have been defined by Hanaysha (2018) as a set of online communication tools whose purpose is to share information to different users. The purpose of these media is to enable efficient information sharing and interactions (Edosomwan *et al.*, 2011). The effectiveness of social media also lies in the fact that they offer the opportunity for interaction regardless of location (Mann & Sahni, 2011). But what about the implications of these social media on customer satisfaction? Is a social media a factor in customer retention? This is precisely the question that Duffet (2015) investigated. In his study, he wanted to analyze to what extent social media marketing could have a significant effect on the perceived value of the brand on the part of customers. The study showed that social marketing has a significant effect on perceived value. The same study showed that social media marketing had a significant and positive impact on customer retention. The mediating variable in this relationship between social media marketing and retention is the customer's perceived value. Of course, it is trivial to conclude that perceived customer value is positively correlated with customer satisfaction. For this reason, the authors agree that social media should be used to change a customer's perception of a brand or products/services (Hanaysha, 2018).

3.1.1.4. Price

Pricing strategy in the digital economy has changed dramatically and often to the detriment of customers. The objective of most organizations is to maximize their profit. This is made possible by a "dynamic" pricing policy. In this kind of policy, a company will offer different prices depending on several factors. For this reason, prices will vary quite often over time, space and from one person to another. The digital technology behind this optimization is the intelligent use of data. Customer and geographical data are constantly used to optimize the pricing policy. It was mentioned in the section 3.1.1.1. that data allows organizations to segment the market to adapt their offers, and this is also the case for pricing policy. Thanks to this, organizations will be able to offer a price to customers that is always at the limit of their willingness to pay. This boosts the economy because dynamic pricing will always make a customer pay less than the maximum that he is able to pay. Nevertheless, each of these will be paid more than in a fixed price policy (OECD, 2018; Caliskan *et al.*, 2021), which can undermine the satisfaction of customers who are not offered a product/service at a favorable price.

3.1.2. Data, IoT and customer behavior

In the digital age and in an increasingly competitive environment, companies need to keep as close as possible to their customers. Organizations must constantly analyze customer data in order to understand their behavior (Hendriyani & Auliana, 2018). Big data is a megatrend and the demand for information technology (IT) is constantly increasing. The challenge behind this demand is to manage the data and interpret its meaning. The data are actually only "raw facts" that need to be analyzed in order to help a firm in its decision-making process (Ylijoki & Porras, 2019). It can be added to this that consumer behavior is constantly changing due to digital transformation. Markets have evolved, and it is imperative to track the evolution of trends in customer behavior (Syaglova & Salamovska, 2019). Abu Ghazaleh and Zabadi (2020) have rightly shown in their study that big data allows a company to adapt its offer according to the market and customer behavior in order to keep a high customer retention. Also, this data analysis can help an organization in its decision making when launching a new product/service on the market. This is how a company will be able to adapt its offer according to the needs of the identified customers. Customer satisfaction can therefore be positively impacted by the use of big data, as it can contribute to adapting an offer to the needs of this customer.

The Internet of Things (IoT) is also one of the challenges of digital transformation directly linked to customer satisfaction. In the section 1.2.5., we already discussed this concept. The term IoT refers to the connection of physical objects to each other through the Internet, even though they are not physically connected. It should be noted that the term Internet of Things is used for objects that do not initially have any capability connections. We will therefore speak of IoT for connected watches, intelligent lightbulbs, etc. This is not the case for smartphones, computers, etc., as these were designed with the aim of connecting to each other (Cong *et al.*, 2021). The advantage of the Internet of Things is that it allows organizations offering this type of technology to "capture data about how consumers use their products." (Cheah & Wang, 2017). This means that it is possible to capture data about how a product is used. This can also guide an organization in making decisions about a product. As a result, Engdahl (2022) stated that customer satisfaction can be improved with a good management of data obtained thanks to the Internet of Things and managed in thanks to the technologies related to the data management.

However, it is also worth considering the other side of the iceberg. Customer privacy comes into play. Privacy can be defined as "the desire of people to choose freely under what circumstances and to what extent they will expose themselves, their attitude, and their behavior to others" (Westin, 1967). Nevertheless, digitalization allows organizations to capture customer preferences and behavior. Some of these customers are reluctant to share this information and this impacts on companies that do not have a clear idea of consumer behavior. This can lead to ineffective personalization and frustrated customers who feel that the products/services offered are not in line with their needs. The issue behind this is that customers want their data to be used (so that the offer is tailored to their needs) while ensuring secure data management (Hemker *et al*., 2021).

3.1.3. Managing transition

It was mentioned in the previous sections the personalization that digital transformation can offer. In addition to this, platforms offer the possibility for organizations to no longer worry primarily about frontline customers. This is because the relationship with close customers is almost identical to that with more distant customers, as the means of communication have enabled companies to connect with their global customer base. What are the problems of such a communication mode? In fact, the problem is that the relationship itself has changed. We have moved from a human-human relationship to a human-machine relationship. This poses a problem for many customers who need direct connections with their service provider (Cherry, 2021). Organizations are all busy carrying out their digital transformation in order to keep as many connections with their customers as possible. For example, more and more firms are offering online support services rather than a simple "help" page. Nevertheless, the study by Larsson and Viitaoja (2017) showed that customers currently consider themselves to be technologically ahead of companies, and that companies would consequently have difficulty being present on the right channel at the right time. This can lead to dissatisfied customers, who do not feel a real connection with the company that offers them products/services. Therefore, the retention of those ones can be undermined.

3.2. Internal Process Quality

The performance of the internal process depends on a multitude of factors such as the motivation of the employees, their productivity, the equipment available to them, leadership, etc. The digitalization of the different stages of the value chain has fundamentally changed the performance of organizations in terms of productivity. In this section, we will investigate which stages of the internal process are influenced by the digital transformation of a firm, and to which extent those implications have impact on the organizational performance.

3.2.1. Supply chain management

Before we can give the implications of digital transformation on the supply chain, it is necessary to define this term. Over the years, the supply chain has been defined by different authors. We have retained the one put forward by Lummus and Vokurka (1999), who defined the supply chain as a set of activities whose purpose is to deliver a finished product to an end customer. Christopher (1992) went further in the definition of the supply chain, because according to him, the supply chain is in fact the set of organizations that are involved in different stages of the process, whose aim is to create value for the final customer, in the form of products or services. Therefore, an efficient supply chain is a supply chain that is optimally managed and coordinated between the different stages/entities. As a consequence, the term "supply chain management" is often used. Supply chain management (SCM) has been defined by several authors. Most of those definitions agree that supply chain management is a process whose purpose is to manage a flow of materials across the borders of companies with the aim of delivering an improved product/service to the customer. In other words, a process must respect a certain sequence of activities across time and space (Mentzer *et al.*, 2001). In this section, we will look at the different stages of process management and try to identify the implications of digital transformation on them.

3.2.1.1. Sourcing

The sourcing of organizations enables them to obtain their raw materials, which will be used to obtain a finished product that will be put on the market. Digitalization and all the technologies that go with it play a role in procurement. It allows the quality of a product to be assessed so that the best quality raw materials can be procured (PR Newswire, 2020). As a result, the procured raw materials are most of the time used and there is much less waste of them. This is in line with a lean supply chain perspective, which will be developed later in this section. It can added to this that artificial intelligence technologies have enabled organizations to use their historical sales data to make accurate and reliable forecasts. The consequence of this is a reduced inventory level as companies can afford to use a just-in-time procurement strategy. We will see later in this section that this type of operation requires a resilient supply chain (Agrawal & Narain, 2018).

3.2.1.2. Manufacturing stages

The different stages of a manufacturing process have also been impacted by contemporary technologies. Indeed, digital technologies have profoundly transformed the business model of a company. We will analyze below different technologies that have impacted the productivity of a company.

The robotics enables organizations to perform various operations automatically. These robots can replace humans for certain types of tasks. Sanders and Swink (2019) have pointed out that robotics and robotic process automation can make the automation of manual and transactional processes cheaper and more reliable than human intervention. Robots only require an initial investment (and maintenances) whereas a human needs to be paid for on an ongoing basis. Also, the technology behind robot automation is artificial intelligence, defined in the section 1.2.6. As a result, these robots perform a task without ever making a mistake. The relatability of these robots is therefore perfect. The Internet of Things (IoT) can also contribute to the reliability of robots. Indeed, sensors can be placed on robots and these sensors can communicate with each other through the IoT. This makes it possible to perform maintenance and identify bottlenecks in the production chain. As a consequence, there are economic challenges behind this robotic technology.

3.2.1.3. *Optimal inventory*

The level of inventory is one of the parameters that companies try to optimize. Poor inventory management can lead to product obsolescence, inventory costs and anarchic inventory management (Semal, "Supply Chain Management", UCLouvain, Louvain-la-Neuve, 2020). In order to optimize their inventory level, it would be ideal to be in a situation of perfect information to apply inventory optimization models. The problem is that information is not perfect and these models are therefore not relevant (Chen *et al.*, 2021). However, big data allows for near perfect information. The collection of sales data can allow companies to identify seasonality and to build forecasts that are more or less reliable. In particular, Microsoft has developed a suite of tools for inventory management, also known as Dynamis365. This inventory management is based on artificial intelligence and more particularly on machine learning.

3.2.1.4. *Distribution*

Digital transformation has not yet fundamentally changed the distribution of finished products because the technologies for this are still in the development phase. Nevertheless, it can already be foreseen what the future should look like. The perfect example to illustrate this concept are the autonomous cars made by Tesla. With the help of artificial intelligence, these cars are able to drive themselves from a location to another, perfectly respecting the traffic rules. This type of vehicle is not yet widely available on our roads because these technologies are not yet fully developed but also due to some regulations. However, it can assumed with a fair degree of certainty that, one day, these self-driving vehicles will replace us. As a consequence, this will save companies money, as human interference is not necessary. In addition to that, this digital technology would reduce the delivery time of finished goods. Indeed, all these autonomous vehicles would be interconnected thanks to the Internet of Things. As a result, each of the vehicles will have the exact information of the positions and routes of the other vehicles located in its area and the artificial intelligence would optimize the route of all vehicles in order to avoid congestion, accidents and avoidable pollution (Aćimović & Stajić, 2019).

3.2.1.5. *Resilient supply chain*

The concepts of Big Data were mentioned several times in this Master's thesis. We have explained to what extent they can impact supply chain management (see section 3.2.1.) and customer satisfaction, related to the marketing mix (see section 3.1.). But the use of such technologies does not only bring management benefits to organizations. Indeed, we will see in this section to what extent the use of big data and Internet of Things can help a supply chain to be resilient.

Before we can establish a relationship between digital technologies and supply chain resilience, we need to define the latter term. Businesses operate in a VUCA (volatile, uncertain, complex and ambiguous) environment. Supply chains are particularly exposed to these threats, which can be detrimental to their proper functioning. The risks can be external or internal. By "external risks" we mean all threats such as disasters (tsunami, SARS-CoV2, terrorism, etc.). Internal risks are operational risks related to the organization's activities. Such risks can affect the visibility of the supply chain and make other departments of the organization inconsistent (e.g. sales that lack knowledge to share with a prospect or customer). Customer preferences are dynamic, and it is complicated to keep a perfect customer satisfaction. Poor supply chain management can lead to excessive inventory levels and as a consequence, higher costs. Not only that, but poor supply chain management can also lead to out-of-stock, and with the fierce competition, it is easy for a customer to switch from one organization to another. As you can see, there is a real need for these companies to take these risks into account in the organizational strategy (Mensah & Merkuryev, 2014). Resilience can be defined as “the ability of a system to return to its original or desired state after being disturbed” (Cranfield School of Management, 2003). Hohenstein *et al.* (2015) defined supply chain resilience as "the ability to be prepared for unexpected risk events, responding and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state in order to increase customer service, market share and financial performance”.

We might ask ourselves what steps to take in order to benefit from a resilient supply chain. Hohenstein *et al.* (2015) have investigated this issue and found that the readiness and visibility of the supply chain is a major asset in building a resilient supply chain. It can therefore be affirmed, based on the literature, that it is necessary to have a global visibility of a supply chain in order for it to be more resilient.

3.2.1.5.1. Big Data

Bahrami *et al.* (2022) studied the direct and indirect effect of big data analytics on supply chain performance. The study found that big data analytics plays a positive role on performance, but in an indirect way. The mediator of this relationship would be resilience. In other words, the use of big data allows for some form of supply chain visibility (with regard to inventories, demands, process performance, etc.). This visibility, in turn, enables a resilient supply chain. This study therefore highlights the critical importance of resilience against supply chain disruptions. This study is in line with previous research, notably the one conducted by Dubey *et al.* (2021).

3.2.1.5.2. Internet of Things

Other research has looked at the effects of the Internet of Things (section 1.2.5.) on supply chain resilience. In particular, the study by Al-Talib *et al.* (2020) looked at the effects of the Internet of Things (IoT) on *visibility*, *flexibility*, collaboration and *control* within the supply chain.

In terms of supply chain visibility, the IoT has enabled the tracking of finished and in-process products. This avoids loss of assets.

The second aspect investigated in this study was the flexibility of the supply chain thanks to the IoT. The study also showed that the interconnectivity of objects allows for more flexibility. Flexibility will mean that a disruption can be managed without affecting the process.

Collaboration is the third aspect to be emphasized with the IoT. The ideal situation is one where information is given in real time. This is made possible with the IoT, which will lead to supply chains where the organization of the process is perfect. For example, in the manufacture of a product, the IoT will allow real-time monitoring and thus avoid the occurrence of unintended circumstances.

The last parameter to be discussed is control. The IoT enables improved capabilities such as quality control and planning. Financially, it is interesting because human monitoring is no longer necessary.

3.2.1.6. Agile supply chain

We mentioned earlier in this Master thesis that companies operate in a VUCA environment. It therefore makes sense for them to be as flexible as possible in order to respond to changes in the market, especially in demand. The term "agile supply chain" is often used. Studies have looked at this concept and have tried to establish a link between big data analytics and the agility of a supply chain. The results of the study conducted by Dubey *et al.* (2018) showed that big data analytics were a source of competitive advantage. This positive relationship is explained by the mediator that is organizational flexibility. These results seem intuitive to us and are in line with the claims of other studies. In particular, Byrne (2012) has argued that data analytics can help a company to build accurate forecasts and can consequently be agile in its supply chain. This, of course, has an impact on the costs of an organization.

3.2.2. Human resources

Digital has also transformed the way in which human resources are managed. Palmer *et al.* (2017) argued that human resources are more people-oriented thanks to digital. Also, several authors agree that human resources are no longer limited to administrative tasks (Bell *et al.* 2006; Larkin, 2017). In addition, the study by Kassim and Sherah (2012) showed that the use of the human resource information system reduces the time needed for HR tasks, and professionals have more time to focus on other issues.

3.2.3. Work organization

The digital economy continues to change the way the work is organized. Different authors have looked at this new organization of work. In this section, we will mention the different organizational parameters and characteristics that have been or will be impacted by the digital transformation.

For years, we have been facing more and more firms using outsourcing. The term crowdsourcing has also appeared within organizational management, as it allows certain tasks to be performed at a lower cost (no facilities needed). This has been made possible by the Internet. The advantages of crowdsourcing are flexibility, scalability and access to a wider range of skills. It is also worth noting that this organization of work makes it possible to bypass employment regulations.

3.3. Financial performance

3.3.1. Finance management

First of all, as explained in the section on financial performance, financial management is an important aspect of a company's economic performance. However, especially for larger companies, managing finances in paper format has always been an additional difficulty to manage. In addition, another risk could surface, that of destruction. For example, all paperwork cannot be stored in duplicate, without incurring even greater difficulties, often unfeasible for many companies. For the majority of these companies, these paper documents were stored in a single copy. These documents were therefore subject to the risk of mass destruction, which would have been a disaster. Indeed, a fire or the activation of sprinklers could destroy entire archives or thousands of documents of a company. Nowadays, digitalization has made it possible to put this on online servers, which although also subject to the risk of destruction, are easier to protect. Moreover, it is also easier and cheaper to have a copy on one or more other servers, which drastically reduces the risks.

Arner *et al.* (2022) also explain that digitalization has revolutionized the way of analyzing the finances of a company. It is now easier for managers or the board to analyze the results. Indeed, it is easier to have a view through each section, sub-section up to the level of a work team. This also makes comparisons much easier. Indeed, digital tools allow a much better organization and use of figures than traditional analysis. For example, one can easily compare two or more sections, compare their evolution, their budgets or any other characteristic that allows one to analyze the financial performance of each part of the company. This amount of additional data is a real asset for companies. Firstly, it facilitates, improves and increases the scenario planning method. This method consists of imagining and building a few possible scenarios based on several parameters that would have a strong impact on the company. This is done in order to imagine the best possible responses for each scenario, in order to create an action plan for each one. This makes it possible to be ready to act in all eventualities that may arise. Digitalization makes it possible to generate much more precise data and thus to make this method more effective. In addition, various tools allow the automatic generation of situations. A greater number of possible scenarios can therefore be explored, and the risk of human oversight is reduced. Secondly, according to Arner *et al.* (2022), this amount of data also allows for optimal planning of financial investments. The management of total costs, potential investments and future income is made much more precise than before. This makes it possible to manage finances in a more secure and sustainable way.

3.3.2. Financial development

According to Rossato and Castellani (2020), companies that survive over time in a sustainable and financially strong way are those that manage to develop at a global level. This theory of globalization is affirmed by many authors in different parts of the world, including Staddler (2011) or Krahnke (2018). In order to expand to different levels, from regional to global, an adequate governance is highly necessary, and to help with financial management, as seen above, digitalization is an important asset. Better financial management, enabled by digitalization, is also an essential asset for going global. As explained in the performance section, good financial management is a springboard for exporting. For example, few companies have enough equity to launch a subsidiary, another division or to make an acquisition. In order to know how much can be borrowed without endangering the company's survival, digitalization is again a major asset. It allows, by means of various tools, to set up different scenarios, simulated digitally, in order to see the different opportunities. The management of finances, improved through digitalization, also allows for better profitability and a high level of digitalization is essential in order to execute a good number of strategies (Rossato & Castellani, 2020). As a result, companies will have more funds to make new investments and acquisitions, allowing them to expand. Weill *et al.* (2019) confirm this by explaining that the most successful companies often have board members who are experts in digitalization. The possession of these experts, who push for the company's digitalization, would then be the "new financial performance differentiator" (Weill *et al.*, 2019). The digitalization presented in the management reports would be a key point for investors and various reviewers. Highly digital companies would then have a better market capitalization than their less advanced counterparts.

Thayla *et al.* (2020) also explained that, in the current age, digitalization has a great effect on the financial results. Indeed, for a company to be competitive, it must constantly adapt to its environment and to new developments. The literature has shown that digitalization is an asset for many business adaptations. This applies even more when the adaptations to be made are technological adaptations, which are more and more in demand recently. Digitalization would then help to implement these new changes in companies by accelerating them. Nevertheless, these changes make the new developments more volatile. The efficiency of transformations is also improved. Indeed, digitalization makes it possible to obtain a lot of information and past experiences on the transformations carried out. It is therefore easier to avoid mistakes that have already been made in the past. Finally, it also allows the transformation to be adapted to the specific industry. Indeed, many tools allow, thanks to the previous experiences and detailed information of the company, to adapt the new technologies and the applied changes in the best way. These transformations allow the company to adapt to the changes in the best possible way, in order to remain competitive and thus present better financial results.

Rossato and Castellani (2020) also indicate that highly digitally developed companies are easier and faster to scale. Indeed, they are said to be of better quality, with a clearer focus that would be more easily replicated. In addition, these highly digitalized companies are the most innovative, especially in terms of online platforms. These platforms, such as Netflix, Uber and others, are part of an increasingly popular business model. They make it possible for supply and demand to meet. They are therefore the intermediary. Thanks to their purely digital attribute, these platforms can transform, move or expand from one place to another around the globe without much difficulty compared to traditional companies. Where traditional businesses, with fixed production locations and workers producing a physical product, have many constraints in moving from one place to another, platform companies generally do not encounter these challenges. They only need to adapt their platforms to the customs, languages and traditions of the new area in order to establish themselves there. This is a case where digitalization is a major asset for development. These more globally developed companies will then be more financially successful.

3.3.3. Corporate Social Responsibility Certifications

In our society, the planet's pollution and the depletion of resources has become a general problem. Everyone knows the risks of climate inaction, and the high probability that we will hit the wall if we do nothing. To overcome this problem, it is necessary for everyone to participate in the change. A major player in the world's pollution is obviously the companies. According to the NGO Carbon Disclosure Project, the world's top 100 polluting companies are responsible for 71% of global CO_2 emissions since 1988. Whether out of good faith, as a result of legislation, or as a result of pressure from various stakeholders, companies, mainly in the West, are starting to change things.

However, a certain amount of these companies engage in greenwashing instead. Greenwashing is defined by Kenton (2022) as follows: "Greenwashing is the process of conveying a false impression or providing misleading information about how a company's products are more environmentally sound. Greenwashing is considered an unsubstantiated claim to deceive consumers into believing that a company's products are environmentally friendly". It is therefore a way to make oneself appear more responsible than one really is. According to Nemes *et al.* (2022), greenwashing is practiced in 40% of cases, a terrible figure.

As a consequence, in order to prevent this from happening and to allow greater transparency in the achievement of ecological, social and societal objectives, certifications are increasingly used. These certifications guarantee, on the basis of criteria, that a good or service sold by a company complies with one or more standards. Some certifications are purely optional and serve as a guarantee of the quality of the company, while providing a good image. Other certifications are mandatory for the company to operate in a country or economic area. Some others are necessary to obtain certain financing. In fact, several banks or investment funds set up prerequisites for so-called responsible financing. It is therefore financially advantageous for companies applying for these funds to hold these certifications. Indeed, such funding, as allocated to responsible causes, is generally less expensive.

For its part, digitalization will allow companies to facilitate the ecological, societal, and social transition. Ionaşcu *et al.* (2022) explain that indeed, digitalization is an effective way to transform companies in terms of corporate social responsibility. Indeed, digitalization and this through smart technologies, can greatly improve these points. These technologies allow for better management of natural resources and recycling processes. The quantity needed is therefore less than the previous quantity needed. This reduces the waste of these natural resources and helps to renew the environment. The technologies also help to limit pollution or other negative impacts on the environment. Processes are indeed improved through machine learning processes, allowing them to be increasingly less polluting.

The study conducted by Ionaşcu *et al.* (2022) concludes that the most socially, societally, and ecologically advanced firms are also the most advanced firms in terms of digitalization. And this, in a significant way. Digitalization allows companies to improve these characteristics and, in the same way, to obtain certifications. As mentioned above, these certifications give a better financial image of the company and give access to less expensive loans. All this undoubtedly increases the financial performance of a company.

3.4. Employee satisfaction

3.4.1. Change in working conditions

First of all, digitalization has brought a whole range of changes to the different jobs. In this section we will try to examine whether the result of these changes has had a positive or negative impact on employee satisfaction, which, as mentioned above, has an impact on performance.

Steidelmüller (2018) confirms that current working conditions have nothing to do with those of yesterday. In the midst of the digital revolution, technology as well as societal and economic developments have changed radically. Demerouti *et al.* (2014) showed us just how much email has become part of everyday life. They are on our laptops, but also our phones. We can consult them very easily and whenever we want. They also allow us to send each other information almost instantly. However, they also follow us at home. As a result, they bring a positive aspect to the daily life of employees by making a number of tasks easier for them. But it also results in a reduction of the boundary between work and private life. In the medium to long term, this can have a strong impact on employees' emotions and thus on their satisfaction.

Also, according to Steidelmüller (2018), these new working conditions will provide employees with more autonomy and flexibility. Furthermore, these benefits will be accompanied by more responsibilities as well as other demands. These new expectations obviously come with a certain additional mental burden, which can be difficult to manage. These employees are also expected to develop more autonomy, and to put in more effort and motivation.

It appears then that autonomy is one of the key points and one of the biggest causes of employees feeling worse than before. Previously, autonomy was seen as a benefit and a sign of confidence. However, studies have shown that too much autonomy has negative consequences. Employees who are left to their own devices no longer feel that autonomy is a gift but rather an obligation. They feel abandoned and unsupported by their superiors. This abandonment is accompanied by a feeling of uselessness. It seems to the employees that there is no time for them, for their questions, for reviewing their work. Nevertheless, it is necessary to temper this fact. This issue can arise when too much autonomy is given and is managed in the wrong way.

By contrast, these changes brought about by digitalization will also bring unparalleled flexibility for the employees benefiting from it. Indeed, this flexibility will bring more serenity to employees. This serenity is most easily displayed when the management in place teaches the employees how to organize their flexibility. For example, it is possible to set up flexible working hours and a flexible workplace. Employees can nowadays, and more easily in large companies, work in different offices in different cities. In the future, this digitalization will be necessary to ensure that employees are motivated according to their different needs (Steidelmüller, 2018). These benefits are also confirmed by Wallin *et al.* (2020).

It is therefore evident that new technological adoptions are a possibility and, in the future, will be a necessity in order to improve employee satisfaction. On the other hand, it is necessary to implement these new changes in an adapted, progressive, and human way.

3.4.2. Personal Development

As it was seen in the performance section, personal development is an important factor in employee satisfaction. This personal development can take different forms, ranging from promotion to various apprenticeships. It can also take place in everyday life at work. This can be done by listening to and learning from the experience of colleagues, as well as by learning by oneself on a trial-and-error basis. Various authors have even concluded that an employee who cannot develop professionally or whose hope of promotion is extinguished will in most cases leave the company. Wallin *et al.* (2020) indicate that digitalization will also have a significant impact on this career development.

Firstly, Wallin *et al.* (2020) explained that employees who are currently performing redundant and uninteresting tasks will be able to evolve. Indeed, these employees will be able, through digitalization, to evolve their jobs in order to obtain more interesting ones. At the same time, their jobs, which are easier to do and require less learning, will be increasingly automated. Digitalization has also proven that it will create more jobs that require this training. Employees in lower positions will then be able to get better jobs without the essential need to replace them. It is worth remembering, however, that for this transformation to take place, there will need to be a will from the company to train them, in order to reach that next level position. It is important to remember that there has always been a risk that the company will not want this, but that training will be easier because of digitalization.

According to a survey done on government workers by Wallin *et al.* (2020), a majority of respondents believe that digitalization will result in higher personal development than they currently achieve. Among the improvements they are looking forward to, there are more versatile tasks, which will allow them to learn more and more things as they work. These new tasks will also be more demanding, which will boost their motivation. They also expect the simpler tasks to be automated as mentioned above, which would give them more time to learn new skills. Interactions between workers will be simpler and at any time, which will have the direct effect of increasing these interactions. As they become more present, we will have more sharing of knowledge and experience. Moreover, digitalization will make it even easier and faster to learn than it is now.

The participants naturally have certain concerns. There is firstly a risk of not being able to adapt to the new tasks required. There is also the fear that the possibility of working anywhere will overwhelm employees quite quickly. According to the participants, there is also the danger of losing real contact between people. They would only see each other through the screen, which would lead to a certain amount of loneliness. A very small number of respondents also said that they liked their jobs and did not want to change them.

When analyzing the resulting outcomes of digitalization on personal development, we arrive at the following result. Wallin *et al.* (2020) showed us that the results are much more positive than negative. It seems then that digitalization is considered a real asset or even an opportunity for some people to improve their daily life at work. Indeed, this digitalization will facilitate the expansion of knowledge. But it will also make it possible to manage it much more efficiently than before.

However, the risks mentioned above are not fictitious. It is then the task of the management, or the team setting up these new technologies, to implement them correctly. Amongst the respondents, the most common concern is the fear of isolation. Indeed, participants fear that they will be working at home all the time, in a room, isolated from the world and from social contact. As the recent pandemic has shown, doing all the work at home is not suitable for everyone. The period of the pandemic created many psychological concerns for people who did not get out enough.

It is therefore necessary for management to deal with this issue. The solution could be a return to a certain number of guaranteed on-site days. On this basis, and as explained above, some flexibility for everyone else will improve everyone's experience. As with any new development, it is important to implement it with some degree of caution. It is indeed necessary to allow time for each person to adapt at their own pace. Again, according to Wallin *et al.* (2020), it is also necessary to implement this digitalization in a way that is personalized to each employee. But it is also necessary to involve the various employees in the decisions and the adoption of this digitalization.

3.4.3. Teleworking

As seen above, teleworking is a subject of discussion. Teleworking is not new; indeed, it has been around for some time. However, the recent pandemic has inevitably reshuffled the balance. Indeed, when social contacts had to be reduced to a minimum, a solution had to be found in order not to stop all the businesses. Teleworking then appeared as a natural choice for all office-based businesses (Săvescu *et al.*, 2022). But currently, with COVID-19 being a better managed disease in most places, the issue of teleworking is coming back on the table. Many companies as well as employees have experienced a multitude of benefits in it. Nevertheless, there are also disadvantages, including those mentioned in the previous section.

The fact that teleworking is possible and has become so effective is largely due to digitalization and its rapid growth (Kohont *et al.*, 2022). Teleworking makes it possible to work from home, but also from abroad, at any time. It also reduces the need for commuting. In a world of work where some employees find themselves commuting two hours to work and two hours back, this is a real opportunity for them. It also allows for greater flexibility. Indeed, it also allows for more flexible working hours, which can benefit many employees by allowing them to arrange their activities in a better way. It is thus possible to take a break a little later to pick up one's children, for example. In addition, as the commute to work is eliminated, these breaks can be increased.

In their study, Rodríguez-Modroño and López-Igual (2021) tell us that there is indeed a significant difference between workers, who could be classified as traditional, and workers who choose to work from home. There is also a significant distinction between three teleworking groups, those who stay at home permanently, those who telework occasionally and those who alternate between home and office work.

Firstly, of the three groups of workers, those alternating between home and office are the ones who perceive the work as more intensive, followed by the occasional and then the permanent. This can be explained by the fact that they have many difficulties in drawing a clear line between work and home. So, if you work a lot of the time at home, you are obviously more quickly tempted to check your email, do a small task, even outside working hours. This corresponds well with the following finding: these alternating workers are the ones who work the most, while the other two groups are equally active. In addition, all types of teleworkers have a much more optimistic outlook on life and the future than conventional workers. The latter are additionally 30% behind in learning skills. Overall, it can also be said that teleworkers have more privacy, better incomes and are more optimistic than regular workers. However, the teleworkers perceive more intensity at work and a lower quality of working time than the regular workers. It should be noted that the last two differences, in the positive direction of the regular workers, are smaller than those in the negative direction.

3.4.4. Significant variables

Moreover, digitalization has really exploded in recent years, which is also confirmed by Umans *et al.* (2018). They state that this digitalization influences the organizational culture, which in turn is a significant factor in employee satisfaction. However, digitalization also involves a certain amount of complication. In order to analyze its implications on employee satisfaction, Umans *et al.* (2018) conducted a study with the purpose of investigating the impact of new technology on employees by using multiple regression. Among the variables used in their models, three are of interest to us. First, there is the use of digital tools for information management. This variable includes the various tools used to share information. It can vary from the classic website to various means of communication such as Teams, and also to the various new methods of learning. Then, there is the use of digital tools for work optimization. These include software that automates several tasks that used to have to be done by oneself, as well as software that makes it easier to carry out daily tasks. Finally, the last variable of interest to us is the use of digital tools as a change agent. As it is understood, it is about using these tools for the purpose of facilitating transitions. The study shows us the positive or negative influence that these variables will have on three parameters. These are job satisfaction, satisfaction in everyday life and finally work-life balance.

The analysis of the results of this linear regression leads to the following results. The use of digital tools for information management has a very significant and positive impact on satisfaction in everyday life. The influence on the other two parameters, although positive, is too small to be truly significant. The use of digital tools to optimize work has a positive impact on the three parameters listed. It is very significant on job satisfaction and work-life balance but only slightly significant on everyday life. Finally, the impact of using digital tools as an agent of change is only marginally significant, although it is slightly positive.

This study therefore explains that the impact of digitalization, at least with regard to the three selected factors, has a positive impact on employee satisfaction. Moreover, it does not only improve employee satisfaction at work, but also in their everyday life and in the establishment of a clear separation between work and private life.

4. Literature review conclusion

Having defined and analyzed digitalization and performance (with its components), we then analyzed the impact of the former on the latter.

First of all, there was the impact of this digitalization on *customer satisfaction*. The first point of this satisfaction is the impact of digital marketing, made possible by this digitalization. It showed that the product, the promotion and the place were improved, while on the other hand the price could be adjusted more easily to each customer. This gave the seller the opportunity to take a larger share of the surplus from the customer (which could undermine his satisfaction). Furthermore, we mentioned data, the Internet of Things and customer behavior. It emerged that all these new technologies and connections allow companies to capture interesting data about customers much better. This data is then used to improve products and services based on the gathered information. This improves customer satisfaction, although the misuse of the data may upset some of them. Finally, in managing the transition, we have seen that the relationship between customers and organizations is bound to change. Digitalization is a tool to keep this relationship qualitative, especially through the use of online tools. In conclusion, it is clear that digitalization offers many advantages to increase customer satisfaction. There are however some drawbacks that have appeared, but these are less impactful and less numerous than their opposites.

Secondly, the impact that digitalization could have on the *quality of the internal process* was analyzed. The most visible benefits that digitalization will create are obviously in the supply chain. Procurement is a typical example. Digitalization can reduce waste and wastage, as well as optimize inventory. We can add to this the fact that the robotization of tasks and the automation of those ones have made production lines more reliable and resilient. It is also claimed that the interconnectivity between all devices will lead to better performance, more production and greater agility. In addition, optimal schedules will be more easily recreated in the event of a machine failure. Another challenge of digital transformation is that it allows an easier problem detection. Stock management and the ability to never run out without having too much is also an improvement. The management of outsourcing or even crowdsourcing is also optimized. Digitalization also makes distribution more efficient, fast and environmentally friendly. Finally, the automation of tasks allows human resources to become more human-oriented. When analyzing in a consolidated way, it is therefore clear that, as far as the quality of the internal process is concerned, digitalization brings only positive points for the most relevant factors.

Subsequently, we analyzed the impact of digitalization on *financial performance*. Firstly, digitalization will lead to increased security and protection of data through various technological means. Furthermore, digitalization also allows for a better complete view of all the finances of an organization. It thus facilitates a full understanding of the entire or any sector or sub-sector of an organization. The knowledge of more accurate figures allows for comparison, analysis and much more optimal decision making. In addition, it has been shown that the adoption of technology makes it easier to grow and in particular to expand more globally. Having an expert in this field is a very valuable asset. Organizations that are highly developed technologically are also faster and more likely to expand easily. Finally, digitalization, particularly through the advantages mentioned above, also allows for the obtaining of certifications, which are themselves a guarantee of quality and allow several advantages. For financial performance, it is clear that digitalization brings only positive results in all sectors with a significant impact.

And finally, the impact of digitalization on *employee satisfaction* was analyzed. To begin with, it induces a definite change in the working conditions of many employees. These new conditions bring more autonomy, flexibility and responsibility, which can bring serenity. However, these new attributes also bring their own difficulties, such as the feeling of abandonment by their hierarchy. It can also be accompanied by a growing sense of uselessness. Nevertheless, digitalization will allow for greater and faster career development. Uninteresting jobs will be replaced by more interesting and less redundant ones. There is still a fear of not being in these jobs, although digitalization has been shown to improve and facilitate training. This fear is accompanied by the fear of being overloaded and losing the real human contact. Then we also explained that teleworking was the most common example of this digitalization and the problems that could arise, including some statistics. We then explained that digitalization in information systems had significant and positive impacts on everyday life satisfaction. And also, that digital tools for work optimization had a significant and positive impact on job satisfaction, in everyday life and in the work-life balance. It is immediately apparent that this last paragraph is much more mixed than the others. Indeed, whereas the first three were mostly positive, this fourth component is much more nuanced in its conclusions.

5. Research question

As mentioned above, of the four performance factors, the results are overwhelmingly positive for three of them. These are customer satisfaction, internal process quality and financial performance. However, the fourth and final factor is different. Indeed, the articles analyzed show much more mixed results concerning the employee satisfaction. According to the theory, there are a number of positive effects on employees, but also a number of negative effects on them. In order to carry out a quantitative analysis, it therefore seems much more interesting to analyze this factor. We can then draw more interesting and innovative conclusions than for the other three factors.

After finishing our conclusion and discussing it to Mr. Lejeune, we realized that analyzing the whole performance was a tremendous task, and that it was too much for our Master's thesis. For that reason, we decided to focus on only one component of performance, the employee satisfaction. And among the components of employee satisfaction analyzed, we chose teleworking. The COVID-19 crisis has made teleworking mandatory for many companies, so it is a very current topic. But being a practice that has been made compulsory, it has been developed much more quickly and massively than the other practices discussed. When developing new processes, it is clear that mistakes can be made. Organizations will therefore learn from their mistakes so that they do not make them again and thus optimize the practice. The conclusion is that teleworking is at a much more advanced stage of optimality than the other practices mentioned. As said before, the practices improved or made possible by digitalization have to be implemented in the best possible way to create the most positive effects and the least positive effects possible. By choosing teleworking, one ensures that the practice will be implemented in a truly effective and efficient way. This allows us to get closer to the real positive and negative effects of teleworking. And at the same time, it helps us to avoid the negative effects of poorly implemented teleworking or teleworking at an immature stage of implementation. The real effects of teleworking can then be analyzed. For an optimal analysis, we chose the company Cerence. We will explain this choice later, in the section 5.2.1. This then leads us to the following research question:

"Quantitative study of the impact of telecommuting on employee satisfaction: the case of Cerence.".

The objective of this master thesis is therefore to analyze, in a quantitative study, the satisfaction of employees with teleworking on various factors. We will therefore analyze the changes that have occurred and will occur as a result of this particular concept of digitalization, in order to observe the advantages and disadvantages that it can bring on the employee satisfaction.

Throughout this master thesis, it is important to clarify that we will use teleworking and telecommuting as synonyms, as indicated by the Oxford Language Dictionary.

Part 2: Empirical Analysis

In the second part of this Master's thesis, an empirical study will be conducted. This empirical analysis will be divided into several parts. In a first step, we will explain in detail the methodology for collecting data relevant to the progress of our study. We will then present the data obtained but also the trends and results that emerged from this analysis. We will conduct a statistical study on these data in order to identify meanings in the statistical parameters studied. Finally, the last part of this empirical analysis will be a principal component analysis and a clustering, which has the aim to identify clusters within the studied sample. The empirical analysis will be concluded with the limitations of the results.

1. Research methodology

We will describe below the methodology used to conduct our empirical analysis in the best possible way. However, it is first necessary to define the terms "empirical analysis" and "quantitative study".

1.1. Definition – Empirical Analysis

An empirical study is a research technique based on observation and experience, as opposed to a literature review. In this type of research, the principle is to collect data and then analyze them. The data can be qualitative or quantitative. In the case of this Master's thesis, our analysis will be based on quantitative data. Hence, this type of research is about testing hypotheses in a concrete way, and not through the claims made by other sources of information.

1.2. Definition – Quantitative Study

Before we can carry out our study, it is important to define the term "quantitative study" in order to avoid any errors in the analysis of the results. A quantitative study is a study based on numbers. In this regard, Lakshman *et al.* (2000) stated that a quantitative analysis is a study that "examines the effects of specified circumstances (independent variable) on an outcome of interest (dependent variable) in ways that can be expressed numerically. In these settings, causal inferences are drawn either from direct observation, as in true experiments, or from associations established through statistical analysis. Marais (2012), for his part, highlights the fact that the objective of a quantitative analysis is to put numbers to abstract concepts. The characteristic of this type of research lies in the fact that enough data is necessary to ensure a certain reliability.

This type of research is opposed to qualitative studies, whose main objective is to explain a theory or phenomenon in detail. In this type of study, interviews and observation will be the methods of data collection, and the type of variables used will be more oriented to speech, expressions, etc.

The objective of this thesis is to quantify the impact of the telecommuting of an organization on the different variables representing the employee satisfaction. It seems to us, therefore, more appropriate to conduct a quantitative study for this empirical analysis with the aim of seeing the significance of each of the parameters that we will study.

2. Research environment

In this section, we will look at the environment in which our research was conducted. This empirical analysis will explore the extent to which telecommuting (and the resulting technologies) can impact employee satisfaction. We will therefore analyze these different parameters on a broad scale. We will nevertheless focus on a company that is relatively advanced in their digital transformation. This choice was made because digital transformation in companies can be a complicated transition to manage. As a result, analyzing a company that is only at an early stage of its digital transformation may lead to a bias in the results we will have to analyze. This explained why we will focus our analysis on IT-oriented organizations. We will explain later how the population was defined and how the sampling was done.

3. Data collection method

Apuke (2017) stated that a quantitative study aims to answer questions such as *who, how many, what, where, how much* and *how*. Therefore, the purpose of this quantitative study is to quantify the results to be analyzed. For the empirical analysis, a quantitative study in the form of a survey will be conducted. However, it is necessary to be able to construct this questionnaire in a reliable way so that we rely on the results obtained for analysis. For that purpose, we have based ourselves on the research of Raj Dangal (2021). According to this author, it is necessary to:

- Define the objectives of the research. This helps to construct the research question and the hypotheses.
- Define the use of the final results. This determines how the results will be used for the analysis.
- Determine the studied population. This is important to define it as it will impact the way in which he results will be analyzed.

Once these steps have been taken, the questionnaire itself can be constructed. Raj Dangal (2021) emphasizes that the questionnaire should ideally be as short as possible, to keep the response rate and concentration of respondents high enough.

According to him, the questions of the survey must meet certain criteria in order to be considered as valid:

- Do the answers to the questions meet the purpose of the survey?
- Is the used language simple and not specific to the field of study?
- Does each question ask only one question? Or, is each question specific enough?
- Are the questions formulated in such a way that they are understood in the same way by all respondents?
- Are the questions neutral? Do they induce answer?
- Is the study population able to answer the questions with their knowledge? Is the topic understood by the respondents?
- Are screening questions included in the survey? This allows for the identification of respondents who answered inconsistently.
- Ensure, in multiple choices questions, that all of the categories are mutually exclusive. It will not be a problem as this survey is of “agree-disagree” type.

These criteria have been defined in order to create a questionnaire of sufficient quality. This will allow us to analyze the results obtained in the questionnaire in the knowledge that the results are relevant and reliable.

The questionnaire will consist of a set of multiple choices questions, under the form of a likert scale. The main advantage of written questionnaires is that they allow the respondents to take as much time as they want with each question. This avoids knee-jerk responses and therefore responses that do not reflect reality. In addition, this type of survey allows for a wide geographical range. Concerning the survey, we must be careful to ensure that the questions are as clear as possible, in order to avoid misunderstanding them. Finally, a precise order for the question must be respected, as this one could affect the response as respondents try to remain consistent (Raj dangal, 2021). You can find in Appendix 1 all the questions of the survey that was conducted for our Master's thesis.

4. Data manipulation and analysis

4.1. Data manipulation

After receiving a sufficient number of responses to our survey, an analysis of the data that were collected will be done. We want a sufficiently large number of respondents so that the data is representative of the study population, in order to be able to generalize the conclusions that have been drawn. As a first step, the outliers will be removed from the results, i.e. the respondents who did not answer the questions consistently or who are too far away from the population we wish to study (it would not make sense to analyze telecommuting and get response of employees that did not make the transition to this technology). After that, we will analyze the different variables of our data, and we will make some manipulations of them by grouping them by the different categories of the employee satisfaction defined in the section 6. It will make our variables stronger in the sense that they were computed in different ways, with different questions. We will therefore be able to analyze the different components of the employee satisfaction and the parameters that could influence each of them.

4.2. Analysis

Once the data has been manipulated, we will analyze it for each of the employee satisfaction category defined by Küskü (2001). We will study whether any correlation exists between the different variables and the components of the employee satisfaction. If this statistical test proves significant, we will analyze the reasons for such a correlation with an identification of a potential mediating variable. This analysis will be made on IBM SPSS Statistics, a powerful statistical analysis tool.

5. Population and sampling

5.1. Population

For statistical analyses, scientists often use samples rather than the whole population. This is because sampling saves costs and time. On the other hand, representative sampling will give results that are closer to the whole population. Most of the time, the larger the sample in terms of observations, the more representative the data will be of reality. For that reason, it is important to have a sufficiently large sample of observations.

The questionnaire could have been sent to the general public, i.e. to all private sector employees who have been or are in a teleworking situation. It can be added to this that we are dealing with a concept that is familiar to a large majority of employees because they have been confronted with telecommuting in recent years, especially with the COVID-19 pandemic which forced a large number of workers to work remotely. It can be added to this the fact that it could bring global view, and not the specific case of a particular company or type of population.

Nevertheless, as said before, we will focus our research on a well-defined sector: the IT sector in Europe. The choice to focus on the IT sector is due to the fact that IT companies are generally digitalized themselves and have to manage their digital tools in an optimal way. Therefore, the results would not be biased by telework in the development phase.

5.2. Sampling & description

5.2.1. Sample description

As mentioned above, it is impossible to analyze the whole population and a sample is needed. Moreover, sending out the questionnaire so that only people from the IT world answer seems completely utopian. For that reason, we had the idea to send the questionnaire to a company: Cerence. The choice of Cerence is an additional component to go in this direction. Indeed, in order to really target the effects of well-established teleworking, it was necessary to choose a suitable company. We then had to target and analyze a company in which digitalization was already strongly implemented. Cerence is a very modern and highly digitalized company. This is necessarily reinforced by the fact that its purpose is to produce and provide digital services to its customers. From these affirmations, it can be seen that Cerence is a perfect choice for our analysis. Moreover, Cerence was already teleworking before the COVID-19 crisis set in. Hence, they are certainly one step beyond the other companies in terms of experience. Finally, Cerence is a company in which we have contacts, which can greatly facilitate the response rate which is often too low to be significant.

The sample that will be analyzed dis a "spontaneous" sample. Indeed, Cerence HR was responsible for distributing the survey internally. Therefore, the sample is not a random sample, but we will see later if it behaves as if it were. We should also note that our sample is in fact a subsample of the population, as not all Cerence employees will respond to the survey. This is because the response rate is almost never 100%.

5.2.2. Cerence presentation

Cerence, previously a division of Nuance Communications, is being made autonomous in October 2019. Nuance Communications has existed since 1992 under the name Visioneer. Both before and now, Cerence has always pursued the same goal. This is mainly to produce voice recognition systems for cars. However, they also produce other artificial intelligence products for cars. Like all speech recognition products, they allow the driver to perform a variety of commands to operate the car. Cerence's artificial intelligence is therefore a product that is directly integrated into the car's computer system and consequently does not require an external driver. It can control the vehicle's parameters, including music, temperature, air conditioning and other settings. It also allows you to set or change the GPS destination. This means that you don't have to stop or touch the GPS while you are driving. Through continuous development, Cerence has also enabled other technologies such as facial recognition, personalized controls or different modes adapted to the car. Cerence is active in all the major automotive trends of today, which are as follows: vehicle intelligence, virtual assistants, non-distracting solutions, shared mobility, autonomous driving and electric vehicles. This broad diversity has made Cerence an undisputed leader in the global automotive artificial intelligence market. Presently, one car of two is shipped with Cerence technology, by 2019 there were already more than half a billion cars running with Cerence technology on board. Active voice recognition in cars is available in more than 70 different languages and more than a thousand patents have been filed.

As for Cerence's partners, the organization works with all the market leaders, whether they are in the artificial intelligence market or the automotive market. For example, they partner with Tencent, Microsoft, Google, Samsung and Amazon for artificial recognition. But they also do with BMW, Audi, Mercedes, Ferrari, Volkswagen, Tesla and dozens of other manufacturers or groups. Other software partners include LG, Xiaomi, Bosch, Panasonic and dozens of others. Finally, partners for use in the car include Twitter, LinkedIn, Spotify, Wikipedia, and many others.

Cerence has won a large number of awards over the years. Many of these are among their customers. So, they have been elected many times the best suppliers of the year, the best innovators and the best technology specialists.

Their Vision is: "A safer, more enjoyable journey for everyone and everything". This clearly shows the desire for comfort and safety for as many people as possible. Their mission is: "Empower an artificial intelligence mobility ecosystem with digital platforms for connected and autonomous vehicles". They are therefore focused on three main areas. The first is necessarily the driver and passengers, the second is the car and the road and the third is the cloud and data. So, Cerence's purpose is to produce the world's best artificial intelligence co-driver in the future.

Finally, Cerence has more than 1800 employees and had a turnover of $387.18 million in 2020. The company is listed on the S&P MidCap 400 and is headquartered in Massachusetts, and its CEO is Stefan Ortmanns.

6. Research method

As mentioned above, our empirical analysis will address the following research question: " *Quantitative study of the impact of telecommuting on employee satisfaction: the case of Cerence."*. Nevertheless, it is first necessary to identify the different dimensions of the employee satisfaction that could be impacted by teleworking. What are the variables that influence this employee satisfaction? This is what the author Küskü (2001) investigated. In his study, he defined the different dimensions of an employee's job satisfaction. After that, those different dimensions will explain the overall job satisfaction felt by the employee.

First of all, there is the *management satisfaction* as a component of the employee satisfaction. This dimension of the employee satisfaction highlights the importance of superiors, and more specifically the management and consideration that superiors have for their employees. We could take as an example the considering of employees' suggestions when making decisions, etc.

Another dimension to be considered in employee satisfaction is *colleague satisfaction*. All employees are required to discuss, collaborate and exchange with each other. Besides that, the satisfaction of an employee also depends on the interest/success of other employees. These elements can affect an employee's satisfaction.

Another component of employee satisfaction is *job satisfaction*. Job satisfaction and employee satisfaction have often been used interchangeably. Nevertheless, in this study, we will consider job satisfaction as the satisfaction of an employee with his or her job in itself. He should thus ask himself how he perceives the tasks assigned to him.

The following component does not deal directly with an employee's job. Here, we will rather deal with the physical aspects of the job. We will talk about *physical environment satisfaction*. Indeed, no matter how motivated an employee may be, the physical aspects will affect the ease with which an employee can achieve the goals he or she has set by himself or herself. We could talk about the workplace, the tools available for work, the premises, etc. Therefore, the satisfaction could be impacted by those factors.

Finally, the last component of employee satisfaction is the following category: *salary and other materials benefits satisfaction*. This component of employee satisfaction is due to the financial pressure on all employees to fund their life projects.

In the following sections, each of these dimensions and the extent to which telecommuting has affected them will be discussed. It will also be possible to analyze these components by categories in order to identify the trends that emerge from our empirical analysis.

7. Results, Analysis & Discussion

Given the different identification variables we had, we wanted a minimum number of responses to maintain significance in each group. Therefore, we left our questionnaire on the market for quite a long time. This allowed us to obtain a database of 220 observations identified with 26 different variables that will be described and explained in the following section.

7.1. Explanation of the variables

Our survey was built in order to understand clearly the perceptions of the different employees of the IT sector. For each statement of the components of the employee satisfaction defined by Küskü (2001), we will describe it in detail to understand why it was asked and what conclusions we could draw from it.

7.1.1. Management satisfaction

I think that the management is well executed remotely: The objective of this statement is to determine whether management has changed since the advent of telework. Has the business model changed? Has the relationship to the hierarchy changed with telework?

I do not feel that my suggestions have lost their impact on management decision making with remote working: The objective here is to understand whether employees feel that their role is still as important as before teleworking. Also, it could be used to identify whether teleworking enables effective collaboration.

I feel that vertical mobility is possible even with this telecommuting transition: Vertical mobility is also a component to be taken into account in relation to management. Are employees' efforts perceived and taken into account by management?

I feel that my N+1 is still remotely accessible: This last statement concerns the availability of superiors. We can ask ourselves whether management is accessible or not, to take into account the different suggestions, or even to collaborate.

7.1.2. Colleagues' satisfaction

I feel that telecommuting allows the employee to collaborate in an efficient way: One of the risks of moving to distance learning is not working well as a team. The purpose of this variable is to analyze the existence or absence of this issue.

I keep socializing with my colleagues even through teleworking: This statement concerns the new relations that can be built between colleagues. The question is whether this relationship has deteriorated as a result of teleworking.

Collaboration with my colleagues is easier with remote working: This time the purpose of the variable is to analyze the possible improvement in collaboration between colleagues that teleworking would allow.

I feel that my colleagues are happy to work remotely: Employee satisfaction also depends on the satisfaction of their colleagues. The perception of this colleague's satisfaction is then analyzed.

I am satisfied with the "remote" relationship I have with my colleagues: Here we analyze more generally the entire relationship, whether it be at the level of agreement or work between colleagues, through the means of communication used as a consequence of the changes of teleworking.

7.1.3. Job satisfaction

I feel that the tasks I am assigned are no different from those I had before teleworking: The purpose here is to analyze whether teleworking has led employees to change the tasks they used to perform by teleworking.

I find my job difficult to set up with teleworking: The need to telework and for some people to adapt to the technology required for this change can be complicated for some people. We are therefore assessing this complication.

The purpose of my work has changed with teleworking: We are testing here, unlike before, not whether the tasks have changed, but whether the intrinsic purpose of the work has been modified.

I find that my goals are achievable, even with this transition to teleworking world: The purpose of this statement is to check whether employee productivity has been reduced by teleworking or whether the objectives are as achievable as before.

Working remotely keep me motivated every day: Motivation is one of the key points of employee satisfaction. The purpose of this proposal is to see whether this motivation has remained stable.

I feel comfortable with the tasks assigned to me in teleworking: The purpose of this sentence is to analyze how comfortable employees are with the different tasks they have been assigned since moving to remote work.

The results of my work are as quantifiable as before teleworking: By being further away from the workplace, colleagues and especially from managers and customers, the different employees could be losing sight of the results of his or her work. We are therefore testing this possibility.

7.1.4. Physical environment satisfaction

I find teleworking more comfortable than working in person: The purpose of this item is to analyze employees' preferences regarding the additional comfort they could have at home compared to the restrictions present during face-to-face work.

I think that teleworking allows me to manage my professional and private life better: Knowing how to draw a line between work and private time, for example when taking a break or starting work later, is also an important factor. The objective of this sentence is to analyze whether teleworking has improved or decreased this aspect.

7.1.5. Salary and other materials benefits satisfaction

My global package (salary, benefits) has decreased since the arrival of telecommuting: Some benefits or extra pay are given to employees because of the journeys they have to make for work. It is important to analyze whether employees feel that they have lost out.

I have more flexibility in terms of time since teleworking: Teleworking can make it possible to have a more flexible schedule, especially because of the time saved by not having to travel to the workplace. The purpose of this variable is to observe whether this is the case or not especially.

I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking: Another monetary aspect is the extra costs passed on to employees to work from home. We will consequently analyze whether these costs are covered by the employer.

Individual bonuses are achievable and easily quantifiable: The purpose of this sentence is to observe whether employees feel that they can still obtain their performance bonuses despite working remotely.

Team bonuses are achievable and easily quantifiable, even with telecommuting: We follow the same reasoning as we have just done above. But this time, we do it for bonuses achievable within teams.

7.2. Presentation of the database

Our database contains a total of 220 observations, so 220 participants. These 220 participants are then differentiated in three different ways. It should be noted that none of the observations have missing value. According to different criteria, those observations have been divided.

Firstly, we classify them by their gender, which is respectively male or female (we will not consider other gender). In our database, there are therefore a total of 98 men and 122 women. This means that 55.5% of the respondents were women and 44.5% were men.

The second way of differentiating them was by age. The age category (which may be linked to status) is also interesting to analyze. In order to cover all ages, 3 age categories were established. It will be assumed that all people would be at least 18 years old, otherwise they would not normally be working in private enterprise. We then set up the categories as follows: the first category is made up of people in the category [18;35], the second category is made up of employees in [36;50] and the last category is made up of employees in [51;→]. The reason why the age group [18;35] is larger than the others is explained by the fact that in the IT sector, a certain level of education is often required. For that reason, we will rarely have people aged 18 working in this sector, as the minima diploma is often a bachelor. We thus put in a broader category in order to have homogeneous groups in terms of numbers. These ages were then separated into three categories as we had seen in the marketing research course. The first category will consequently include employees up to and including 34 years old. The second category will be made up of employees between 35 and 50 years old inclusive. Finally, the last category will naturally be made up of employees aged 51 and over. The first group, the youngest, has 69 representatives, making up 31.4% of the population. The second group is made up of 82 employees for a percentage of the population, which represents 37.2% of it. Finally, the oldest group is naturally made up of 69 employees for a proportion of 31.4% of the population.

Finally, we wanted to distinguish between the status of the employees, based on the enterprise information's. That is to say, a first category for juniors, a second category for seniors and finally a third for managers or above. Of the 220 responses, the largest proportion was for senior employees with 122 responses, representing 55.5% of the population. The other two groups are more equal. The next group is managers and above with 53 representatives for a proportion of 24%. Finally, the juniors represent 45 observations. This brings their proportion to 20.5%.

We then created 23 quantitative variables on which we will base our observations and analyze the responses. The possible answers are in the form of a likert scale. The 7 possible answers are, in order of most agree to least agree, "Strongly disagree", "Disagree", "Somewhat disagree", "Neutral", "Somewhat agree", "Agree", "Strongly agree".

The first four categorical variables are part of the category of employee satisfaction with management. The next five questions fall into the category of colleague satisfaction. The next category is the one of the job satisfaction. This is the largest category with a total of 7 variables analyzed. Next, we have the analysis of the physical environment where we will analyze two variables. Finally, the last category is salary and other material benefits. Once again, there are 5 variables analyzed in this category.

7.3. Representativeness of the sample

In order to be able to generalize widely from results obtained in quantitative statistical studies, it is necessary to determine whether the sample studied is representative of the target population. In order to determine this, there are variables in statistics, called "control variables", which are designed to identify the characteristics of the studied sample. These same variables are then subjected to various tests to determine whether the proportions, the means, correspond to those actually present in the population. The control variables that will be used in this study will be gender, employee status and age category. We have therefore decided to analyze them in the following sections.

7.3.1. Age category

The demographics of the workforce structure, and more specifically the age, is a control variable that must be taken into account. Indeed, perceptions may differ according to age, as the work structure and the perception of it evolves over the years (old age, job redundancy, etc.). If the age structure is not respected in the sample, the results may be biased. To analyze whether the age is significantly different from that of the study population, we will calculate the average of the analyzed employees and compare it with those actually represented in the Belgian population. According to Acerta, Belgian workers were 43 years old in 2019 in the organizations with more than 500 employees. In our survey, the average age observed was 42.41-year-old. According to the mean comparison test, it cannot be concluded, with a risk of error of 5% that the average age of our sample differs significantly from that observed in the population (as the p-value is 0.454). You can find the results of this test in Appendix 2.

However, to perform this test, an underlying assumption is the normality of the distribution. In our case, the distribution does not appear to be normal. Indeed, the Kolmogorov-Smirnof test allows us to reject, with a 1% risk of error, that the age distribution does not follow a normal distribution. We have tried to manipulate the variables to have a normal variable, notably with a logarithmic transformation. You can see from the graph below that the distribution is bi-modal and that the distribution of the logarithm of age is also non-normal. Therefore, working with the age and the logarithm of the age did not seem to make sense for the next statistical tests we wanted to perform.

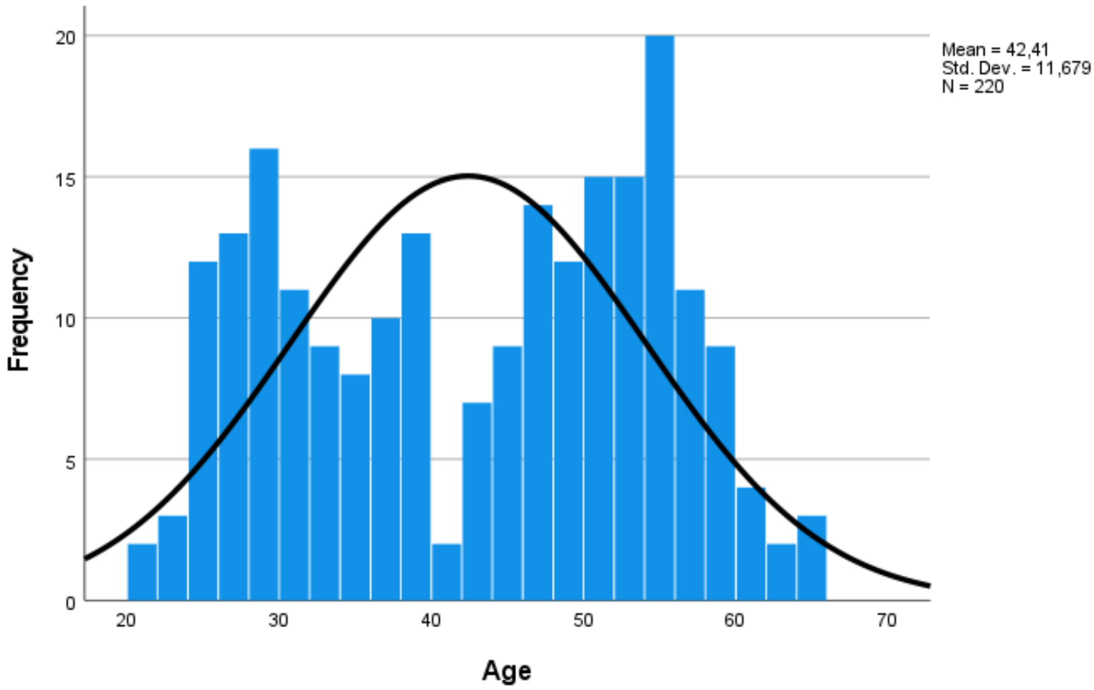


Chart 3 - Age distribution compared to the Normal distribution

We consequently decided to transform the "Age" variable into a categorical variable (splitting the different ages into categories), which of course does not require a normality hypothesis. We discussed it in the section 7.2.

7.3.2. Gender

Another control variable to be taken into account is gender. In fact, in recent years, the question of the place of women in business has been increasingly highlighted. It is considered that women do not have a sufficiently important place in them. In this respect, it was argued in 2019 that 20% of women hold a position in a private organization (Statsbel, 2019). We have not found recent figures and assume that these have not changed significantly. In our sample, the women represent 55.5%. The p-value being 0.001, we can therefore state, with a 5% risk of error, that the proportion of women in our sample is significantly different from that in the population (Appendix 2).

However, the problem potentially lies elsewhere. Indeed, despite their greater effectiveness in many respects, online surveys still have some problems. For example, Averty *et al.* (2003) report that women respond more to online surveys than men. This is also confirmed by Sylvestre (2008), the Ministry of Education. As the survey was optional for Cerence employees, we can assume that more women than men responded. After verification, this assumption was confirmed with the company's information. Indeed, the company has been historically composed of around 75-80% of men and thus 20-25% of women.

7.3.3. Status

The last control variable to be analyzed is the status of employees. In our questionnaire, we split the status into 3 categories of employees: juniors, seniors and managers or above. The proportions of these three distinct categories can be compared with the proportions actually observed in the population. As we do not have precise data on the status of employees in companies, we will assume that the distribution of status is similar to the one of the population. We can add to this the fact that we have enough observations in each of the categories and the results will therefore not be biased by a lack of observations.

7.3.4. Representative sample or not?

Globally, after analyzing our database, it can be said that it is not completely representative of the population studied. This is mainly due to the fact that women are over-represented in our sample. Nevertheless, we will analyze in a later section whether women's perceptions differ greatly from those of men. If not, it can be considered that our sample behaves uniformly, as one group comprising both genders. If perceptions are fundamentally different, we will use this survey as an indicator that can be applied to the population, without assuming that it is an exact science.

7.4. Univariate descriptive statistics

Descriptive analysis is a statistical technique for describing and summarizing data. The objective of descriptive analysis is then to provide basic information on the different variables studied. In univariate descriptive analyses, we will then deal with central tendencies and dispersion.

7.4.1. Global perception

Before a bivariate analysis can be carried out, it is necessary to carry out descriptive statistics in order to understand a little about the behavior of the sample questioned. We consequently conducted tests on the 5 components of employee satisfaction defined by Küskü (2001). However, we will not analyze the means because we are dealing with ordinal scales. Therefore, analyzing parameters such as standard deviation or mean do not really make sense in descriptive statistics, because the scales are subjective from one person to another. Indeed, there is no quantifiable scale with a common unit. For this reason, we will use frequency as an indicator, which does not require any unit.

7.4.1.1. Management satisfaction

You can find in Appendix 3 the repartition of the answers for this component of the employee satisfaction.

In terms of satisfaction with the management, different things can be said. Without considering the different groups that can be formed, we can assert that the sample seems to be satisfied with the way in which management is managed. Indeed, 79.1% are satisfied with the way their superiors manage the company, even in this transition to the world of telework.

The same observation can be made in relation to the interest shown by superiors in the suggestions made by employees. In this respect, we observe that 21.4% of employees are also fully satisfied with the way in which their suggestions are taken into account in the decision-making process, without taking into account the different groups. This seems rather logical, as there is no reason for a company to change its policy with telework. Also, it would seem absurd for a company not to take into account the suggestions of its employees, as it would necessarily expose itself to risks and loss of performance.

Finally, employees feel that their N+1 remains easily accessible despite teleworking. Once again, this seems quite logical in the sense that telework allows a new organization of work but does not distance superiors from their employees.

You can find below a bar chart of the perceptions of the different employee:

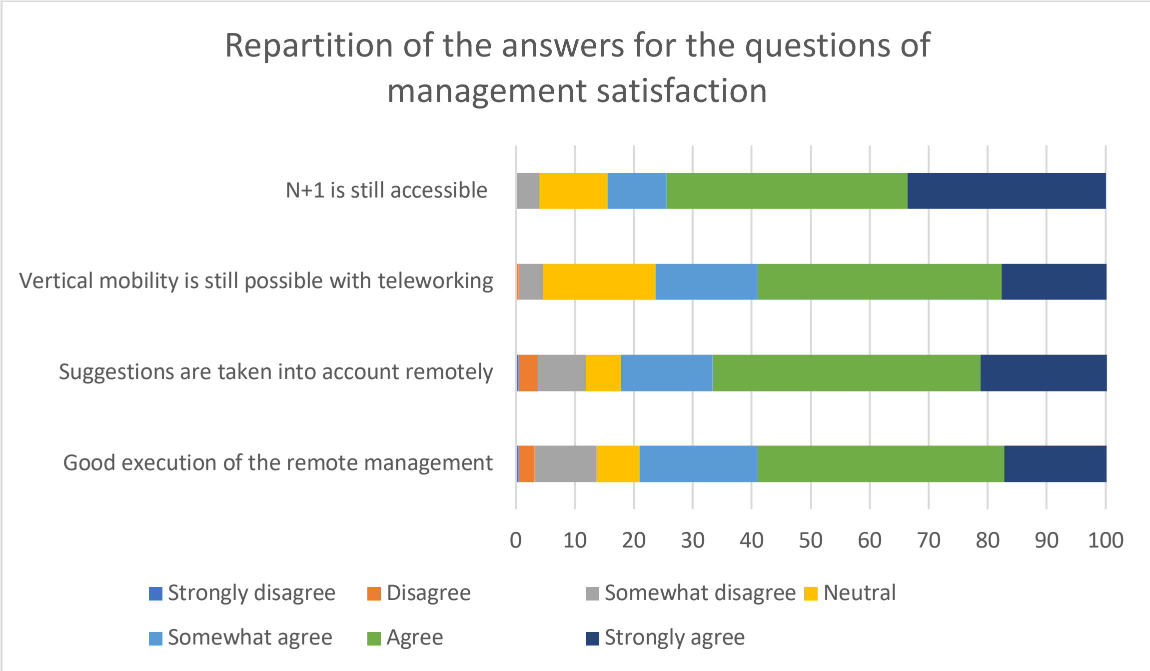


Chart 4 - Repartition of the answers for the questions of management satisfaction

7.4.1.2. Colleagues satisfaction

As far as colleague satisfaction is concerned, we had a preconception about employees satisfaction. In fact, a lot of media reported that employees were not satisfied with the cooperation they had with their colleagues. Therefore, some of our questions focused on this issue. However, it emerged that the employees felt that the cooperation with their colleagues was still effective even with the advent of teleworking (in will be analyzed in a future section the dispersion indicator of this problematic).

With regard to the same collaboration, some employees felt that it was more complicated. It seems that the main challenge is the trade-off between efficiency and ease of collaboration. The survey shows that 38.5% of employees find it more difficult to collaborate with telework.

Nevertheless, it should be noted that the trend is not the same regarding the fact that employees continue to socialize with their colleagues. Indeed, the results seem to be more scattered and we will see in more detail the reasons for this dispersion (Appendix 4).

You can find below a bar chart of the perceptions of the different employee:

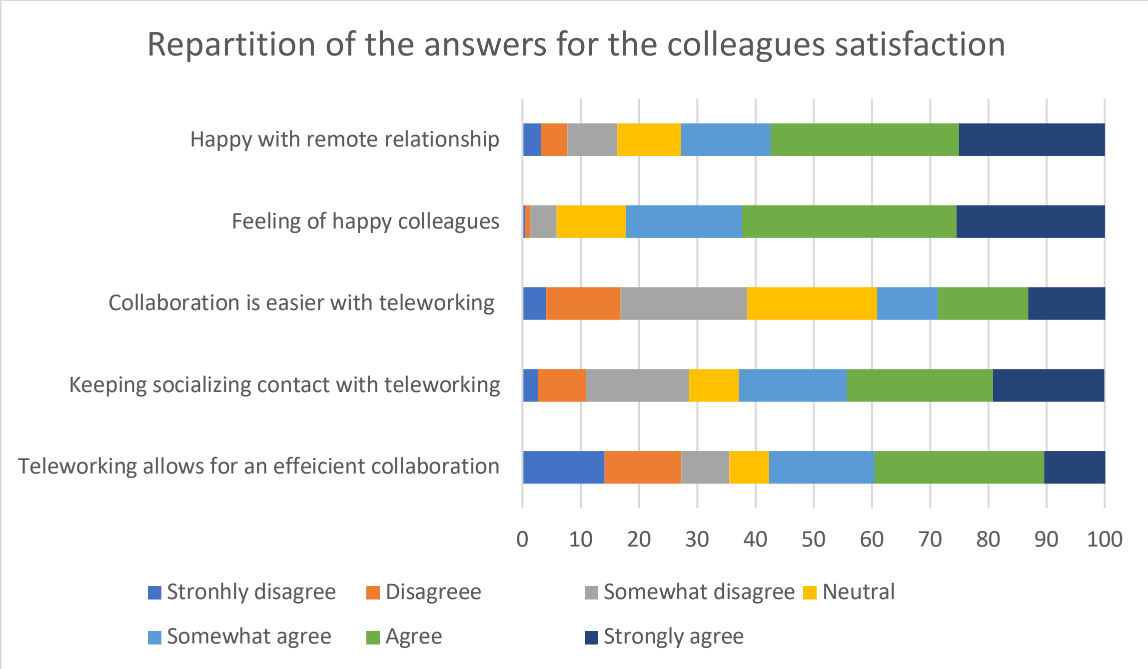


Chart 5 - Repartition of the answers for the colleagues satisfaction

7.4.1.3. Job satisfaction

Job satisfaction is about the job and its purpose in itself. You can also find in Appendix 5 the histograms of these distributions.

First of all, the surveyed sample seems to agree that telework has not fundamentally changed the purpose of the job. This is in line with the assertions we made earlier that companies have no reason to change the different positions and jobs because it is not in their interest.

However, we have to mitigate our opinion with regard to the motivation of employees. Indeed, the effect seems once again to be somewhat obscure, i.e. the dispersion of the results is high. This could really indicate that the personalities of the employees are all different and that it therefore seems logical that each of them perceives their job differently. We will analyze in a later section whether there are significant differences between the different groups, including gender and age.

You can find below a bar chart of the perceptions of the different employee:

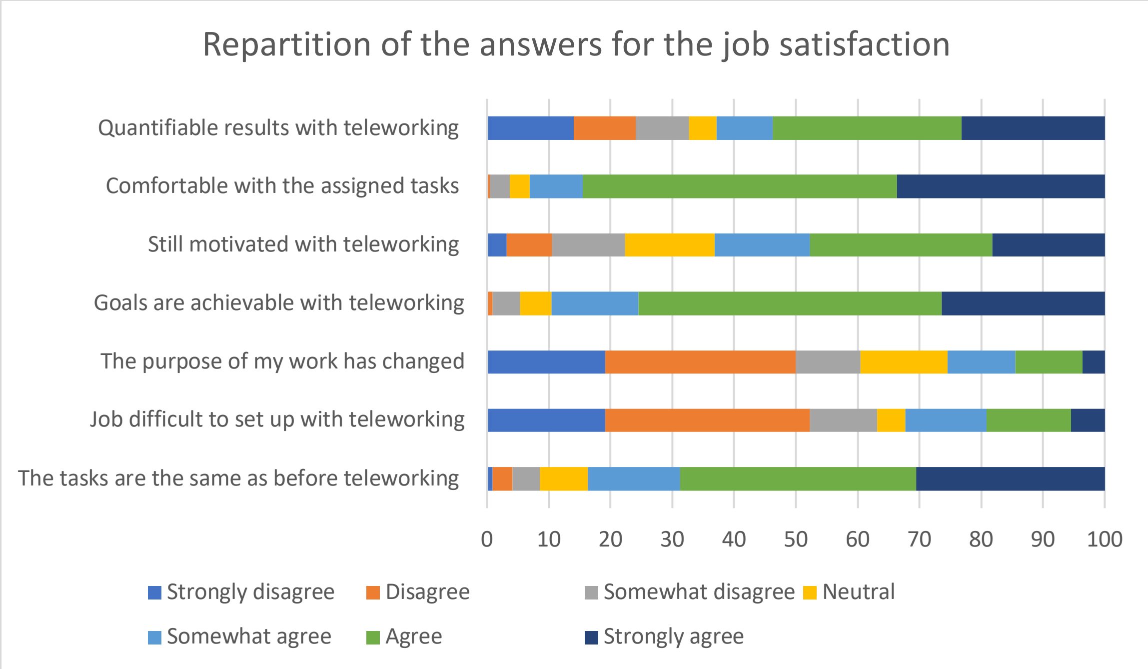


Chart 6 - Repartition of the answers for the job satisfaction

7.4.1.4. Physical environment satisfaction

The basic assumption we had constructed was that employees necessarily preferred telecommuting to face-to-face work because it was more comfortable (no travel, comfort of home facilities, etc.). This hypothesis seems to have been confirmed in our study as 65% agree that it is more comfortable to telework.

Another claim made by employees is that teleworking allows them to manage their professional and private lives more effectively. Indeed, 53.2% strongly agree on this issue (and almost 90% agree with this statement). These kinds of results are in line with the hypotheses that were built.

You can find in Appendix 6 the results of the questions related to this section and below a bar chart of the perceptions:

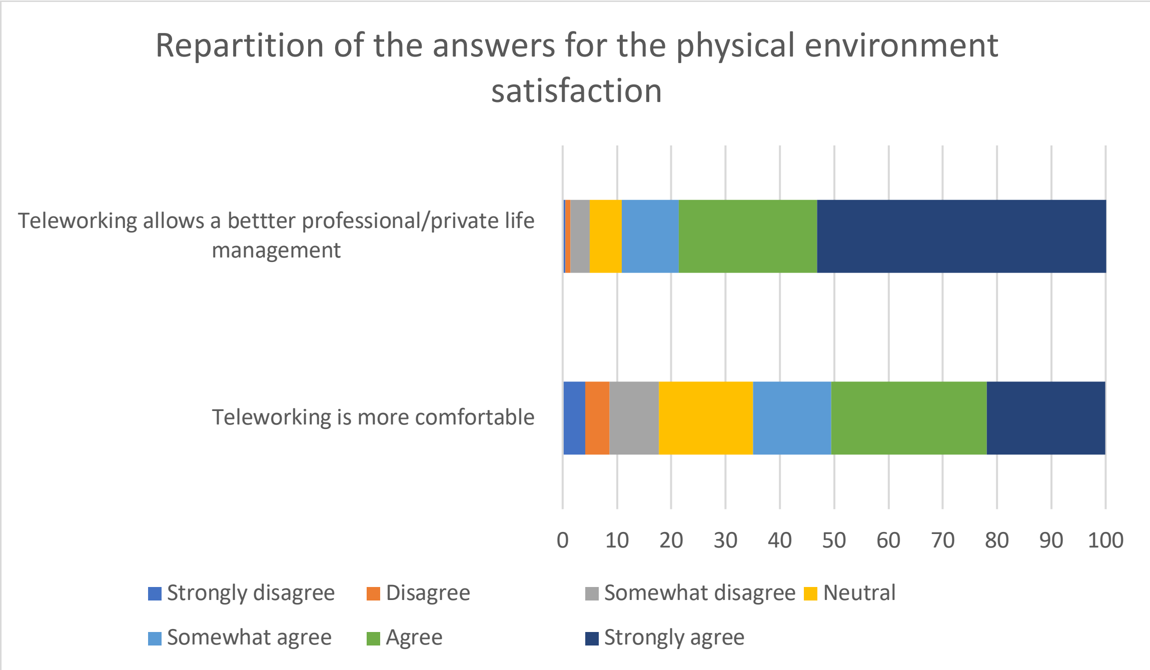


Chart 7 - Repartition of the answers for the physical environment satisfaction

7.4.1.5. Salary and other materials benefits satisfaction

You can find in Appendix 7 some details of the perceptions regarding this component of the employee satisfaction.

Satisfaction with wages and other benefits will not be analyzed in the same way as the other sections. This is because it does not concern perceptions that employees have but tangible elements that can be quantified and linked to the company and its management style in itself. Therefore, some elements of this section cannot be generalized to the whole IT sector. For example, it seems that the overall financial package has not changed radically since the arrival of telework (more than 90% agree with this statement).

Nevertheless, some elements can be analyzed and potentially generalized. For example, employees seem to agree that teleworking offers them increased flexibility in terms of time.

You can find below a bar chart of the perceptions of the different employee:

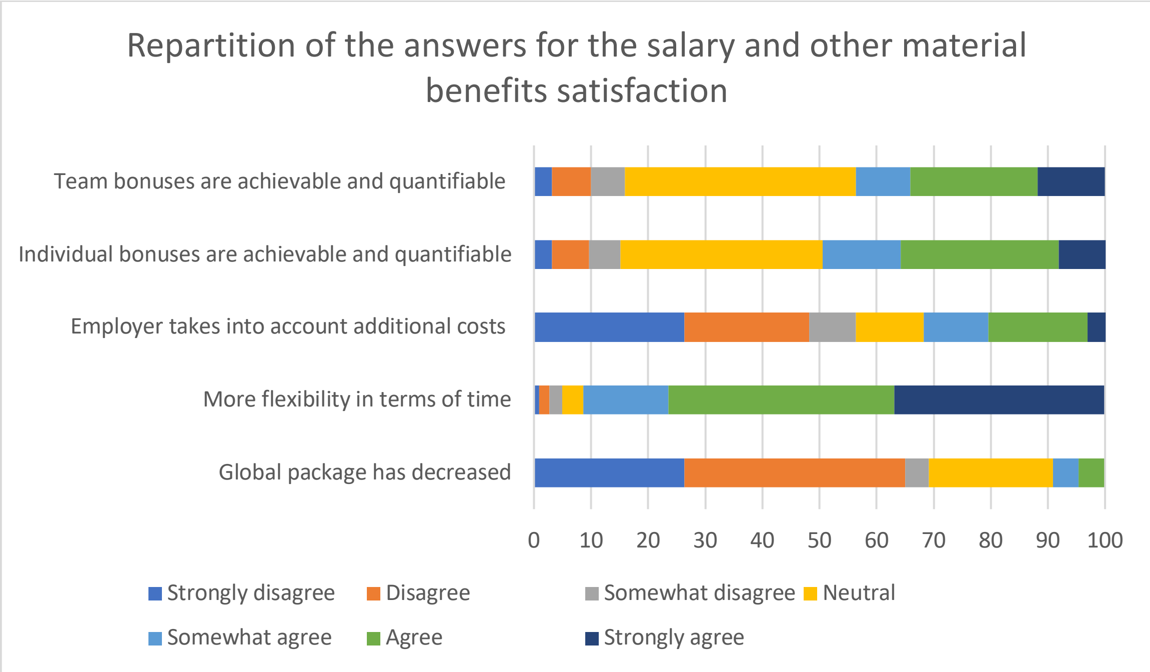


Chart 8 - Repartition of the answers for the salary and other material benefits satisfaction

7.4.2. Dispersion indicator

Having analyzed in a global way what the employees in our sample perceive in relation to telecommuting, it is appropriate to analyze the dispersion of these results. Indeed, analyzing a general trend without taking into account the dispersion factor does not make much sense. A high dispersion may indicate that perceptions differ greatly from one person to another, or it may simply indicate that further analysis is needed, especially if different groups think fundamentally differently.

If we had quantitative scale variables, we could have analyzed the standard deviation. This is not the case, so we will use quartiles, which refer to the frequency mentioned in the section 7.4.1. More specifically, we will analyze the inter-quartile range, i.e. the distance between the first quartile (Q1) and the third (Q3). In this space, there are 50% of the observations that fall within it, the rest being in the tails of the distribution. The narrower this inter-quartile range, the closer the data are.

7.4.2.1. Socialization: big gap between groups?

After analyzing the inter-quartile range (Q3-Q1), it appears that this range is quite high in relation to the question of sociability. Indeed, the inter-quartile range has a value of 3 (on a scale of 7, the number of levels of perceptions). This dispersion may indicate several elements, as mentioned above. Indeed, it may be due to the fact that some people do not feel the need to keep social contacts with their colleagues, while others feel it is necessary. In this case, we will speak of a "natural" dispersion, i.e. on average, the respondents to the questionnaire have a different perception. On the other hand, it may also indicate that several clusters have different perceptions. We will analyze in a later section whether this variability can be explained by a gap between the different groups.

7.4.2.2. Technology adoption: a challenge for the olders?

Another variable with inter-quartile range is the variable analyzing the fact that it is difficult to set up one's job with teleworking. This variability (inter-quartile range of 3 on a scale of 7), again, may be due to the fact that everyone perceives technology differently. Nevertheless, it is more complicated to master technology when one has not been used to it. Therefore, older people may have difficulties in managing their work remotely, using different technologies such as resource management tools, CRM, shared documents, etc.

7.4.2.3. Telecommuting and efficient collaboration

Efficient collaboration is also a question with a fairly high dispersion of within the provided responses (inter-quartile range of 4 on a scale of 7). This is consistent with the hypotheses put forward in the section 7.4.2.2. We will also analyze in the section 7.5.2. to what extent perceptions differ from one group to another.

7.5. Bivariate analysis

Doing a bivariate analysis is, in fact, analyzing the relationship between several variables. The objective is to answer the following question. Are those variables related to each other? Do the values of one influence the values of the other? This section be structured in two parts. The first part will do an analysis of the correlation between the ordinal variables (the different questions asked). Then, the second part of the bivariate statistical analysis will aim to identify whether there is any form of dependence between the ordinal variables and the categorical variables (gender, status and age categories). This will allow us to identify potential clusters.

7.5.1. Correlation

Once that the overall perceptions have been described, it is necessary to analyze the extent to which there may be any correlation between two variables. The objective of this section is to identify potential causal links between different perceptions. It should be noted that a correlation does not imply causality. The analysis of correlation is the first step in identifying different clusters within the sample. For this purpose, we speak of correlation. The correlation defines, in percentage terms, the link (dependence) between 2 variables. A classic example of correlation is the Phillips curve, which shows the negative dependance between the unemployment rate and the inflation rate. Indeed, the more unemployment increases, the more inflation decreases. A negative correlation therefore exists between these two components. For this survey, an analysis of the correlations that can exist between different questions will be conducted. To do this, the Spearman correlation coefficient will be used, as the variables we are testing are ordinal. If the variables had been of the scale type, we would have used the Pearson coefficient.

This correlation analysis also allows us to identify whether the respondents have, on average, responded consistently, for example if an illogical correlation appears.

7.5.1.1. Motivation and its relations

7.5.1.1.1. Management contribution

A first element to be highlighted in our analysis is the relationship between *management performance, vertical mobility* and *motivation*. We could legitimately think that the advent of telework is changing the management that was set up in companies. However, in the sample used, it seems that management has not changed since the arrival of telework. Also, the respondents (without taking into account the different groups) globally believe that it is still possible to move vertically within the company. Moreover, it seems that motivation is positively correlated with these two factors. Indeed, we observe a correlation of 32.5% between the fact that respondents believe that vertical mobility is still possible and motivation. These results do not surprise us and in fact seem rather logical. In fact, it seems reasonable to think that a person assuming that verticality is possible at work will be more motivated. It has been shown that motivation is a source of productivity and performance and will therefore be more easily promoted to a higher position. The same is true for the fact that they say that management is well executed at a distance. Indeed, an effective management necessary fosters motivated employees that will feel that they work for a good purpose. The observed correlation between those variables is 38.9%.

7.5.1.1.2. Human interaction contribution

We could also analyze the link between the *motivation of an employee and various parameters related to human interactions*. It appears from this survey that employees who remain motivated with telework are generally those who feel that collaboration is easier with telework. Indeed, a correlation of 0.497 appears between these two variables. These results do not seem abnormal, in the sense that laborious collaboration is always synonymous with irritation, frustration and thus a loss of motivation.

At the same time, a positive correlation appears between the degree of motivation and the fact that respondents maintain strong social contacts with telework. It can consequently be affirmed that social contact is an important component in work motivation (correlation of 0.402 and significant at the 1% threshold). This seems to be in line with many studies that have shown that maintaining social ties brings contentment at work and thus motivation.

It can be added to this the fact that employees who remained motivated with the arrival of telework also seem to be those who are satisfied with the remote relationship they have with their colleagues. This finding seems to be in alignment with the idea that well-being regarding the relationships they have at work is a source of motivation and therefore of performance. It will be interesting to see, in a subsequent section, to what extent perceptions differ by group. In terms of interpretation, these correlations seem to be in line with what we initially thought (57.3% of correlation between the variables).

The last element to be analyzed is the possible dependence between the *work environment (in physical terms) and motivation*. It emerged from our survey that people seem to find it more comfortable to work at home than at work and that this statement is related to employee motivation. Indeed, a positive correlation of 58.4% appears. This positive correlation seems quite logical to us. Indeed, it has been shown from other studies that a favorable work environment increases employee motivation and productivity. For that reason, we would have been surprised to see results that did not support this statement.

Finally, there is a positive correlation between motivation and the fact that telework allows for a more effective management of professional and private life (correlation of 47.8%). In this correlation, it can be understood that people who find it easier to manage their private and professional life believe that telework allows them to spend more time on extra-occupational activities and that time spent at work is only meant to be spent at work. This gives a kind of framework and clearly defines the time that is supposed to be devoted to work and private life.

7.5.1.2. Quantifiable work results and collaboration between employees

Another interesting correlation is the one between the fact that the results of the work done by employees are as observable by them as before teleworking and that collaboration between employees is effective. The correlation between these two variables is thus 76.4%. Of course, it is known that employees do not appreciate working with their colleagues if they do not work enough in their opinion. We can consequently assume that this positive correlation indicates that, in addition to seeing the results of their work, employees also see the results of their colleagues' work. The possibility of seeing these, consequently indicates to employees that their colleagues are also working as required for the collaboration, and thus puts them in a good teamwork perspective.

7.5.1.3. Managing professional and private life better and its relations

The correlation between the possibility to arrange one's private and professional life better through teleworking and the satisfaction of the remote relationship with colleagues is also interesting to analyze. This time, the correlation coefficient is 0.389. We might have thought that, notably in the management of private and working time, being able to arrange one's schedule as one pleases might have worsened the relationship between colleagues. Indeed, in a face-to-face setting, it is easier to meet at the coffee machine and thus be there at the same time. However, at home, there is a greater tendency to disconnect during breaks and also to take breaks at the time that suits them best. It would then be more difficult to meet up during breaks and to maintain a relationship outside of work and the satisfaction of the relationship would have been undermined. The fact that this correlation is significant indicates that, despite different working hours, employees globally still manage to maintain a good relationship with each other. It can be assumed that the emergence and advanced development of means of communication has a lot to do with this. For example, it is now possible to meet more easily in virtual rooms, which make it possible to talk to each other while working. Previously, it was necessary to reserve a room or to stand next to each other without speaking too loudly. Digitalization has therefore made it possible to solve a problem that it would create.

The correlation between better management of one's professional and private life through teleworking and easier collaboration through work also supports this point. Indeed, the score of 44.5% between these points tells us that collaboration between employees is also positively impacted by managing one's private and professional life in a better way. Employees are thus able to work together despite having different working hours.

7.5.2. Analysis by groups

Now that we have described the different perceptions in a global way, and identified the correlations between the different variables, it is necessary to define how the perceptions differ from one group to another. It was explained in section 7.3. how we tested whether the sample collected is representative of the population. We have created control variables, i.e. variables that identify the groups and that we test against the population. What would be interesting at this stage of our research is to analyze to what extent perceptions differ according to groups (gender, age category and status in the company). For that reason, we had some discussions with Couvreur (2022) in order to test these potential differences. In statistics, there are the classical mean comparison tests, which are designed to compare the means of different groups on a quantitative scale variable. These tests are ANOVA tests and t-tests, which are parametric tests. However, we are dealing here with perceptions and thus with ordinal scales. Therefore, testing the mean are not valid for this type of variables. Nevertheless, other tests exist and are adapted to ordinal variables. These tests are the non-parametric tests. In particular, the Wilcoxon-Mann-Whitney test allows this type of analysis to be carried out when the groups are at two levels (particularly the case for gender, if we consider that there are only two in the scientific sense). We will then refer to these as non-parametric tests, as they do not estimate the mean and variance. When more than 2 levels exist (e.g. status), an equivalent test exists: the Kruskal-Wallis test.

Differences exists between groups on each of the perceptions, but we will only retain the significant differences, i.e. the ones that have a p-value of < 0.05.

It should be noted that we will compare the means of each group to quantify the discrepancies between them. Even if it makes less sense than analyzing the relative frequencies (as mentioned in section 7.4.1.), it will allow to quantify clearly the trends that appear.

7.5.2.1. Gender

The first analysis we can make is comparing the perceptions depending on the gender. Indeed, since the arrival of telework, many studies have been made on the perceptions of different genders. In this research, we want to quantify the different discrepancies that might exist between what women and men think.

It seems interesting to analyze the extent to which *motivation* has been impacted to a different extent by gender. It could allow us, in a following section to identify clusters between the different respondents.

It seems, according to the sample analyzed, that men and women no longer have the same motivation to telework. Indeed, men seem to be less motivated than women to work remotely, as they agree on that statement at 4.69 out of 7, while women agree themselves at 5.12 on the same scale. The difference in perceptions is significant at the .05 level, allowing us to reject the null hypothesis of no difference in the perceptions (p-value of 0.032). Although this does not make much sense with ordinal variables, we have drawn this conclusion based on the mean per gender, and it seems that men have, on average, a lower motivation than women. We could thus ask ourselves what variables might explain such a difference in motivation between men and women.

Firstly, it seems that women perceive more flexibility in terms of time than men (6.17 against 5.69 for men). This seems to indicate that men have not changed their style of life and the way they arrange their time as much since the advent of telework (p-value of 0.008, which give us a 1% risk of error on the rejection of the hypothesis of equality of perceptions). Nevertheless, it should be noted that the differences are not aberrant, and all tend towards greater flexibility, not just for women. We can add to this another variable, which goes in the same direction. Women seem to perceive that telework allows them to manage their private and professional life (p-value of 0.026). Men are broadly of the same opinion, but to a lesser extent (6.01 against 6.25). Women thus seem to use their flexibility at work to manage other occupations in their private lives. Men perceive this flexibility less and at the same time use it less in their private life. These two mediating variables could therefore explain why men's motivation is lower than the one of women. However, our conclusions should be mitigated in the sense that the men are still motivated with the telework, but just in a lower level.

Nevertheless, one aspect caught our attention: collaboration. The analysis shows that men do not as much as women concerning the fact that telework is an effective way of working together, whereas women seem to agree with this assumption (p-value of 0.033). The mean difference in perceptions are quite distant and seem to indicate another reason why women seem to be more motivated than men to teleworking (3.97 for men and 4.58 for women). Vertical mobility is also closely related to this issue. Indeed, women feel that vertical mobility is still possible despite telework (5.28 for men and 5.65 for women). Men have the same opinion, but on a smaller scale. It could be related to the fact that women feel that collaboration is effective and increases their chances of being promoted to a higher position.

In summary, an analysis of the motivation of each of the gender was conducted. Men seem to be less motivated to telework than women for the following reasons:

- Women perceive more flexibility in terms of work balance and can thus devote more time to their private life than men. They have, for that reason, the feeling that the work hours should be devoted to work.
- Women feel more than men that collaboration is effective with telework and therefore feel that vertical mobility is still favored by telework.

These results are in line with other studies that have been carried out, including one published by l'Opinion (2022). This study showed that women were happier with telework than before. You can find in Appendix 8 the statistics of Mann-Whitney related to the studied variables.

7.5.2.2. Status

The first difference in perception that appears between the different statuses is that managers have less difficulty in *achieving their team bonuses* (p-value of 0.037). While juniors and seniors have, on average, the same perceptions (4.47 on a scale of 7), managers agree with this statement at 5.04. The Kruskal-Wallis test shows that this is also the case for *individual bonuses*, where each group has different perceptions, all pointing in the same direction, but at different levels (4.36 for juniors, 4.62 for seniors and 5.00 for managers/above). We will not draw any conclusions from this because these are not perceptions but rather quantifiable elements that we cannot generalize to the population.

Nevertheless, another element caught our attention: *the satisfaction of employees with the relationships they have with their colleagues at a distance*. Although it seems that, on average, the members of each group are satisfied with the "remote" relationship they have with their colleagues, we can assert that managers are not as satisfied as the others (we can reject the null hypothesis of absence of equality in perceptions with a risk of 5%, as the p-value is 0.011). Indeed, managers have a satisfaction level of 4.77 while seniors have a level of 5.52. This is probably due to the fact that the position of manager requires "people management" skills and is more akin to a human resources role. As a result, juniors and seniors do not see their relationship fundamentally changing (as collaboration is still possible), while managers see the purpose of their job somewhat taken over by the teleworking situation.

You can find in Appendix 9 the results of the Kruskal-Wallis tests.

7.5.2.3. Age category

Regarding the differences between the categories, we have identified a few that deserve further investigation. You can find in Appendix 10 the Kruskal-Wallis tests results for the age category comparison.

First of all, we would like to point out the following: the *remote socialization*. Each group seems to perceive this aspect differently but the one that stands out the most is the 51+ age group (4.45 on a scale of 7), and the difference appears significant as the p-value is 0.026. These results do not seem to fit in with the idea of digital transition. Indeed, the youngest have no problem keeping social contact with telework, with the different solutions available to them (team meetings, intranet, etc.). The people most affected are the older people. Indeed, older people might have more difficulty in managing these new tools because they have not been used to them in the past and the transition is therefore more difficult. This could also explain another difference: *the satisfaction of the remote relationship they have with their colleagues* (p-value of 0.007). Once again, it seems that the oldest age group is the most affected by telework, as it appears that this group is less satisfied with it than the others (4.45 for the 51+ category, 5.15 for 34-50 and 4.86 for 18-34).

7.6. Principal Component Analysis & clustering

In this section, we will conduct a principal component analysis and then cluster (creating groups) with respect to the components that have been retained, based on the variance that they explain. It should be noted that principal component analysis and clustering are intended for continuous variables. For this purpose, our variables will be considered as scale variables.

7.6.1. Principal Component Analysis

The Principal Component Analysis (PCA) is a statistical procedure that aims to create a set of components that represent the different observations. Each of the original variables is represented to some degree in each of the components. For example, in the case of our survey, we could assume that the variable "motivation" is represented at 30% in the first component, at 15% in the second, etc. The maximum number of components is equal to the number of variables (in our case 23, as we do not take into account the categorical variables). Nevertheless, the main objective of PCA is to reduce the number of dimensions that can represent the observations. For that reason, we must try to find a compromise between the number of components and the variance that they represent together. Generally, statistical tools are set up in such a way that the components are kept as long as their eigenvalue is greater than 1. In PCA, the eigen value is "a ratio of the shared variance to the unique variance accounted for in the construct of interest by each "factor" yielded from the extraction of principal components." (ScaleStatistics, 2022). However, the number of retained components will be the object of a future section.

7.6.1.1. Objective of the PCA

As part of our empirical analysis, we will perform a principal component analysis in order to be able to accurately project our observations onto the selected components. Once the different components are highlighted, we will analyze the variance that these explain. Also, we will be able to create clusters within the sample studied. It will then be possible to analyze their characteristics to determine whether they belong to one of the categorical variables defined initially, or not.

7.6.1.2. Retained components

We therefore performed the necessary commands in SPSS to carry out a principal component analysis. The outputs show different statistics regarding the dimension reduction. A first element that we notice is the fact that the algorithm retained 5 components according to the eigenvalue criterion. Beyond that, the eigenvalues of the components are below 1 and we have specified in the software that we only keep those with an eigenvalue greater than 1 (Couvreur, 2022).

You can see in the table below the components kept and the variance they explain:

Total Variance Explained

Component	Initial Eigenvalues Total	Initial Eigenvalues % of Variance	Initial Eigenvalues Cumulative %	Extraction Sums of Squared Loadings Total	Extraction Sums of Squared Loadings % of Variance	Extraction Sums of Squared Loadings Cumulative %
1	6,449	28,041	28,041	6,449	28,041	28,041
2	3,267	14,206	42,246	3,267	14,206	42,246
3	1,850	8,042	50,288	1,850	8,042	50,288
4	1,439	6,258	56,546	1,439	6,258	56,546
5	1,260	5,476	62,022	1,260	5,476	62,022
6	,987	4,292	66,314			
7	,875	3,805	70,119			
8	,780	3,393	73,512			
9	,734	3,190	76,702			
10	,682	2,966	79,668			

Table 1 - Principal Component Analysis

On the basis of the table above, it can be said that, based on the criterion of eigen value, the first 5 components should be retained. These 5 components capture 62% of the variance of the observations. It should be noted that the first two components are the most efficient and together represent more than 42% of the variance. We could cluster on the basis of all the variables, but the idea is to reduce the dimensions as much as possible while still capturing the variance. For that reason, we will cluster the observations based on the two first components. Some variances will not be captured, but the objective is to find a trade-off between the simplicity and the effectiveness.

All observations can be projected onto the first 2 components (as on the Chart below), and this is a primary indicator of the different clusters. In the graph below, you can see that one cluster seems to dissociate from the rest of the scatter plot:

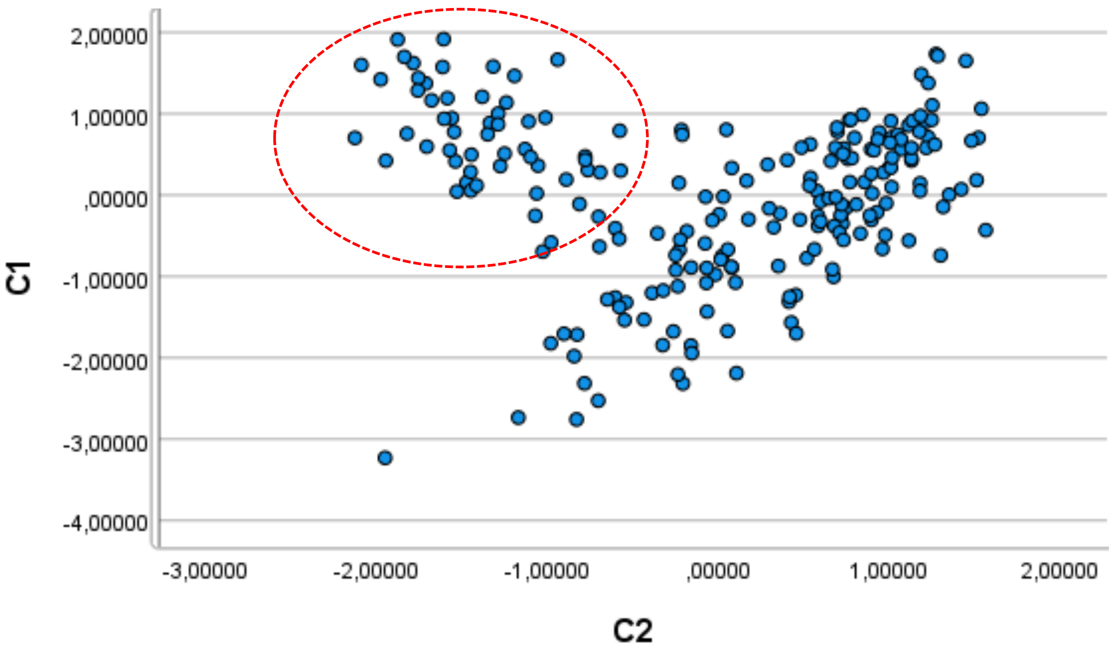


Chart 9 - Projection of the observations on the 2 first components

Of course, this will be explored further in the next section, but it seems that one group will stand out from the others in terms of the different discussed perceptions, as it is visible on those 2 components.

7.6.2. Clustering

The idea of clustering is to start with the raw data, i.e. the set of available observations and the different variables that represent them, and then arrive at a set of groups that classify these observations.

7.6.2.1. Clustering method

Before we can go any further in our analysis, it is necessary to determine how clustering works. Initially, the algorithm treats all observations as a cluster. Then, it will find 2 clusters that are the closest and put them together. The algorithm stops once there is only one cluster remaining, because they have all been assembled. We will not go into detail about the different clustering methods, but we will explain the one that was used.

In the algorithm used, the distance between the different clusters is calculated with the average of the distances between the pairs of objects of each cluster (a pair of objects consists of one object of each cluster). At each iteration, the assembled clusters are those whose distance is minimized. This method is called the “average linkage clustering”.

7.6.2.2. Retained clusters and their typology

After reviewing the different clusters created by the algorithm, it was possible to retain a lot of them. Nevertheless, an iterative way was used so as to have fewer different clusters. The limit was set at 3. On these 3 different ones, how each of them globally behaves will be analyzed. The first cluster is composed of 103 observations, the second of 59 and the last is composed of 58 observations. For the analysis, they will be called "Cluster 1", "Cluster 2" and "Cluster 3".

You can find below a dendrogram, which represents the tree structure and allows us to identify the different clusters. The retained clusters have also been circled:

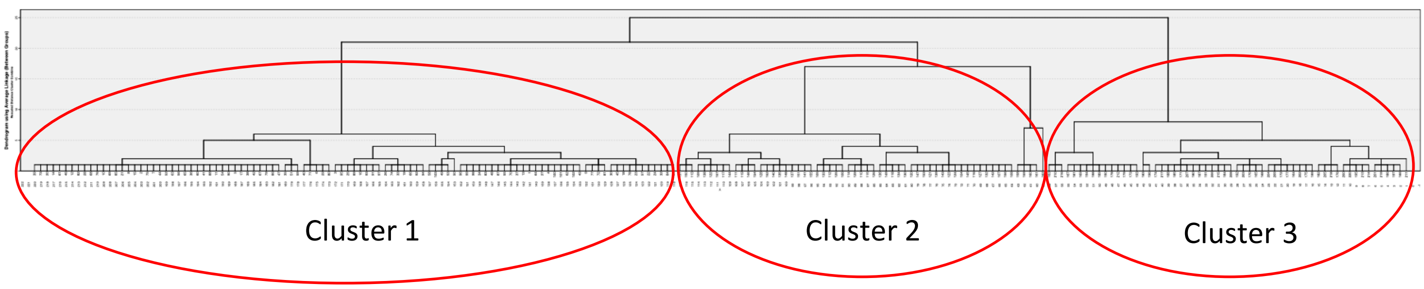


Chart 10 - Dendrogram of the observations

- The lower the groups are split on the diagram, the more homogeneous the groups will be (fairly similar answers), but the more groups you have;
- The higher you split the groups in the dendrogram, the larger the groups will be but the less homogeneous they will be;
- The further apart the groups are, the more different their perceptions will be.

The analysis of these clusters will be discussed in a later section.

One thing that stood out in the analysis of the different clusters was their similarity to the overall sample. Indeed, the different categorical variables (gender, status and age category) that allow our sample to be split into different groups are similarly represented in the different clusters. It will discussed in the following sections.

7.6.2.2.1. Gender

You can find below a graph showing the different clusters proportion in relation to the general population according to the gender:

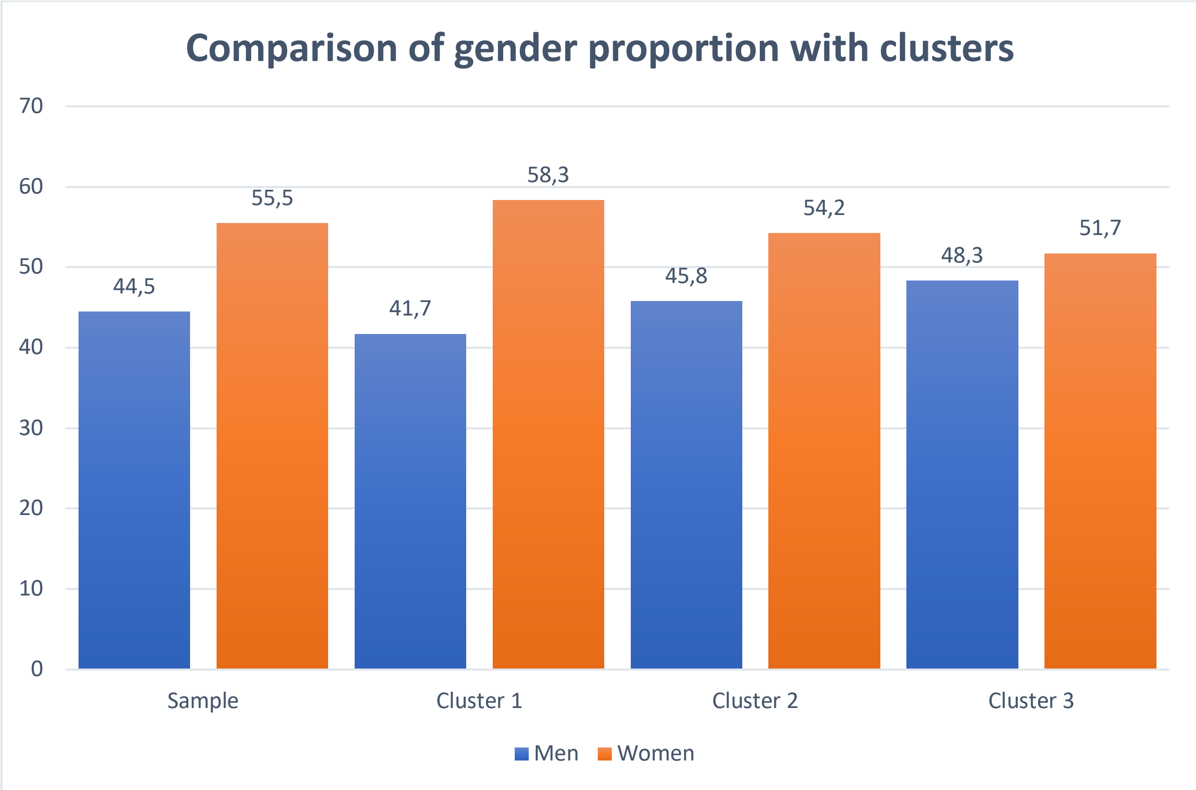


Chart 11 - Comparison of gender proportion with clusters

This chart above shows the comparison of the sample with the different clusters. The trend seems to be the same in all the groups, as more women are represented.

7.6.2.2.2. Status

The same logic applies to the different status. It can be seen in the chart below that the proportions are similar, even if to a different degree:

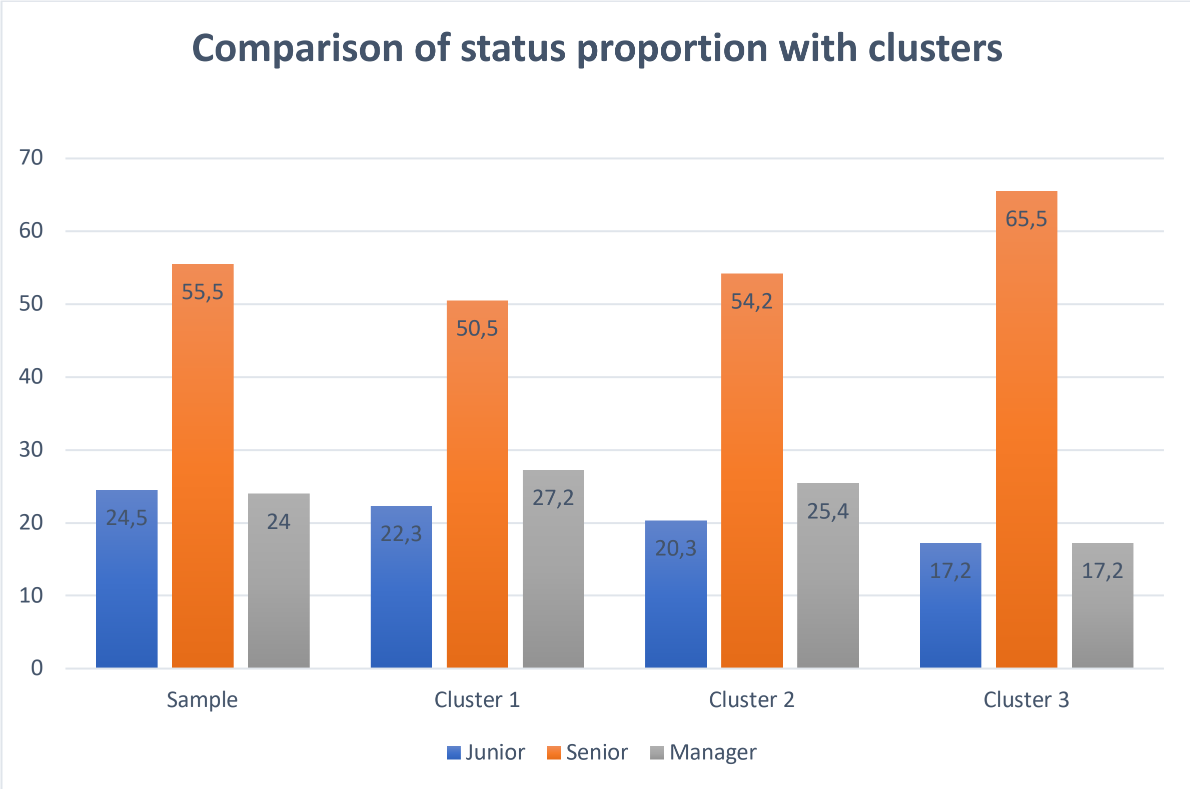


Chart 12 - Comparison of status proportion with clusters

7.6.2.2.3. Age category

Finally, this statement must somewhat be qualified for the age categories. Indeed, there are some discrepancies with regard to the proportions, as you can see on the chart below:

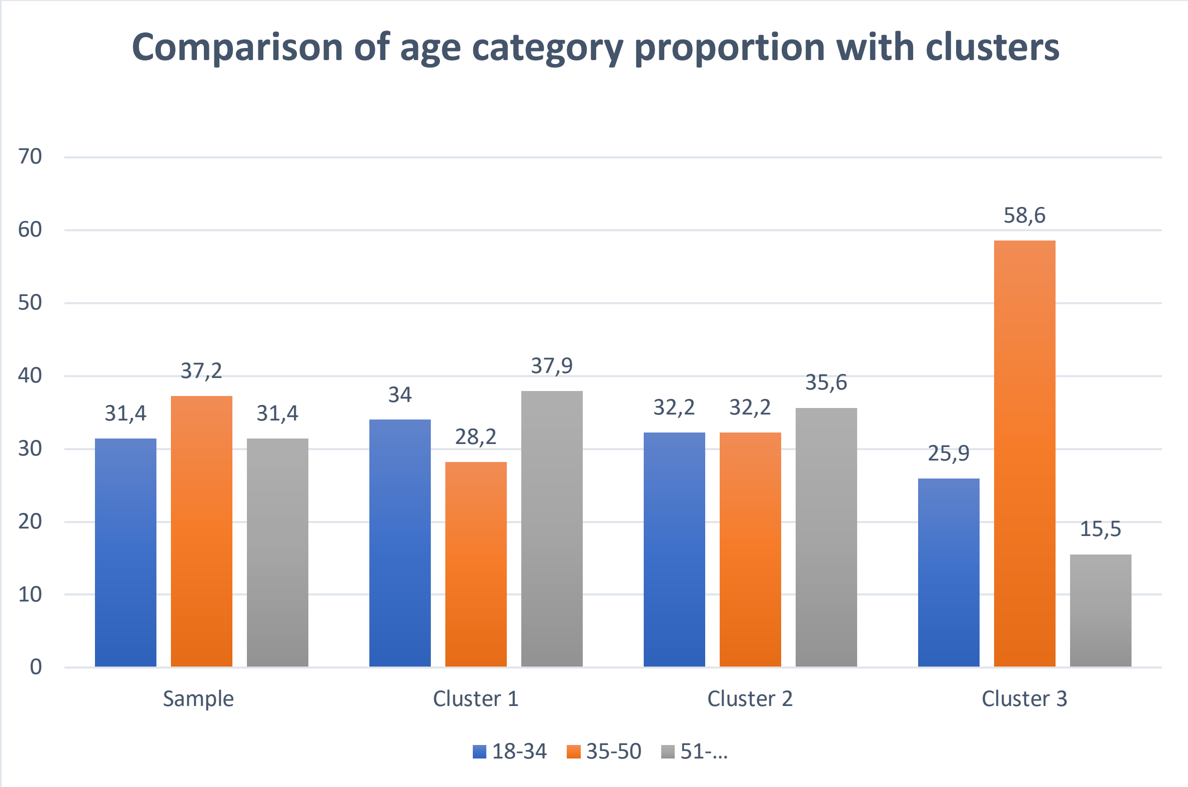


Chart 13 - Comparison of age category proportion with clusters

Overall, our clusters are rather similar to our sample with respect to the control variables. What are the consequences of this? In the section 7.5.2. the major differences between the different groups, for the different issues addressed, have been defined. Nevertheless, these differences do not allow for the creation of groups with different characteristics, as each of the clusters have similar categorical characteristics. This means that the perceptions approached in a global way (by dealing with the whole set of perceptions and not by doing each question independently of the others) are different because people's personalities are intrinsically different and are not linked to any particular category (gender, age category and status).

7.6.2.3. Perceptions of the clusters

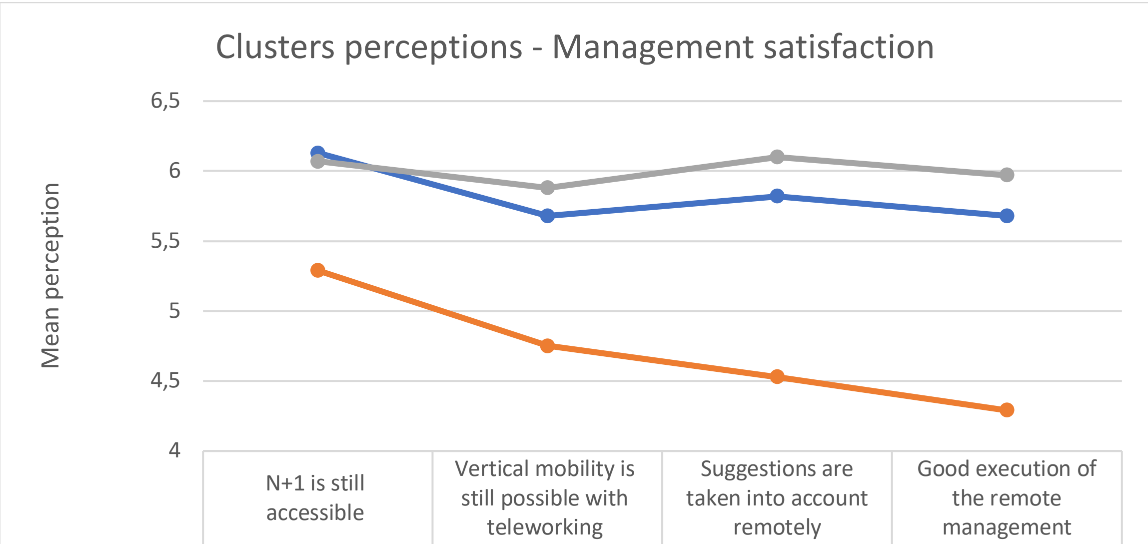
The objective, based on these different clusters, is to analyze their perceptions of telework. Knowing that the algorithm has split the observations according to their similarities, it can be assumed that the perceptions should be different. Therefore, they will be analyzed for each of the components of the employee satisfaction. As mentioned earlier, the analysis of means for ordinal values is not the most accurate analysis. However, for cluster and section analysis, it would have been clearly unreadable and incomprehensible to do a frequency comparison. Moreover, as clustering has put together individuals with similar opinions, using averages is less inconvenient. It is indeed less disturbing to proceed to a mean when a large part of the cluster answered "agree" and the rest of the cluster "somewhat agree" or "strongly agree", for example, than when the 7 different answers are present in the sample of people.

7.6.2.3.1. Management satisfaction

In this first section of variables, which is management satisfaction, the cluster analysis is fairly easy to explain.

The Cluster 1 and Cluster 3 are, within a few hundredths or tenths, similar for each of the variables. There is therefore no significant difference. However, the Cluster 2 has significant differences in three out of four variables, and a smaller difference in the last variable. Indeed, the average of the results of the Cluster 2 is one to two units lower (on a basis of one to seven, as mentioned above) than in clusters one and three. It is easy to deduce that the Cluster 2 has had a worse relationship with management than the other two since the start of teleworking. They may find it more difficult to contact them in real life and to make themselves heard. The fact that they are behind a screen could be a barrier to discussion with their superiors. The fact that the largest gap is on the variable "I think management is well executed remotely" supports this interpretation quite clearly. Nevertheless, the impression of a loss of influence on decisions and a loss of vertical mobility is also sufficiently important to be noted.

Globally, the Cluster 2 seems to behave a bit differently than the two others regarding the management satisfaction. The chart below represents the perceptions of each of the clusters:



	N+1 is still accessible	Vertical mobility is still possible with teleworking	Suggestions are taken into account remotely	Good execution of the remote management
Cluster 1	6,13	5,68	5,82	5,68
Cluster 2	5,29	4,75	4,53	4,29
Cluster 3	6,07	5,88	6,1	5,97

Chart 14 - Clusters perceptions on management satisfaction

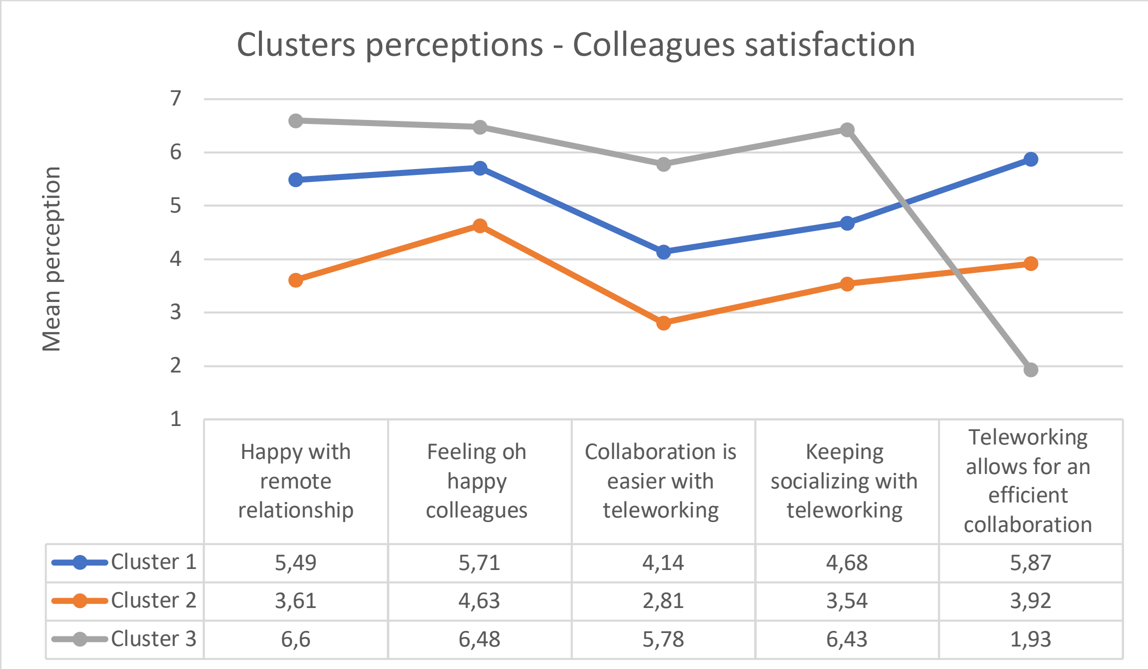
7.6.2.3.2. Colleague satisfaction

For the second section, which evaluate colleague satisfaction, the results start to differ a little more. Once again, the Cluster 2 stands out from the Cluster 1 and Cluster 3. Indeed, the average results of this one, for three variables, are between 1.8 and 3 points lower than those of the other two clusters. It appears that the Cluster 2 is less satisfied with the remote relationship they have with their colleagues, and that collaboration with them is also more complicated as a result of teleworking. Finally, they have less of an impression that their colleagues are happy to telework. These results are quite interesting because they seem to confirm the hypothesis that was put forward earlier. Indeed, it seemed that the Cluster 2 had more difficulty with contacts with management. It looks like this finding applies not only to management but also to colleagues. It appears that the members of the Cluster 2 have more difficulties in communicating, collaborating, and contacting their colleagues than the other two clusters. It is also important to note that, even though the differences are less significant than with the Cluster 2, the average of the Cluster 3 is still a little higher than that of the Cluster 1, by half a point to a whole one.

Another significant difference is the ability to socialize with colleagues. It can be seen that the Cluster 3 is significantly higher than the other two. It appears that, for the members of the Cluster 3, distance is not an obstacle to the creation of relationships with new people or new relationships with the same people. This leads us to believe that this cluster has not really experienced any relationship difficulties since the introduction of teleworking. It would seem that they are actually better at this task than the other two.

Finally, the analysis of the last variable, specifically in relation to the Cluster 3, is particularly interesting. Regarding the question: "I feel that telecommuting allows the employee to collaborate in an efficient way". Again, the mean results for the Cluster 1 are about two points higher than for the Cluster 2. However, where one would expect, given the start of the analysis, that the results for the Cluster 3 would still be slightly higher than the first, but this is not the case. The average of the Cluster 3 is about two out of seven, whereas the first and second ones are six and four respectively. If we then look at the results of the third cluster for the whole category, it appears that relations with colleagues, as mentioned above, are not a problem. Nevertheless, it also shows that although collaboration between colleagues is easier, it is less efficient. This is particularly interesting. So, according to the feelings of this cluster, it would be easier to set up a team collaboration, but the latter would be less efficient. The most logical intuition is that it is easier, for example, to call each other by means of communication than to travel to the location of a colleague. However, working together will not be as effective at a distance as two people next to each other.

You can find below the perceptions of the different clusters regarding the colleagues satisfaction questions:



	Happy with remote relationship	Feeling oh happy colleagues	Collaboration is easier with teleworking	Keeping socializing with teleworking	Teleworking allows for an efficient collaboration
Cluster 1	5,49	5,71	4,14	4,68	5,87
Cluster 2	3,61	4,63	2,81	3,54	3,92
Cluster 3	6,6	6,48	5,78	6,43	1,93

Chart 15 - Clusters perceptions on colleagues satisfaction

Based on the chart above, it can be asserted that each of the cluster is quite different from each other, but the Cluster 1 is still between the 2 others.

7.6.2.3.3. Job satisfaction

The third section is the job satisfaction. This is where there are the most differences in perceptions between the clusters. However, the average of the Cluster 2 is still significantly lower in three categories:

- First of all, the employees in the Cluster 2 do not agree as much as the others that the tasks are still the same as before. They therefore have the feeling that they have a significant proportion of different tasks.
- These same employees also have the feeling that their objectives are less easily achieved than before. Indeed, where the other clusters feel that their objectives are almost as attainable as before, the Cluster 2 does not quite agree.
- Finally, their motivation to work remotely on a daily basis is in free fall compared to the others. This time, their average is 2.5 points lower than the other clusters. With a

mean score of 3.19, the cluster "somewhat disagrees" that teleworking keeps employees motivated every day.

However, things change for three other variables. Firstly, for the difficulty of implementing teleworking. The Cluster 3, which so far seemed to have had the least difficulty, is the cluster for whom teleworking was the most difficult to implement. Then comes the Cluster 2, followed by the first, for whom teleworking was not at all complicated to set up. The Cluster 3 also feels most strongly that the intrinsic purpose of their work has changed. Again, there is a significant difference between the three clusters. And here again, the Cluster 2 is mixed while the Cluster 1 did not see much difference in the intrinsic purpose of their work. It is interesting to observe that the Cluster 3 feels that the tasks they perform have not changed, but that the intrinsic purpose of their work has indeed been changed. And it is in the next variable that a clue to explain this can be found. The next variable is: "The results of my work are as quantifiable as before teleworking". It can be seen that the Cluster 3 has great difficulty in observing the results of their work. Conversely, the Cluster 1 has no difficulty in observing the results of their work, while the Cluster 2 is mixed between the two. The difference is of course significant with about 2 points difference between each answer. It then seems justified to explain, for the Cluster 3, that if they have not changed their tasks, but feel that the intrinsic purpose of their work has changed, it is probably because of the impossibility of seeing the results of their work. Presumably, these employees now only feel that they are doing a meaningless task and have therefore lost the purpose and achievements of their work.

You can find below the chart representing the perceptions of the different clusters concerning the job satisfaction in itself:

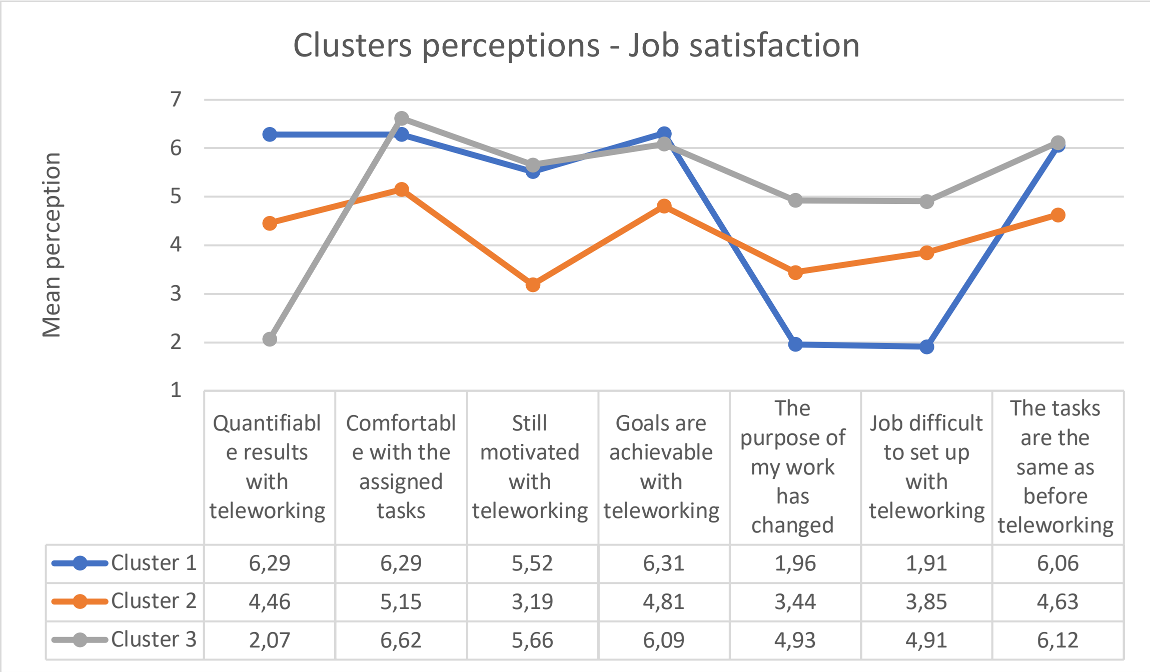


Chart 16 - Clusters perceptions on job satisfaction

The analysis of this chart is more complicated to perform. The 3 clusters seem to behave in a completely different way.

7.6.2.3.4. Physical environment satisfaction

The next section is the physical environment satisfaction. Again, the averages of the Cluster 1 and Cluster 3 are quite similar. However, the Cluster 2 expresses a significantly different feeling. Where the Cluster 1 and 3 are definitely more comfortable working remotely, the Cluster 2 slightly prefers to work face-to-face. The same is true, but to a lesser extent, for the management of working time and private time. This time, all three clusters agree that teleworking allows better management of work and private time. Nevertheless, the Cluster 2 does not agree very strongly, while the other two clusters support this statement almost completely.

Here below, you can also find the chart representing the perceptions of the 3 clusters regarding the physical environment:

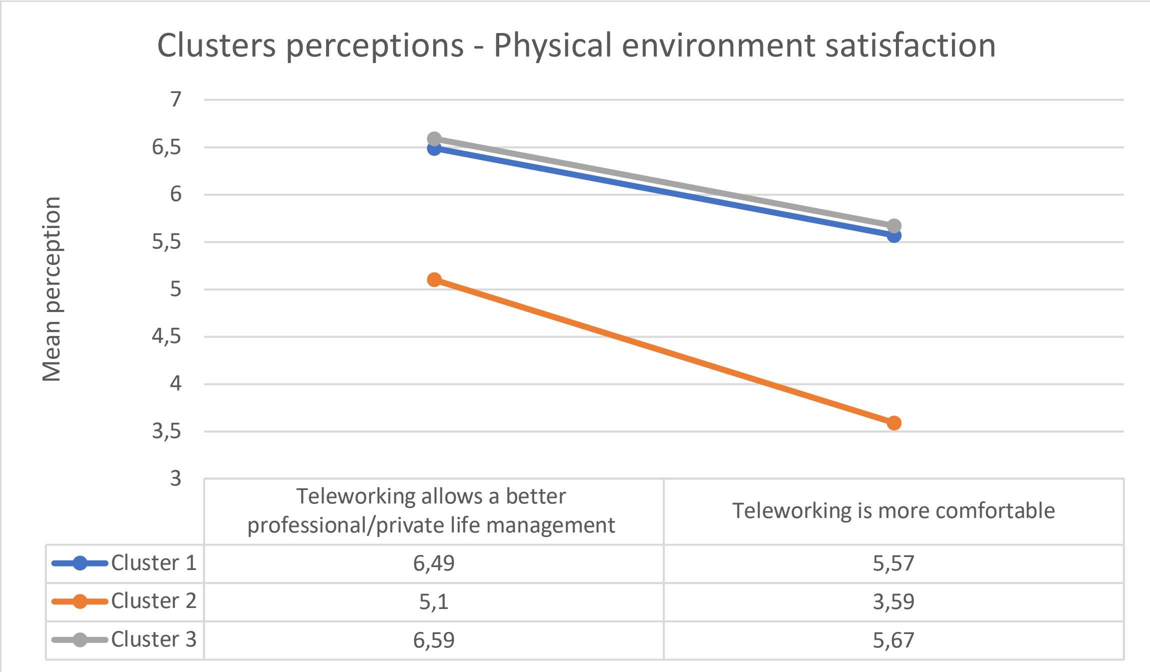


Chart 17 - Clusters perceptions on physical environment satisfaction

This chart allows us to understand that the Cluster 1 and the Cluster 3 are quite similar regarding this component of the employee satisfaction.

7.6.2.3.5. Salary and other materials satisfaction

The last section shows the least differences. This can be explained by the fact that this section is based more on more easily quantifiable concepts than the others. The results are less influenced by people's feelings because the factual will be more relevant than in the previous sections. One' s perception will influence one's relationship with colleagues more than whether or not the overall package of benefits and pay has decreased since teleworking. The latter category is obviously more easily quantified than a relationship.

There is, however, one notable difference. It is found in the following variable: "I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking". Indeed, employees in the Cluster 3 have a significant difference with those in the first one. While the latter slightly agree with this statement, the members of the Cluster 3 slightly disagree. The difference, although significant, is not huge. It is conceivable that the members of the Cluster 3 have sustained slightly more costs than the members of the Cluster 1, but this is only a hypothesis to try to explain this difference.

7.6.2.4. Conclusions about clusters

After analyzing the difference between the clusters on all variables, several conclusions can be drawn.

First of all, it is clear that the Cluster 2 differs more significantly from the other two. As can be seen immediately from the graphs, employees in the Cluster 2 have experienced much more difficulty than those in the other clusters following the implementation of teleworking. Firstly, they have more difficulties in their relationship with management. Their ability to communicate has definitively been severely damaged since the switch to telework. They have had great difficulty in adapting to the new communication technologies. This is then verified by their equally diminished results in the category of colleague satisfaction. They also find it much more difficult to dialogue, collaborate and build relationships with their colleagues. Logically, they are also less happy, which points to a damaged satisfaction in their working life since teleworking. This finding is also continued in the next section, which is job satisfaction. Indeed, the Cluster 2 is the least motivated of the three, with the most significant difference of all. Furthermore, the Cluster 2 still scores lowest in four other "job satisfaction" variables, in the two "physical environment satisfaction" variables. The same is true in the only variable with a significantly different score of "salary and other materials satisfaction". This further indicates that the Cluster 2 is made up of employees who had and still have the most difficulties with the introduction of teleworking, and are therefore more in favor of a return to face-to-face work.

On the other hand, the averages of employees in Cluster 1 and Cluster 3 are, apart from a few variables, generally much more similar. The results of these two clusters show that the employees in them are largely in favor of teleworking. It is nonetheless to be noted that, for the majority of variables, the Cluster 3 generally scores slightly higher than the first. This tells us that, despite the ease of teleworking of both clusters, the Cluster 3 is more accepting of teleworking for most variables. There are, however, some exceptions to this constant. Firstly, employees in the Cluster 3 find that collaboration, although easier, is less efficient than in face-to-face work. While the job satisfaction results for the Cluster 1 and Cluster 2 are stable, the results for the Cluster 3 fluctuate. Indeed, these employees feel that their results are no longer as quantifiable and that, although the tasks have not changed, the intrinsic purpose of their work has. One possibility would be that, since these employees no longer see the results of their work, they lose the final purpose of their tasks.

Finally, it is therefore complicated to establish a hierarchy between Cluster 1 and Cluster 3 regarding ease and complacency in teleworking. Nevertheless, it can be said that these two clusters, representing about 75% of the population, support teleworking and are mostly happy with it. On the other hand, it is clear that the Cluster 2, representing 25% of the sample, finds it much more inconvenient and difficult.

7.7. Generalization of the results

Nevertheless, our study cannot be generalized to the population for various reasons. First of all, our study focuses on one sector. Therefore, this high-tech sector may bias employees' perceptions. We can add to this the fact that we analyzed a sample of employees from a well-defined company and the results may, as a consequence, be specific to the organization.

Finally, the sampling method is not a random method, and the results do not guarantee to be representative of the population.

For that reason, our analysis cannot be generalized to the whole population of teleworking employees, but it can be used as a reliable trend indicator.

8. Empirical analysis conclusion

An empirical analysis was conducted with the objective of quantifying the perceptions of employees in the IT sector with regard to teleworking.

First, the main trends in the perceptions of these employees were identified, regardless of the categories to which they belong. The analysis showed that employees are satisfied with the execution of the "remote" management. At the same time, it seems that employees feel that their suggestions have not lost their impact on decision making. Regarding collaboration with colleagues, it seems that employees feel that this has remained effective despite teleworking, although it has become more complicated to collaborate. Also in this respect, the analysis showed that the purpose of the job has not changed since the arrival of telework. The effects on motivation are a bit tricky as its dispersion index is quite high. On the other hand, telework seems to be more comfortable for the employees in the studied sample. At the same time, they agree that telework allows them to manage their private and professional life better.

Next, an analysis of the correlations that could exist between the different answers to the questions was conducted. First of all, it appears that motivation is positively correlated with other management variables: management effectiveness and the perception that vertical mobility is still possible with telework. It can be added to this that motivation is positively correlated with the ease of collaboration between employees. The social factor also plays a role in this motivation, as a positive dependency appears between these two variables. Again, motivation is correlated with satisfaction with the relationship maintained with colleagues. Finally, motivation appears to be correlated with the answers stating that telework allows better management of one's private and professional life, but also that it is more comfortable than face-to-face work.

Following this analysis of correlations, we analyzed the extent to which employees' perceptions differed according to the category to which they belonged (gender, status and age category). Firstly, it appeared that women perceive more flexibility in terms of time than men. Women also believe more than men that telework allows better management of work and private life. The fact that women feel more than men that telework allows for effective collaboration can be added to this. Finally, women agree that vertical mobility is still possible with telework, while men have the same opinion but to a lesser extent. These different elements allow us to see that women's motivation is higher than that of men.

In the last step, a principal component analysis was conducted, with the aim of identifying clusters in order to establish their typology and perceptions. This clustering allowed us to retain 3 clusters (one composed of 103 observations, another of 58 and the last of 59). Each of these clusters seems to be in alignment with the proportions and parameters of the control variables (gender, status and age category). It was seen that a clustering splits observations because differences between them exist and it was seen that the control variables were respected. It can legitimately be affirmed that groups of different perceptions cannot be formed on the basis of these control variables (by doing an overall analysis and not each of the variables in turn). It appeared that the Cluster 2 seems to have more difficulties than the two others since the implementation of telework. Their relationship with management seems to have been affected by telework. This is also felt with the colleagues of the employees in this cluster, as they find it more difficult to collaborate and build a relationship with their colleagues. Logically, they feel less happy since the arrival of telework and are less motivated than employees in other clusters. They also manage their private and professional life less well than others. However, there is much less difference in salary and benefits since teleworking, which is logical as it is less about feelings and more about tangible aspects. The other two clusters, despite some differences between them, seem to appreciate this new way of work organization. It should be noted that they, the Cluster 1, and the Cluster 3, represents around 75% of the sample. Therefore, around 75%of the sample seem to support teleworking.

Finally, these analyses and conclusions can be taken as a more or less reliable indicator of reality. In particular, it can be assumed that a majority of the population is satisfied with this new way of working.

Limitations

There are various limitations to our study and they must be considered for this Master's thesis.

First of all, we studied a very specific population: employees in the IT sector in Europe. For that reason, the analyses and conclusions cannot be generalized to the general public. Even within the population studied, we cannot really generalize our results because the dispersion indicators are too high.

It is also necessary to point out that the sample size is not large enough to generalize to a larger population. Indeed, although it is sufficient to perform statistics, a population of 220 individuals is somewhat too small.

Another limit of our quantitative studies is that it is based on perceptions are always subjective and it often happens that the questions asked lead to specific answers. We tried to avoid this bias by following good questionnaire practice. However, we are aware that the answers could not exactly represent what the respondents really think.

Finally, it was seen in the section on the representativeness of our sample that women were over-represented. Therefore, a potential bias could appear in the overall perceptions, if women think differently from men. This was unfortunately confirmed in the group analysis, as women think differently from men on different questions. Therefore, our analysis of the overall perceptions were biased, as women influence the sample with a higher weight than their effective weight in the population. The observations could have been adjusted, i.e. given more weight to men than to women. However, it should be noted that even if the perceptions were between the 2 genders, they went in the same direction but on a different degree.

Conclusion

Digital transformation is a concept that concerns the majority of companies nowadays. The search for performance, however, has always been a challenge for those organizations. For that reason, a literature review on the effect of this digitalization on the organizational performance was conducted. After analysis of the literature review and reflection on the population to be studied, we arrived at the following research question: "Quantitative study of the impact of telecommuting on employee satisfaction: the case of Cerence.". The objective of this subject is to analyze and understand the perceptions that the employees could have about this transition to telecommuting.

In the first part of this Master's thesis, the literature review, digitalization and performance were defined and explored. Thanks to an intensive desktop research, we investigated the underlying mechanisms of digital transformation, the way in which business models have to be revised, etc. After that, the performance of a company and the extent to which it could be impacted by digitalization were analyzed. We realized that the business performance can be analyzed through four components, which are the customer satisfaction, the internal process, the employee satisfaction and the financial performance. The literature review allowed us to extract the advantages and the challenges of digitalization on these four components. The literature review also explained us that digitalization had a positive impact on three factors of digitization. While also positive, the result was less one-sided for the fourth component: the employee satisfaction. Employee satisfaction can be impacted in many ways, but it seems appropriate to analyze one of the new method of working: telecommuting.

The second part of this Master's thesis is a statistical empirical analysis, with the purpose of analyzing the impact of teleworking on employee satisfaction and therefore on the performance of a company. Our methodology was defined, so were our research environment, our data collection method and our data. The population was then defined to be studied, as well as our variables and our research method. We then performed several analyses to indicate some descriptive statistics, to explore some interesting correlations and to analyze potential differences between the population groups. Finally, a principal components analysis and a cluster analysis were run in order to observe the trends that appear between the clusters.

In order to place our empirical analysis in line with our literature review, the link between telework and organizational performance was traced. It was found that telework contributes positively to organizational performance, as the employee satisfaction is positively impacted by the telecommuting.

This master Master's thesis was closed by stating the limitations of our analysis, so as to leave an open door for further studies.

Bibliography

A. (2019, 25 octobre). *En Belgique, les travailleurs sont en moyenne 11 mois plus jeunes qu'il y a un an*. Acerta. https://www.acerta.be/fr/a-propos-dacerta/dans-la-presse/en-belgique-les-travailleurs-sont-en-moyenne-11-mois-plus-jeunes-quil-y-a-un-an#:%7E:text=En%20Belgique%2C%20l'%C3%A2ge%20moyen,les%20statuts%2C%20secteurs%20et%20r%C3%A9gions.

Aćimović, S., & Stajić, N. (2019). *Digital Supply Chain: Leading Technologies And Their Impact On Industry 4.0*. Osijek: J.J. Strossmayer University of Osijek, Faculty of Economics. Retrieved from https://www.proquest.com/conference-papers-proceedings/digital-supply-chain-leading-technologies-their/docview/2311896478/se-2?accountid=12156

Adams-Prassl, A., Boneva, T., Golin, M. and Rauh, C. (2020), "The large and unequal impact of COVID-19 on workers", VoxEU.org. Library Catalog: VoxEU, available at: https://voxeu.org/ article/large-andunequal-impact-covid-19-workers.

Agrawal, P., & Narain, R. (2018). Digital supply chain management: An overview. *IOP Conference Series.Materials Science and Engineering, 455*(1) doi:https://doi.org/10.1088/1757-899X/455/1/012074

Ali, Z., Gongbing, B., & Mehreen, A. (2020). Does supply chain finance improve SMEs performance? the moderating role of trade digitization. *Business Process Management Journal, 26*(1), 150-167. doi:https://doi.org/10.1108/BPMJ-05-2018-0133

Almehdawe, E., Khan, S., Lamsal, M., & Poirier, A. (2021). Factors affecting canadian credit unions' financial performance. *Agricultural Finance Review, 81*(1), 51-75. doi:https://doi.org/10.1108/AFR-06-2019-0065

Al-Talib, M., Melhem, W. Y., Anosike, A. I., Garza Reyes, J. A., Nadeem, S. P., & Kumar, A. (2020). *Achieving resilience in the supply chain by applying IoT technology*. ScienceDirect.

Ansong, E., & Boateng, R. (2019). Surviving in the digital era – business models of digital enterprises in a developing economy. *Digital Policy, Regulation and Governance, 21*(2), 164-178. doi:https://doi.org/10.1108/DPRG-08-2018-0046

Apuke, O. D. (2017, octobre). *Quantitative Research Methods : A Synopsis Approach*. Kuwait Chapter of Arabian Journal of Business and Management Review. https://doi.org/10.12816/0040336

Arner, D., Buckley, R., Charamba, K., Sergeev, A., & Zetzsche, D. (2022). GOVERNING FINTECH 4.0: BIGTECH, PLATFORM FINANCE, AND SUSTAINABLE DEVELOPMENT. *Fordham Journal of Corporate & Financial Law, 27*(1), 1-71. Retrieved from https://www.proquest.com/scholarly-journals/governing-fintech-4-0-bigtech-platform-finance/docview/2640588467/se-2?accountid=12156

Baber, W. W., Ojala, A., & Martinez, R. (2019). Effectuation logic in digital business model transformation: Insights from japanese high-tech innovators. *Journal of Small Business and Enterprise Development, 26*(6), 811-830. doi:https://doi.org/10.1108/JSBED-04-2019-0139

Babu, F., & Thomas, S. (2021). Quality management practices as a driver of employee satisfaction: Exploring the mediating role of organizational image. *International Journal of Quality and Service Sciences, 13*(1), 157-174. doi:https://doi.org/10.1108/IJQSS-10-2019-0124

Backhaus, N., & Steidelmüller, C. (2021). How leadership can help to mitigate the dark side of autonomy: Results based on the german sample of the european working conditions survey **. *Management Revue, 32*(3), 182-218. doi:https://doi.org/10.5771/0935-9915-2021-3-182

Bahrami, M., Shokouhyar, S., & Seifian, A. (2022). Big data analytics capability and supply chain performance: The mediating roles of supply chain resilience and innovation. *Modern Supply Chain Research and Applications, 4*(1), 62-84. doi:https://doi.org/10.1108/MSCRA-11-2021-0021

Başyazıcıoğlu, H. and Karamustafa, K. (2018), "Marketing 4.0: impacts of technological developments on marketing activities", Kırıkkale University, *Journal of Social Sciences*, Vol. 8 No. 2, pp. 621-640.

B, B., & G, B. (2009). *Customer value. Soddisfazione, fedeltà, valore.* Egea.

Bell, B. S., Lee, S., & Yeung, S. K. (2006). *The impact of eHR on professional competence in HRM : Implications for the development of HR professionals*. Human Resource Management.

Berman, S. J. (2012). Digital transformation: Opportunities to create new business models. *Strategy & Leadership, 40*(2), 16-24. doi:https://doi-org.proxy.bib.ucl.ac.be:2443/10.1108/10878571211209314

Bican, P. M., & Brem, A. (2020). Digital business model, digital transformation, digital entrepreneurship: Is there A sustainable "Digital"? *Sustainability, 12*(13), 5239. doi:https://doi.org/10.3390/su12135239

Byrne, R. (2012). DRIVING PROFITABLE GROWTH WITH BIG DATA AND BETTER FORECASTS. *Supply Chain Europe,* , 40-41. Retrieved from https://www.proquest.com/trade-journals/driving-profitable-growth-with-big-data-better/docview/1038369512/se-2?accountid=12156

Brunetti, F., Matt, D. T., Bonfanti, A., De Longhi, A., Pedrini, G., & Orzes, G. (2020). Digital transformation challenges: Strategies emerging from a multi-stakeholder approach. *TQM Journal, 32*(4), 697-724. doi:https://doi.org/10.1108/TQM-12-2019-0309

Caliskan, A., Yeşim Deniz Özkan Özen, & Ozturkoglu, Y. (2021). Digital transformation of traditional marketing business model in new industry era. *Journal of Enterprise Information Management, 34*(4), 1252-1273. doi:https://doi.org/10.1108/JEIM-02-2020-0084

Caputo, F., Cillo, V., Candelo, E., & Liu, Y. (2019). Innovating through digital revolution: The role of soft skills and big data in increasing firm performance. *Management Decision, 57*(8), 2032-2051. doi:https://doi.org/10.1108/MD-07-2018-0833

Carbon Disclosure Project. (2022). Https://Www.Cdp.Net/En. Consulté le 12 mai 2022, à l'adresse https://www.cdp.net/en

Carlos Andrés, T. R., Jesús, H. O., Osamah, I. K., & Andrea Ríos Prado. (2021). Business intelligence: Business evolution after industry 4.0. *Sustainability, 13*(18), 10026. doi:https://doi.org/10.3390/su131810026

Carpio, D. A., PhD, & Urbano, B. (2021). How to foster employee satisfaction by means of coaching, motivation, emotional salary and social media skills in the agri-food value chain. New Medit : *Mediterranean Journal of Economics, Agriculture and Environment* =

Revue Méditerranéenne d'Economie Agriculture Et Environment, 20(1) doi:https://doi.org/10.30682/nm2101c

Cheah, S., & Wang, S. (2017). Big data-driven business model innovation by traditional industries in the chinese economy. *Journal of Chinese Economic and Foreign Trade Studies, 10*(3), 229-251. doi:https://doi.org/10.1108/JCEFTS-05-2017-0013

Chiffres en image : les spécialistes des TIC sur le marché belge du travail | Statbel. (2019, 11 février). StatsBel. https://statbel.fgov.be/fr/nouvelles/chiffres-en-image-les-specialistes-des-tic-sur-le-marche-belge-du-travail?fbclid=IwAR3nilQkc1f0hAMsdE_JoV6geZKmH0B7xFFbz7Mh_70OTnXfyuJ8tGITOgQ#:%7E:text=214.000%20personnes%20occup%C3%A9es%20dans%20une%20fonction%20informatique&text=La%20grande%20majorit%C3%A9%20(82%25),175.000%20hommes%20et%2039.000%20femmes

Chen, D. Q., Preston, D. S., & Swink, M. (2021). How big data analytics affects supply chain decision-making: An empirical analysis. *Journal of the Association for Information Systems, 22*(5), 1224-1244. doi:https://doi.org/10.17705/1jais.00713

Christopher, M. (1992). *Logistics & Supply Chain Management*. Financial Times.

Chukwu, B. A. (2019). The influence of staff promotion on employee turnover intention in food and beverage industry in nigeria. *Journal of Asian Business Strategy, 9*(2), 66-81. doi:https://doi.org/10.18488/journal.1006.2019.92.66.81

Ciriello, R. F., Richter, A., & Schwabe, G. (2018). Digital innovation. *Business & Information Systems Engineering, 60*(6), 563-569. doi:https://doi.org/10.1007/s12599-018-0559-8

Cong, L. W., Li, B., & Zhang, Q. T. (2021). Internet of things: Business economics and applications. *Review of Business, 41*(1), 15-29. Retrieved from https://www.proquest.com/scholarly-journals/internet-things-business-economics-applications/docview/2491235176/se-2?accountid=12156

Davidescu, A. A. M., Apostu, S., Strat, V. A., Scrădeanu, A. I., Zgură, I. D., & Horga, M. G. (2021). THE IMPACT OF TELEWORKING ON THE ROMANIANS EMPLOYEES' JOB SATISFACTION. AN EMPIRICAL EVIDENCE BASED ON MULTIPLE CORRESPONDENCE ANALYSIS (MCA) AND LOGISTIC REGRESSION. *Amfiteatru Economic, 23*(58), 637-653. doi:https://doi.org/10.24818/EA/2021/58/637

Demerouti, E., Derks, D., ten Brummelhuis, L. L., & Bakker, A. B. (2014). New ways of working: Impact on working conditions, work-family balance, and well-being. *The impact of ICT on quality of working life; the impact of ICT on quality of working life* (pp. 123-141, Chapter xii, 230 Pages) Springer Science + Business Media, New York, NY. doi:https://doi.org/10.1007/978-94-017-8854-0_8 Retrieved from https://www.proquest.com/books/new-ways-working-impact-on-conditions-work-family/docview/1707074757/se-2?accountid=12156

de Menezes, L.M. (2012), “Job satisfaction and quality management: an empirical analysis”, *International Journal of Operations and Production Management*, Vol. 32 No. 3, pp. 308-328

Đokić, T., Pepur, M., & Arnerić, J. (2015). The impact of employee satisfaction on customer satisfaction in financial services market. Economic Thought and Practice, (1), 49-79. [in Croatian: Đokić, T., Pepur, M., & Arnerić, J. (2015). Utjecaj zadovoljstva zaposlenika na zadovoljstvo korisnika na tržištu financijskih usluga].

Drechsler, K., Gregory, R., Heinz-Theo Wagner, & Tumbas, S. (2020). At the crossroads between digital innovation and digital transformation. *Communications of the Association for Information Systems, 47*, 23. doi:https://doi.org/10.17705/1CAIS.04723

Dubey, R., Gunasekaran, A., & Childe, S. J. (2019). Big data analytics capability in supply chain agility: The moderating effect of organizational flexibility. *Management Decision, 57*(8), 2092-2112. doi:https://doi.org/10.1108/MD-01-2018-0119

Dubey, R., Gunasekaran, A., Childe, S. J., Samuel, F. W., Roubaud, D., & Foropon, C. (2021). Empirical investigation of data analytics capability and organizational flexibility as complements to supply chain resilience. *International Journal of Production Research, 59*(1), 110-128. doi:https://doi.org/10.1080/00207543.2019.1582820

Duffett, R. G. (2015). Facebook advertising's influence on intention-to-purchase and purchase amongst millennials. *Internet Research, 25*(4), 498-526. doi:https://doi.org/10.1108/IntR-01-2014-0020

Edosomwan, S., Prakasan, S. K., Kouame, D., Watson, J., & Seymour, T. (2011). The history of social media and its impact on business. *Journal of Applied Management and Entrepreneurship, 16*(3), 79-91. Retrieved from https://www.proquest.com/scholarly-journals/history-social-media-impact-on-business/docview/889143980/se-2?accountid=12156

Eira, A. (2022, 14 janvier). *Digital transformation (DX) used to be something that's just good to have. But since COVID-19 disrupted*. Financesonline.Com. Consulté le 21 mai 2022, à l'adresse https://financesonline.com/digital-transformation-statistics/

Engdahl, G. (2022). THE VOICE OF BIG DATA. *Big Data Quarterly, 8*(1), 4-5. Retrieved from https://www.proquest.com/trade-journals/voice-big-data/docview/2653351386/se-2?accountid=12156

Fenech, R., Baguant, P., & Ivanov, D. (2019). THE CHANGING ROLE OF HUMAN RESOURCE MANAGEMENT IN AN ERA OF DIGITAL TRANSFORMATION. *Journal of Management Information and Decision Sciences, 22*(2), 1-10. Retrieved from https://www.proquest.com/scholarly-journals/changing-role-human-resource-management-era/docview/2238482526/se-2?accountid=12156

Ferrentino, R., & Boniello, C. (2020). Customer satisfaction: A mathematical framework for its analysis and its measurement. *Computational Management Science, 17*(1), 23-45. doi:https://doi.org/10.1007/s10287-018-0305-1

Ferrentino, R., Cuomo, M. T., & Boniello, C. (2016). On the customer lifetime value: A mathematical perspective. *Computational Management Science, 13*(4), 521-539. doi:https://doi.org/10.1007/s10287-016-0266-1

Fierro, I., Gavilanez, J., & Diego Alonso, C. A. (2017). Digital marketing. *Pensamiento & Gestión, (43)*. Retrieved from https://www.proquest.com/scholarly-journals/digital-marketing/docview/1984527647/se-2?accountid=12156

Giovana, S. S., & Behr, A. (2018). Emerging technologies and new business models: A review on disruptive business models. *Innovation & Management Review, 15*(4), 338-355. Retrieved from https://www.proquest.com/scholarly-journals/emerging-technologies-new-business-models/docview/2169105111/se-2

Global pandemic accelerates digital transformation according to latest study from dell technologies: Dell technologies' third biennial digital transformation index details how organizations are accelerating digital transformation projects amidst unprecedented uncertainty; 4,300 business leaders in 18 countries weigh in. (2020, Oct 13). *PR Newswire* Retrieved from https://www.proquest.com/wire-feeds/global-pandemic-accelerates-digital/docview/2450043797/se-2?accountid=12156

Gopalan, V. (2019). THE MODERATING ROLE OF SERVICE RECOVERY PERFORMANCE ON THE RELATIONSHIP BETWEEN TEAMWORK AND JOB SATISFACTION: A STUDY OF SINGAPOREAN BANKING INDUSTRY. Journal of Internet Banking and Commerce, 24(3), 1-14. Retrieved from https://www.proquest.com/scholarly-journals/moderating-role-service-recovery-performance-on/docview/2329709350/se-2?accountid=12156

Gruca, T. S., & Rego, L. L. (2005). Customer satisfaction, cash flow, and shareholder value. Journal of Marketing, 69(3), 115-130. doi:https://doi.org/10.1509/jmkg.69.3.115.66364

Hallée, Y., Taskin, L., & Vincent, S. (2018). Pour une approche renouvelée de la gestion des ressources humaines (GRH). *Relations Industrielles, 73*(1), 3-10. Retrieved from https://www.proquest.com/scholarly-journals/pour-une-approche-renouvelée-de-la-gestion-des/docview/2024770125/se-2?accountid=12156

Hanaysha, J. R. (2018). Customer retention and the mediating role of perceived value in retail industry. *World Journal of Entrepreneurship, Management and Sustainable Development, 14*(1), 2-24. Retrieved from https://www.proquest.com/scholarly-journals/customer-retention-mediating-role-perceived-value/docview/1987353974/se-2?accountid=12156

Hemker, S., Herrando, C., & Constantinides, E. (2021). The transformation of data marketing: How an ethical lens on consumer data collection shapes the future of marketing. *Sustainability, 13*(20), 11208. doi:https://doi.org/10.3390/su132011208

Hendriyani, C., & Auliana, L. (2018). Transformation from relationship marketing to electronic customer relationship management: A literature study. *Review of Integrative Business and Economics Research, 7*, 116-124.

Hierarchical Clustering. (2016, 8 février). Solver. https://www.solver.com/xlminer/help/hierarchical-clustering-intro

Ionaşcu, I., Ionaşcu, M., Nechita, E., Săcărin, M., & Minu, M. (2022). DIGITAL TRANSFORMATION, FINANCIAL PERFORMANCE AND SUSTAINABILITY: EVIDENCE FOR EUROPEAN UNION LISTED COMPANIES. *Amfiteatru Economic, 24*(59), 94-109. doi:https://doi.org/10.24818/EA/2022/59/94

Ittner, C. D., Larcker, D. F., & Taylor, R. (2003). Performance implications of strategic performance measurement in financial services firms. *Accounting, Organizations and Society, 28*(7), 715-741. Retrieved from https://www.proquest.com/scholarly-journals/performance-implications-strategic-measurement/docview/195148617/se-2?accountid=12156

Jara, A.J., Parra, M.C. and Skarmeta, A.F. (2012), "Marketing 4.0: a new value added to the marketing through the internet of things", Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2012 *Sixth International Conference on*, IEEE, pp. 852-857.

Kassim, R. T., & Sherah, K. (2012). *Antecedents and outcomes of Human Resource Information System (HRIS) Use*. International Journal of Productivity and Performance Management.

Kenton, W. (2022, 22 mars). *Greenwashing*. Investopedia. Consulté le 22 mai 2022, à l'adresse https://www.investopedia.com/terms/g/greenwashing.asp

Kim, S. (2012). The impact of human resource management on state government IT employee turnover intentions. Public Personnel Management, 41(2), 257-279. Available at: https://doi.org/10.1177/009102601204100204

Kohont, A., & Ignjatović, M. (2022). Organizational support of working from home: Aftermath of COVID-19 from the perspective of workers and leaders. *Sustainability, 14*(9), 5107. doi:https://doi.org/10.3390/su14095107

Kotarba, M. (2018). Digital transformation of business models. *Foundations of Management, 10*(1), 123-142. doi:https://doi.org/10.2478/fman-2018-0011

Kozina, M., & Dusper, D. (2020). *Adopting Best Practices To Improve Customer Experience Management*. Varazdin: Varazdin Development and Entrepreneurship Agency (VADEA). Retrieved from https://www.proquest.com/conference-papers-proceedings/adopting-best-practices-improve-customer/docview/2476863274/se-2?accountid=12156

Krahnke, K., Wanasika, I., & Soltwisch, B. W. (2018). The spirit of *shinise*: Lessons from long-lived Japanese companies. *Global Business and Organizational Excellence*, *38*(1), 6-14. https://doi.org/10.1002/joe.21895

Krewer, J. (2018, 9 mai). *La donnée est-elle le nouveau pétrole ou un nouvel environnement ?* Usbeketrica. Consulté le 17 mai 2022, à l'adresse https://usbeketrica.com/fr/article/quatre-metaphores-pour-une-politique-de-la-donne#:%7E:text=1%2F%20La%20donn%C3%A9e%20ou%20le,des%20industries%20du%20si%C3%A8cle%20pass%C3%A9.

Küskü, F. (2001). Dimensions of employee satisfaction: A state university example*. *METU Studies in Development, 28*(2), 143-173. Retrieved from https://www.proquest.com/scholarly-journals/dimensions-employee-satisfaction-state-university/docview/89069516/se-2?accountid=12156

Lakshman, M., Sinha, L., Biswas, M., Charles, M., & Arora, N. K. (2000). Quantitative Vs qualitative research methods. *The Indian Journal of Pediatrics, 67*(5), 369–377. https://doi.org/10.1007/BF02820690

OxfordLanguage. (2020, 26 mai). *Oxford Languages | The Home of Language Data*. Https://Languages.Oup.Com/. Consulté le 2022, à l'adresse https://languages.oup.com/

Larkin, J. (2017). *HR digital disruption : The biggest wave of transformation in decades*. Strategic HR review.

Larsson, A., & Viitaoja, Y. (2017). Building customer loyalty in digital banking: A study of bank staff's perspectives on the challenges of digital CRM and loyalty. *The International Journal of Bank Marketing, 35*(6), 858-877. Retrieved from https://www.proquest.com/scholarly-journals/building-customer-loyalty-digital-banking/docview/1935251000/se-2?accountid=12156

Lee, M., JinHyo, J. Y., Pyka, A., Won, D., Kodama, F., Schiuma, G., . . . Zhao, X. (2018). How to respond to the fourth industrial revolution, or the second information technology revolution? dynamic new combinations between technology, market, and society through open innovation. *Journal of Open Innovation : Technology, Market, and Complexity, 4*(3), 21. doi:https://doi.org/10.3390/joitmc4030021

Leite, D. N., Afonso, Ó., & Silva, S. T. (2020). THE TWO REVOLUTIONS, LANDED ELITES, AND EDUCATION DURING THE INDUSTRIAL REVOLUTION. *Macroeconomic Dynamics, 24*(6), 1478-1511. doi:https://doi.org/10.1017/S1365100518000937

Li, F. (2020). Leading digital transformation: Three emerging approaches for managing the transition. *International Journal of Operations & Production Management, 40*(6), 809-817. doi:https://doi.org/10.1108/IJOPM-04-2020-0202

Li, S. (2021). How does COVID-19 speed the digital transformation of business processes and customer experiences? *Review of Business, 41*(1), 1-14. Retrieved from https://www.proquest.com/scholarly-journals/how-does-covid-19-speed-digital-transformation/docview/2491244492/se-2?accountid=12156

Liu, N.C. and Liu, W.C. (2014), "The effects of quality management practices on employees' well-being", Total Quality Management and Business Excellence, Vol. 25 Nos 11/12, pp. 1247-1261.

Locke, E. A. (1976). The nature and causes of job satisfaction. Handbook of industrial and organizational psichology. The nature and causes of job satisfaction: Handbook of industrial and organizational psichology, 1297-1349.

Lozic, J. (2019). *Core Concept Of Business Transformation: From Business Digitization To Business Digital Transformation*. Varazdin: Varazdin Development and Entrepreneurship Agency (VADEA). Retrieved from https://www.proquest.com/conference-papers-proceedings/core-concept-business-transformation-digitization/docview/2334751498/se-2?accountid=12156

Lummus, R. R., & Vokurka, R. J. (1999). Defining supply chain management: A historical perspective and practical guidelines. *Industrial Management & Data Systems, 99*(1), 11-17. doi:https://doi.org/10.1108/02635579910243851

Marais, H. (2012). *Towards bridging the quantitative-qualitative divide in business and management research*. Kidmore End: Academic Conferences International Limited. Retrieved from https://www.proquest.com/conference-papers-proceedings/towards-bridging-quantitative-qualitative-divide/docview/1346926259/se-2?accountid=12156

Marr, B. (2005). Business performance measurement: An overview of the current state of use in the USA. *Measuring Business Excellence, 9*(3), 56-62. doi:https://doi.org/10.1108/mbe.2005.26709caf.006

Marr, B. (2021, 14 septembre). The 4 KPIs Every Manager Has To Use. Bernard Marr. Consulté le 24 mars 2022, à l'adresse https://bernardmarr.com/the-4-kpis-every-manager-has-to-use/

Mayangao, C. (2021, Jun 21). Technology and its impact on customer relations. *Mid-East.Info* Retrieved from https://www.proquest.com/wire-feeds/technology-impact-on-customer-relations/docview/2543381783/se-2?accountid=12156

McAuley, G. (2001). Performance studies: Definitions, methodologies, future directions. *Australasian Drama Studies,* , 5-19. Retrieved from https://www.proquest.com/scholarly-journals/performance-studies-definitions-methodologies/docview/2177101/se-2?accountid=12156

Mensah, P., & Merkuryev, Y. (2014). *Developing a resilient supply chain*. Contemporary Issues in Business, Management and Education. https://doi.org/10.1016/j.sbspro.2013.12.875

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., & al, e. (2001). Defining supply chain management. *Journal of Business Logistics, 22*(2), 1-26. Retrieved from https://www.proquest.com/scholarly-journals/defining-supply-chain-management/docview/212663354/se-2?accountid=12156

Mohamad, A. G., & Zabadi, A. M. (2020). Promoting a revamped CRM through internet of things and big data: An AHP-based evaluation. *International Journal of Organizational Analysis, 28*(1), 66-91. doi:https://doi.org/10.1108/IJOA-12-2018-1602

Monica Franco-Santos, Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., . . . Neely, A. (2007). Towards a definition of a business performance measurement system. *International Journal of Operations & Production Management, 27*(8), 784-801. doi:https://doi.org/10.1108/01443570710763778

Morris, M., Schindehutte, M., & Allenc, J. (2005). *The entrepreneur's business model : toward a unified perspective*. Journal of Business Research.

Moullin, M. (2002). Delivering Excellence in Health and Social Care. *Open University Press, Buckingham*.

Moullin, M. (2007). Performance measurement definitions: Linking performance measurement and organisational excellence. *International Journal of Health Care Quality Assurance, 20*(3), 181-183. doi:https://doi.org/10.1108/09526860710743327

Nagel, L. (2020). The influence of the COVID-19 pandemic on the digital transformation of work. *The International Journal of Sociology and Social Policy, 40*(9), 861-875.

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). DIGITAL INNOVATION MANAGEMENT: REINVENTING INNOVATION MANAGEMENT RESEARCH IN A DIGITAL WORLD. *MIS Quarterly, 41*(1), 223. Retrieved from https://www.proquest.com/scholarly-journals/digital-innovation-management-reinventing/docview/1873315319/se-2?accountid=12156

Nathwani, D. (2021). Job satisfaction and employee performance: An empirical approach. *Journal of Applied Management - Jidnyasa, 13*(1), 11-24. Retrieved from https://www.proquest.com/scholarly-journals/job-satisfaction-employee-performance-empirical/docview/2645521550/se-2?accountid=12156

Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design. *International Journal of Operations & Production Management, 15*(4), 80. doi:https://doi.org/10.1108/01443579510083622

Neely, A., Mills, J., Platts, K., Richards, H., Gregory, M., Bourne, M., & Kennerley, M. (2000). Performance measurement system design: Developing and testing a process-based approach. *International Journal of Operations & Production Management, 20*(10), 1119-1145. doi:https://doi.org/10.1108/01443570010343708

Neely, A.D., Adams, C. and Kennerley, M. (2002), The Performance Prism: The Scorecard for Measuring and Managing Stakeholder Relationships, Financial Times/Prentice Hall, London

Nemes, N., Scanlan, S. J., Smith, P., Smith, T., Aronczyk, M., Hill, S., . . . Stabinsky, D. (2022). An integrated framework to assess greenwashing. *Sustainability, 14*(8), 4431. doi:https://doi.org/10.3390/su14084431

Nils-Ole Hohenstein, Feisel, E., Hartmann, E., & Giunipero, L. (2015). Research on the phenomenon of supply chain resilience. *International Journal of Physical Distribution & Logistics Management, 45*(1), 90-117. doi:https://doi.org/10.1108/IJPDLM-05-2013-0128

Nowińska, E. (2020). USE AND APPLICATION OF THE INTERNET OF THINGS IN THE DIGITAL TRANSFORMATION OF ENTERPRISES. *Acta Universitatis Nicolai Copernici.Nauki Humanistyczno-Spoleczne.Zarzadzanie, 47*(2), 21-35. Retrieved from https://www.proquest.com/scholarly-journals/use-application-internet-things-digital/docview/2450761637/se-2?accountid=12156

OECD (2018). Personalised pricing in the digital era, available at: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote5DAF/COMP(2018)13&docLanguage5En (accessed 15 July 2019).

Oliver, R. L. (1999). Whence Consumer Loyalty ? *Journal of Marketing*, *63*, 33. https://doi.org/10.2307/1252099

Palmer, I., Dunford, R., & Buchanan, D. A. (2017). *Managing Organizational Change : a Multiple Perspectives Approach*. International ed. New York : McGraw-Hill Education.

Parker, R. J., Nouri, H., & Hayes, A. F. (2011). Distributive justice, promotion instrumentality, and turnover intentions in public accounting firms. *Behavioral Research in Accounting, 23*(2), 169-186. Available at: 102308/bria-50020

Patrucco, A., Ciccullo, F., & Pero, M. (2020). Industry 4.0 and supply chain process re-engineering: A coproduction study of materials management in construction. *Business Process Management Journal, 26*(5), 1093-1119. doi:https://doi.org/10.1108/BPMJ-04-2019-0147

Pavlović, M., & Marković, D. (2014). Theoretical approach to employee satisfaction and motivation. *Vojno delo, 1*, 289-302. [in Serbian: ПавловиЬ, М., & МарковиЬ, Д. (2014). Теорийки приступ задоволству послом и мотивации запослених].

Prasad, P., Sivasankaran, N., Samit, P., & Kannadhasan, M. (2019). Measuring impact of working capital efficiency on financial performance of a firm: An alternative approach. *Journal of Indian Business Research, 11*(1), 75-94. doi:https://doi.org/10.1108/JIBR-02-2018-0056

Qasim, A. N., Nasir, N., Jamshed, S., Naz, S., Ali, M., & Shahzad, A. (2021). Big data management and environmental performance: Role of big data decision-making capabilities and decision-making quality. *Journal of Enterprise Information Management, 34*(4), 1061-1096. doi:https://doi.org/10.1108/JEIM-04-2020-0137

Raj Dangal, M. (2021, 22 février). *Survey Design~Quantitative research* [Diapositives]. ResearchGate. https://www.researchgate.net/publication/349502367_Survey_DesignQuantitative_research

Rodríguez-Modroño, P., & López-Igual, P. (2021). Job quality and Work—Life balance of teleworkers. *International Journal of Environmental Research and Public Health, 18*(6), 3239. doi:https://doi.org/10.3390/ijerph18063239

Ronald, B., & Marc, L. (2021). The leadership challenge in times of the COVTD 19 pandemic - an empirical investigation on the impact of transformational leadership on motivation and team performance. *Advances in Management, 14*(3), 1-21. Retrieved from https://www.proquest.com/scholarly-journals/leadership-challenge-times-covtd-19-pandemic/docview/2565689799/se-2?accountid=12156

Rossato, C., & Castellani, P. (2020). The contribution of digitalisation to business longevity from a competitiveness perspective. *TQM Journal, 32*(4), 617-645. doi:https://doi.org/10.1108/TQM-02-2020-0032

Perić, G., Gašić, M., Stojiljković, M., & Nešić, I. (2018). THE IMPACT OF EMPLOYEE SATISFACTION ON THE TOURIST SATISFACTION WITH THE SERVICES OF SPA TOURISM. *Ekonomika Poljoprivrede, 65*(2), 617-632. doi:https://doi.org/10.5937/ekoPolj1802617P

Sardo, F., & Serrasqueiro, Z. (2018). Intellectual capital, growth opportunities, and financial performance in european firms: Dynamic panel data analysis. Journal of Intellectual Capital, 19(4), 747-767. doi:https://doi.org/10.1108/JIC-07-2017-0099

Săvescu, R., Kifor, Ș., Dănuț, R., & Rusu, R. (2022). Transition from office to home office: Lessons from romania during COVID-19 pandemic. *Sustainability, 14*(10), 5758. doi:https://doi.org/10.3390/su14105758

Siddh, M. M., Soni, G., Jain, R., & Sharma, M. K. (2018). Structural model of perishable food supply chain quality (PFSCQ) to improve sustainable organizational performance. *Benchmarking, 25*(7), 2272-2317. doi:https://doi.org/10.1108/BIJ-01-2017-0003

Shrivastava, S. (2017). Digital disruption is redefining the customer experience: The digital transformation approach of the communications service providers. *Telecom Business Review, 10*(1), 41-52. Retrieved from https://www.proquest.com/scholarly-journals/digital-disruption-is-redefining-customer/docview/2024123641/se-2?accountid=12156

Stadler, C. (2011). Enduring success : what we can learn from the history of outstanding corporations. *Choice Reviews Online*, *48*(12), 48-7022. https://doi.org/10.5860/choice.48-7022

Steidelmüller, C. (2018). Job demands in a changing world of work: Impact on workers' health and performance and implications for research and practice. *Management Revue, 29*(1), 104-107. doi:https://doi.org/10.5771/0935-9915-2018-1-101

Sturm, S., Kaiser, G., & Hartmann, E. (2019). Long-run dynamics between cost of quality and quality performance. *The International Journal of Quality & Reliability Management, 36*(8), 1438-1453. doi:https://doi.org/10.1108/IJQRM-05-2018-0118

Suvvari, A., Raja Sethu Durai, S., & Goyari, P. (2019). Financial performance assessment using grey relational analysis (GRA): An application to life insurance companies in india. Grey Systems, 9(4), 502-516. doi:https://doi.org/10.1108/GS-05-2019-0010

Syaglova, Y., & Salamovska, S. M. (2019). *DIGITAL TRANSFORMATION IN MARKETING AND BUSINESS – IMPLICATIONS ON RETAIL TECHNOLOGIES AND CUSTOMER ENGAGEMENT*. Dubrovnik: University of Dubrovnik. Retrieved from https://www.proquest.com/conference-papers-proceedings/digital-transformation-marketing-business/docview/2406321458/se-2?accountid=12156

Sylvestre, E. (2008, 17 novembre). *AMÉLIORER LA PARTICIPATION AUX ENQUÊTES EN LIGNE*. reseau-canope. Consulté le 16 juillet 2022, à l'adresse https://www.reseau-canope.fr/agence-des-usages/ameliorer-la-participation-aux-enquetes-en-ligne.html

Taiwo, T. L., Ozturen, A., Kayode, K. E., & Avci, T. (2020). Explicating innovation-based human resource management's influence on employee satisfaction and performance. *Employee Relations, 42*(6), 1181-1203. doi:https://doi.org/10.1108/ER-08-2019-0319

Thayla Tavares Sousa-Zomer, Neely, A., & Martinez, V. (2020). Digital transforming capability and performance: A microfoundational perspective. *International Journal of Operations & Production Management, 40*(7), 1095-1128. doi:https://doi.org/10.1108/IJOPM-06-2019-0444

The digital transformation of supply chain management lowers costs and reduces risk: Digital solutions mitigate much of the coronavirus supply chain disruptions. (2020, Apr 30). *PR Newswire* Retrieved from https://www.proquest.com/wire-feeds/digital-transformation-supply-chain-management/docview/2396179131/se-2?accountid=12156

The next industrial revolution: How supply chains can benefit from industry 4.0. (2020). *Strategic Direction, 36*(6), 29-31. doi:https://doi.org/10.1108/SD-03-2020-0051

The Third Industrial Revolution : How the Internet, Green Electricity, and 3-D Printing are Ushering in a Sustainable Era of Distributed Capitalism. (2012). *World Economy*, 1-5.

Torry, H. (2022, 19 mars). *Le télétravail, aimé des femmes, freine leur carrière*. l'Opinion. https://www.lopinion.fr/economie/le-teletravail-apprecie-par-les-femmes-nuit-a-leur-carriere-selon-les-economistes

Umans, T., Kockum, M., Nilsson, E., & Lindberg, S. (2018). Digitalisation in the banking industry and workers subjective well-being: Contingency perspective. *International Journal of Workplace Health Management, 11*(6), 411-423. doi:https://doi.org/10.1108/IJWHM-05-2018-0069

Université de Genève, Faculté de Médecine. (2015). *Participation aux enquêtes en ligne* [Diapositives]. Unige.ch. https://www.unige.ch/medecine/files/7914/5613/9924/PresEvalBC.pdf

Use and Interpret Principal Components Analysis in SPSS. (s. d.). Statistician For Hire. https://www.scalestatistics.com/principal-components-analysis.html

Veritis Group inc. (2022). *Global Digital Transformation Market to Reach USD 1009.8 Billion by 2025*. veritis.com. https://www.veritis.com/news/global-digital-transformation-market-to-reach-usd-1009-8-billion-by-2025/

Verhoef, P. C., Kannan, P. K., & Inman, J. J. (2015). From multi-channel retailing to omni-channel retailing: Introduction to the special issue on multi-channel retailing. *Journal of Retailing*, *91*(2), 174-181. doi:https://doi.org/10.1016/j.jretai.2015.02.005

Wallin, A., Pylväs Laura, & Petri, N. (2020). Government workers' stories about professional development in a digitalized working life. *Vocations and Learning, 13*(3), 439-458. doi:https://doi.org/10.1007/s12186-020-09248-y

Westerman, G. (2016). Why digital transformation needs a heart. *MIT Sloan Management Review, 58*(1), 19-21. Retrieved from https://www.proquest.com/scholarly-journals/why-digital-transformation-needs-heart/docview/1832180458/se-2?accountid=12156

Westin, A. The Right to Privacy; Athenaeum: New York, NY, USA, 1967.

Ylijoki, O., & Porras, J. (2019). A recipe for big data value creation. *Business Process Management Journal, 25*(5), 1085-1100. doi:https://doi.org/10.1108/BPMJ-03-2018-0082

Appendices

(1) Questionnaire

How does telecommuting impact the employee satisfaction?

Hello,
We are Arthur Servaty and Robin Couvreur and we are in our last year of business engineering at UCLouvain.
This survey is conducted as part of our Master's thesis on the implications of digital transformation in organizations. Specifically, we would like to quantify the impact of telecommuting on the employee satisfaction.

By completing this survey, you agree to your data being recorded for analysis.

If you have any question related to this survey, you can contact us at the following email address : robin.couvreur@student.uclouvain.be

Thank you in advance for your participation.

Arthur & Robin

* Obligatoire

Management satisfaction

Within this section, we will cover the implications of the management on the employee satisfaction.

1. Please answer the following questions *

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I think that the management is well executed remotely.	○	○	○	○	○	○	○
I do not feel that my suggestions have lost their impact on management decision making with remote working.	○	○	○	○	○	○	○
I feel that vertical mobility is possible even with this telecommuting transition.	○	○	○	○	○	○	○
I feel that my N+1 is still remotely accessible.	○	○	○	○	○	○	○

Colleague satisfaction

Here, we will get about how your satisfaction can be impacted depending on your direct colleagues.

2. Please answer the following questions *

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I feel that it telecommuting allows the employee to collaborate in an efficient way.	○	○	○	○	○	○	○
I keep socialising with my colleagues even through teleworking.	○	○	○	○	○	○	○
Collaboration with my colleagues is easier with remote working.	○	○	○	○	○	○	○
I feel that my colleagues are happy to work remotely.	○	○	○	○	○	○	○
I am satisfied with the "remote" relationship I have with my colleagues.	○	○	○	○	○	○	○

Job satisfaction

This part of the survey will be made of questions related to the purpose of your job.

3. Please answer the following questions *

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I feel that the tasks I am assigned are no different from those I had before teleworking.	○	○	○	○	○	○	○
I find my job difficult to set up with teleworking.	○	○	○	○	○	○	○
The purpose of my work has changed with teleworking.	○	○	○	○	○	○	○
I find that my goals are achievable, even with this transition to teleworking world.	○	○	○	○	○	○	○
Working remotely keep me motivated everyday.	○	○	○	○	○	○	○
I feel comfortable with the tasks assigned to me in teleworking.	○	○	○	○	○	○	○
The results of my work are as quantifiable as before teleworking.	○	○	○	○	○	○	○

Physical environment satisfaction.

This part of the survey will cover the physical aspects of your job.

4. Please answer the following questions *

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I find teleworking more comfortable than working in person.	○	○	○	○	○	○	○
I think that teleworking allows me to manage my professional and private life better.	○	○	○	○	○	○	○

Salary and other materials benefits satisfaction

We will get about on how is the financial management and development of an organization affected by the digitalization.

5. Please answer the following questions *

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
My global package (salary, benefits) has decreased since the arrival of telecommuting.	○	○	○	○	○	○	○
I have more flexibility in terms of time since teleworking.	○	○	○	○	○	○	○
I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking.	○	○	○	○	○	○	○
Individual bonuses are achievable and easily quantifiable.	○	○	○	○	○	○	○
Team bonuses are achievable and easily quantifiable, even with telecommuting.	○	○	○	○	○	○	○

(2) Representativeness of the sample

One-Sample Test

	Test Value = 43					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Age	-,750	219	,454	-,591	-2,14	,96

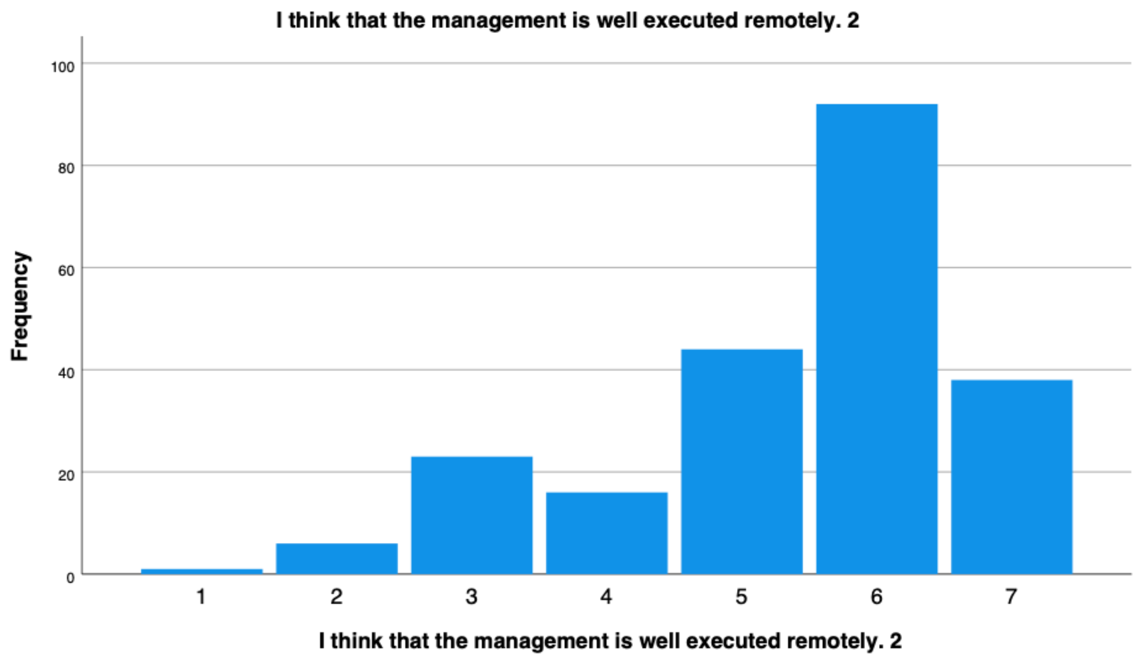
One-Sample Test

	Test Value = 0.2					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Age	53,606	219	<,001	42,209	40,66	43,76

(3) Global perception – Management satisfaction

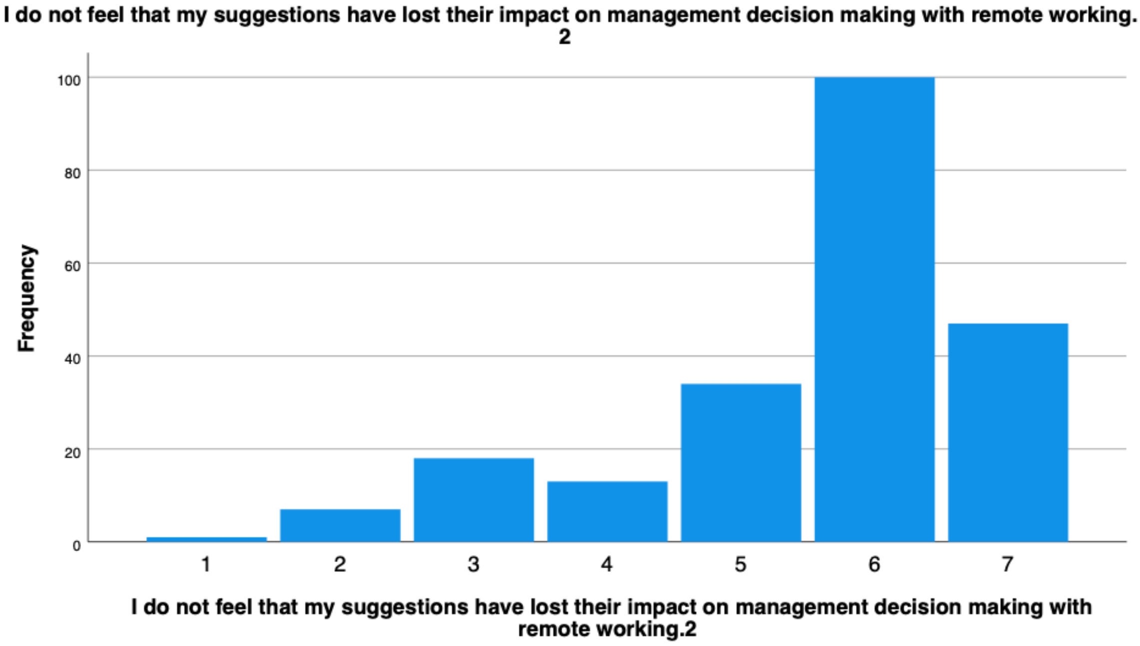
I think that the management is well executed remotely. 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	,5	,5	,5
	2	6	2,7	2,7	3,2
	3	23	10,5	10,5	13,6
	4	16	7,3	7,3	20,9
	5	44	20,0	20,0	40,9
	6	92	41,8	41,8	82,7
	7	38	17,3	17,3	100,0
	Total	220	100,0	100,0	



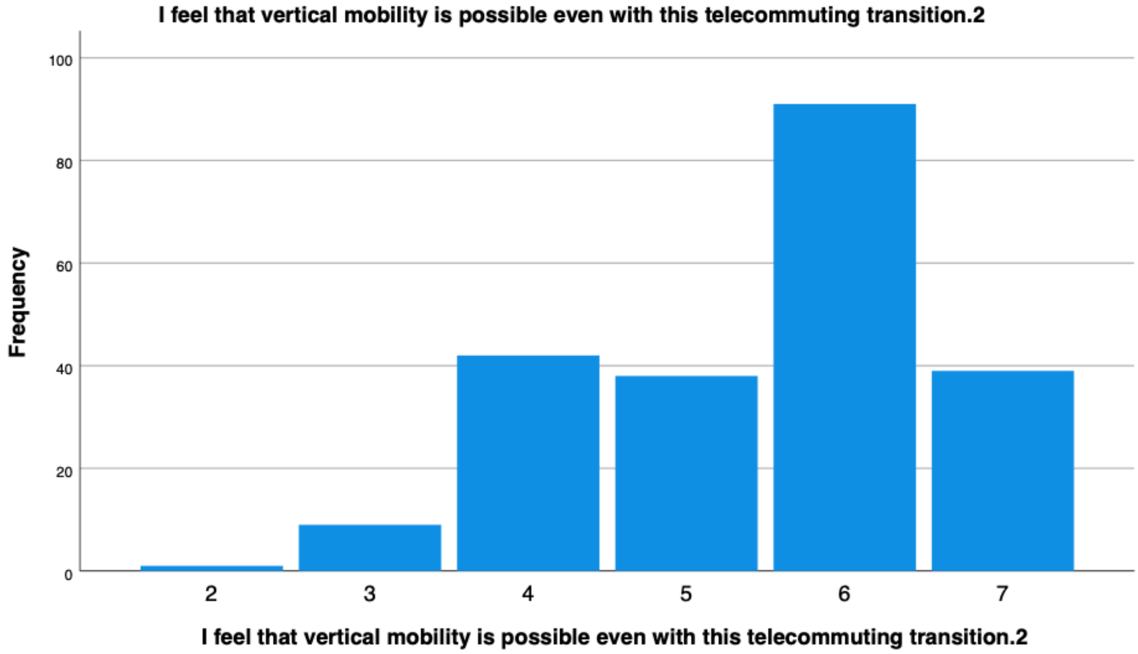
I do not feel that my suggestions have lost their impact on management decision making with remote working.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	,5	,5	,5
	2	7	3,2	3,2	3,6
	3	18	8,2	8,2	11,8
	4	13	5,9	5,9	17,7
	5	34	15,5	15,5	33,2
	6	100	45,5	45,5	78,6
	7	47	21,4	21,4	100,0
	Total	220	100,0	100,0	



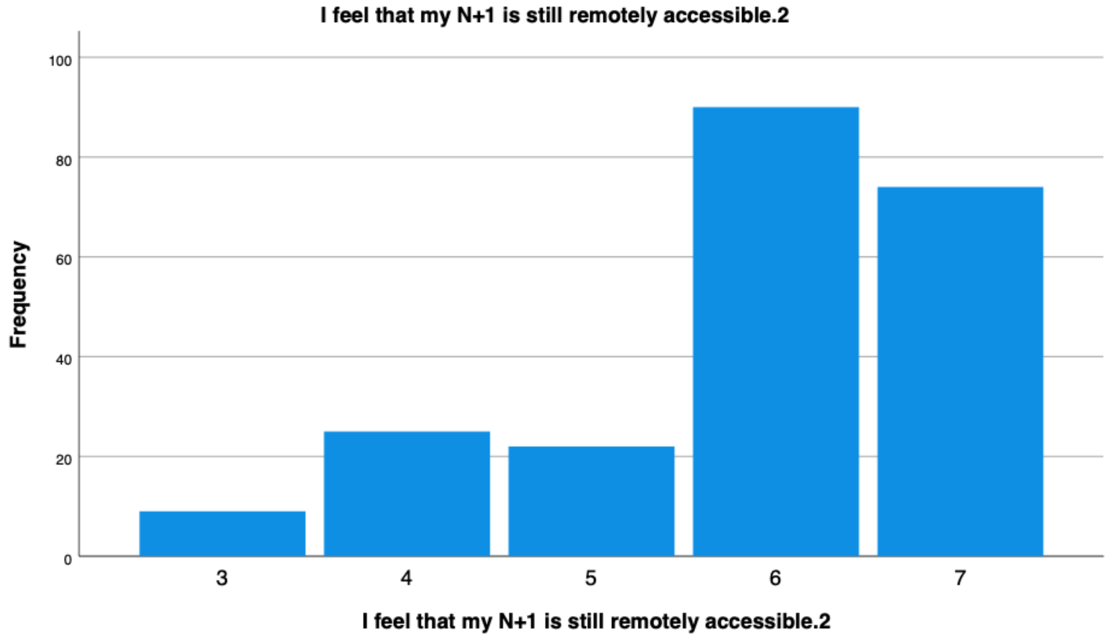
I feel that vertical mobility is possible even with this telecommuting transition.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	,5	,5	,5
	3	9	4,1	4,1	4,5
	4	42	19,1	19,1	23,6
	5	38	17,3	17,3	40,9
	6	91	41,4	41,4	82,3
	7	39	17,7	17,7	100,0
	Total	220	100,0	100,0	



I feel that my N+1 is still remotely accessible.2

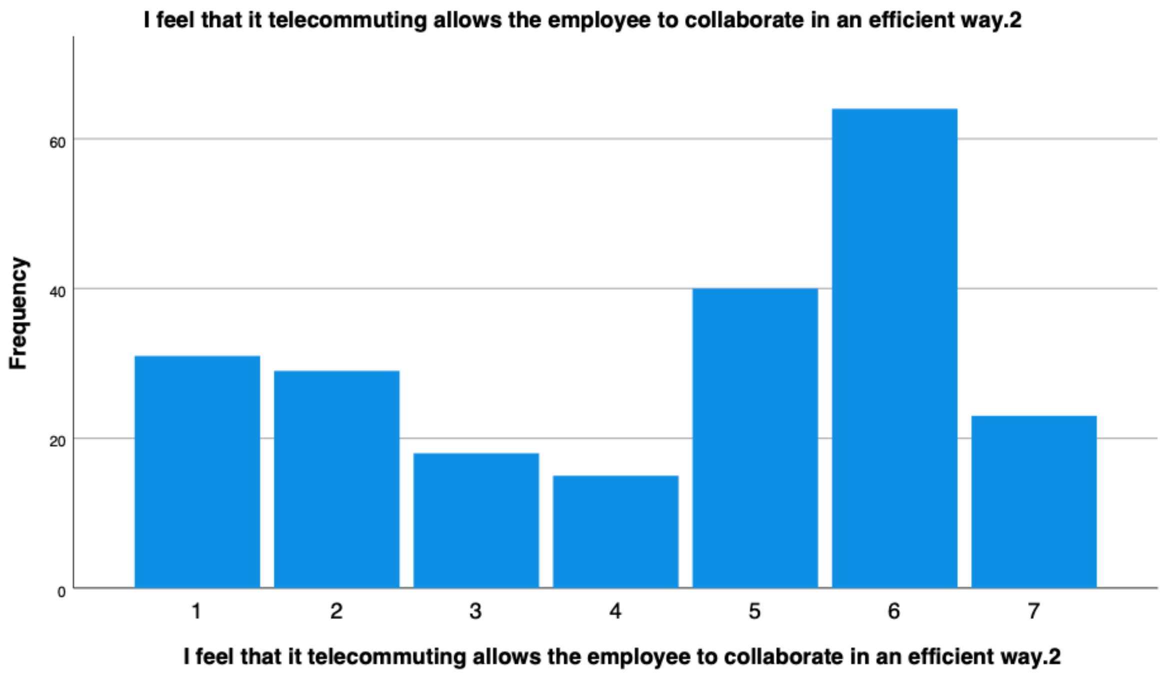
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	9	4,1	4,1	4,1
	4	25	11,4	11,4	15,5
	5	22	10,0	10,0	25,5
	6	90	40,9	40,9	66,4
	7	74	33,6	33,6	100,0
	Total	220	100,0	100,0	



(4) Global perception – Colleague satisfaction

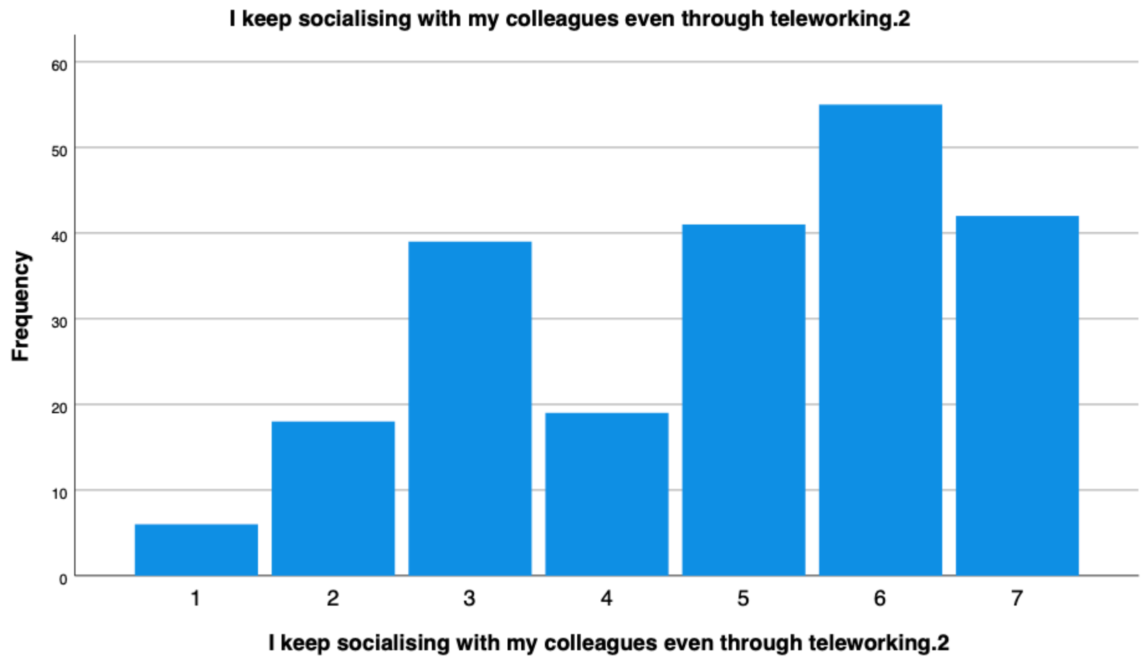
I feel that it telecommuting allows the employee to collaborate in an efficient way.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	14,1	14,1	14,1
	2	29	13,2	13,2	27,3
	3	18	8,2	8,2	35,5
	4	15	6,8	6,8	42,3
	5	40	18,2	18,2	60,5
	6	64	29,1	29,1	89,5
	7	23	10,5	10,5	100,0
	Total	220	100,0	100,0	



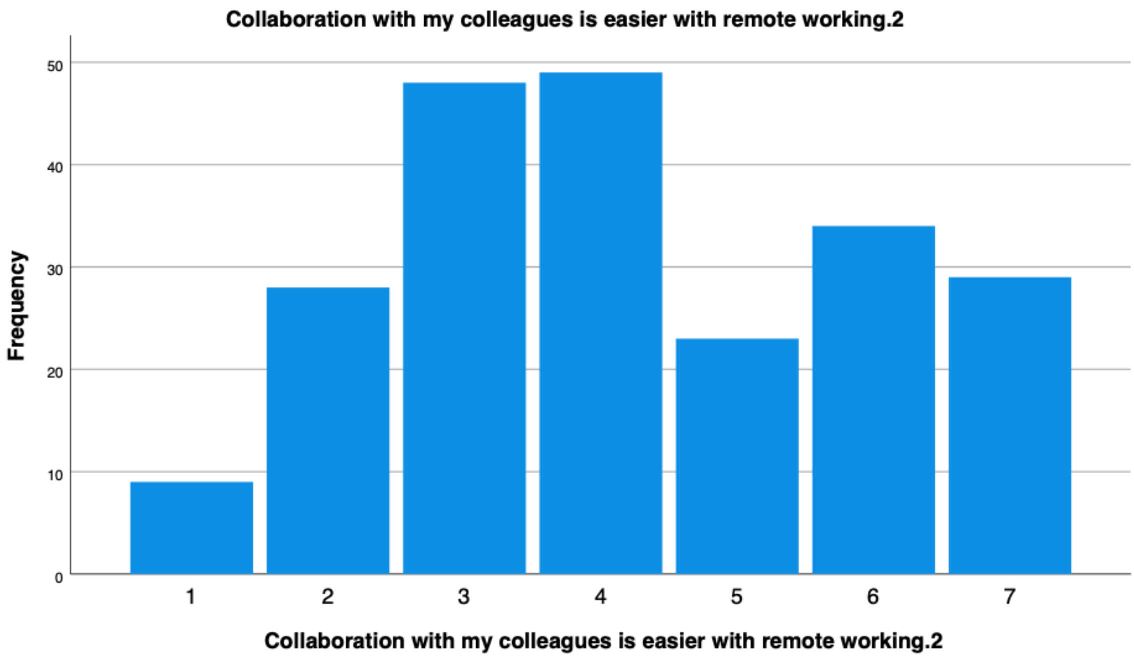
I keep socialising with my colleagues even through teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	2,7	2,7	2,7
	2	18	8,2	8,2	10,9
	3	39	17,7	17,7	28,6
	4	19	8,6	8,6	37,3
	5	41	18,6	18,6	55,9
	6	55	25,0	25,0	80,9
	7	42	19,1	19,1	100,0
	Total	220	100,0	100,0	



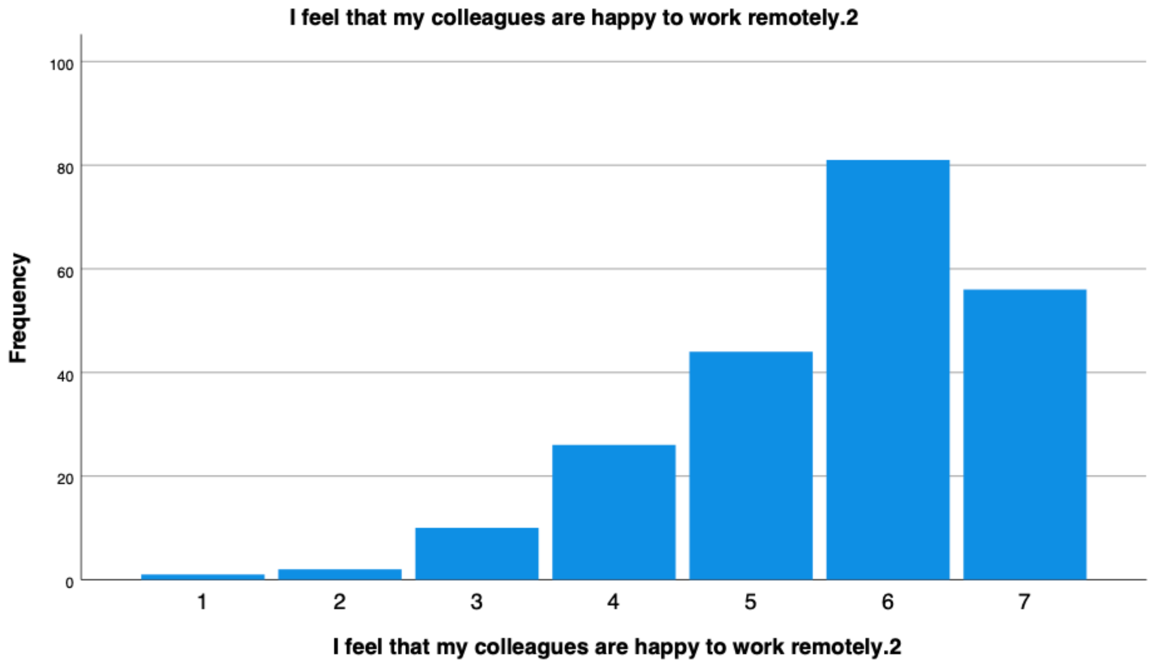
Collaboration with my colleagues is easier with remote working.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	4,1	4,1	4,1
	2	28	12,7	12,7	16,8
	3	48	21,8	21,8	38,6
	4	49	22,3	22,3	60,9
	5	23	10,5	10,5	71,4
	6	34	15,5	15,5	86,8
	7	29	13,2	13,2	100,0
	Total	220	100,0	100,0	



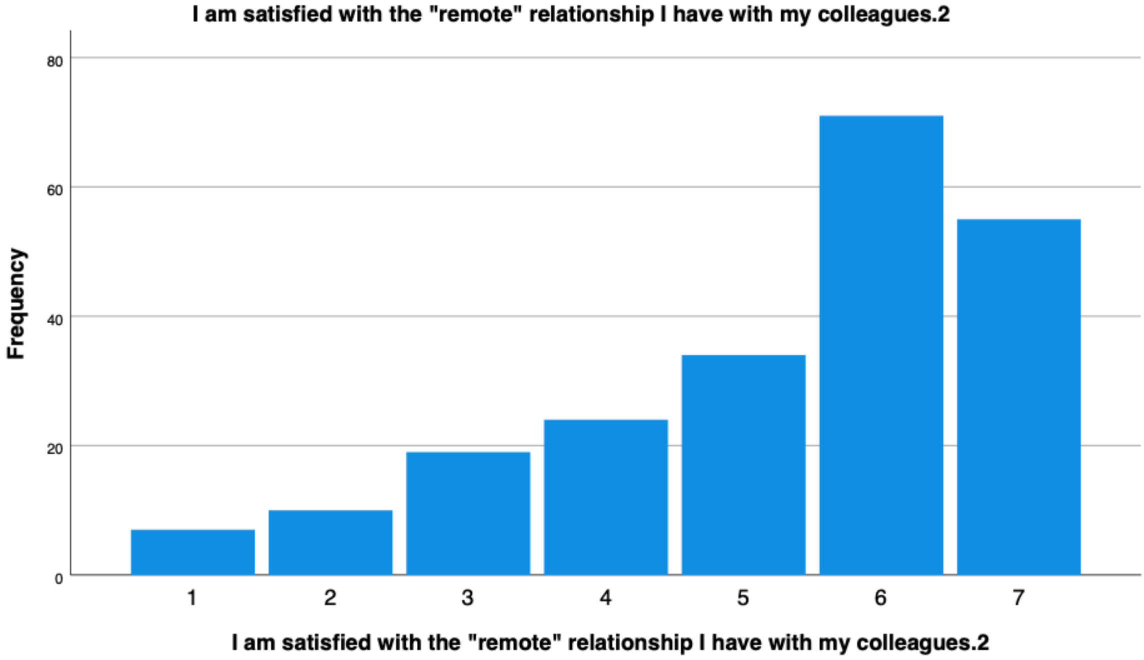
I feel that my colleagues are happy to work remotely.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	,5	,5	,5
	2	2	,9	,9	1,4
	3	10	4,5	4,5	5,9
	4	26	11,8	11,8	17,7
	5	44	20,0	20,0	37,7
	6	81	36,8	36,8	74,5
	7	56	25,5	25,5	100,0
	Total	220	100,0	100,0	



I am satisfied with the "remote" relationship I have with my colleagues.2

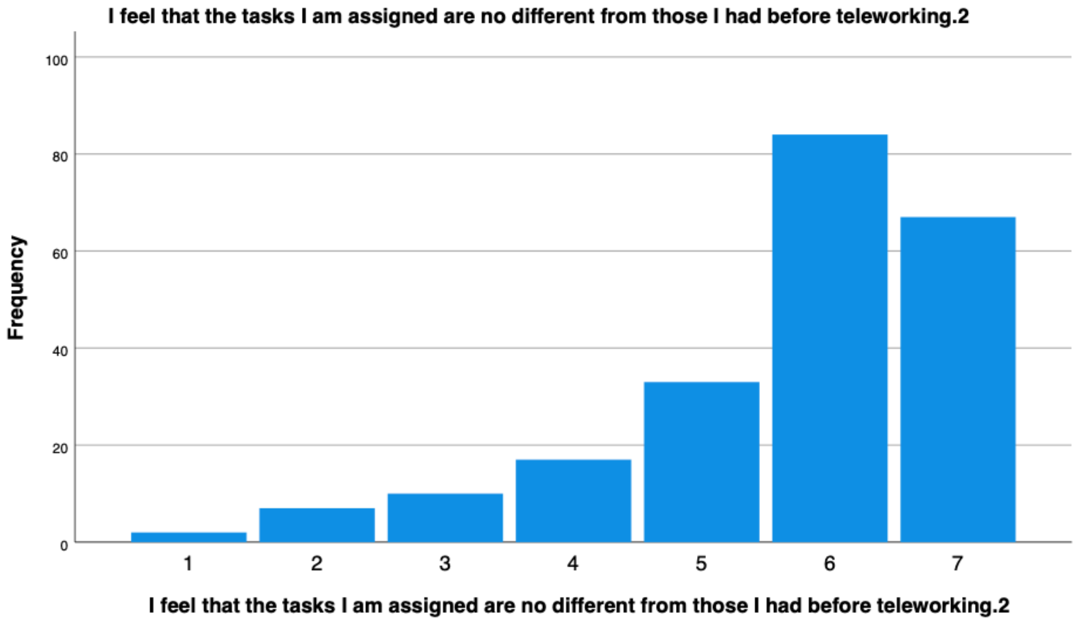
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	3,2	3,2	3,2
	2	10	4,5	4,5	7,7
	3	19	8,6	8,6	16,4
	4	24	10,9	10,9	27,3
	5	34	15,5	15,5	42,7
	6	71	32,3	32,3	75,0
	7	55	25,0	25,0	100,0
	Total	220	100,0	100,0	



(5) Global perception – Job satisfaction

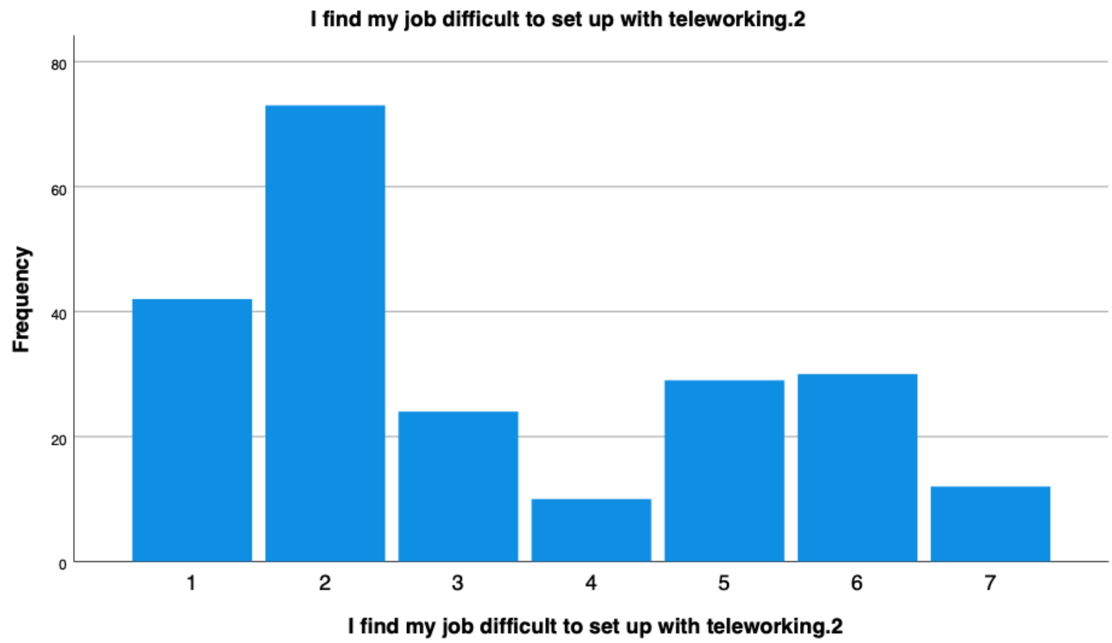
I feel that the tasks I am assigned are no different from those I had before teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	,9	,9	,9
	2	7	3,2	3,2	4,1
	3	10	4,5	4,5	8,6
	4	17	7,7	7,7	16,4
	5	33	15,0	15,0	31,4
	6	84	38,2	38,2	69,5
	7	67	30,5	30,5	100,0
	Total	220	100,0	100,0	



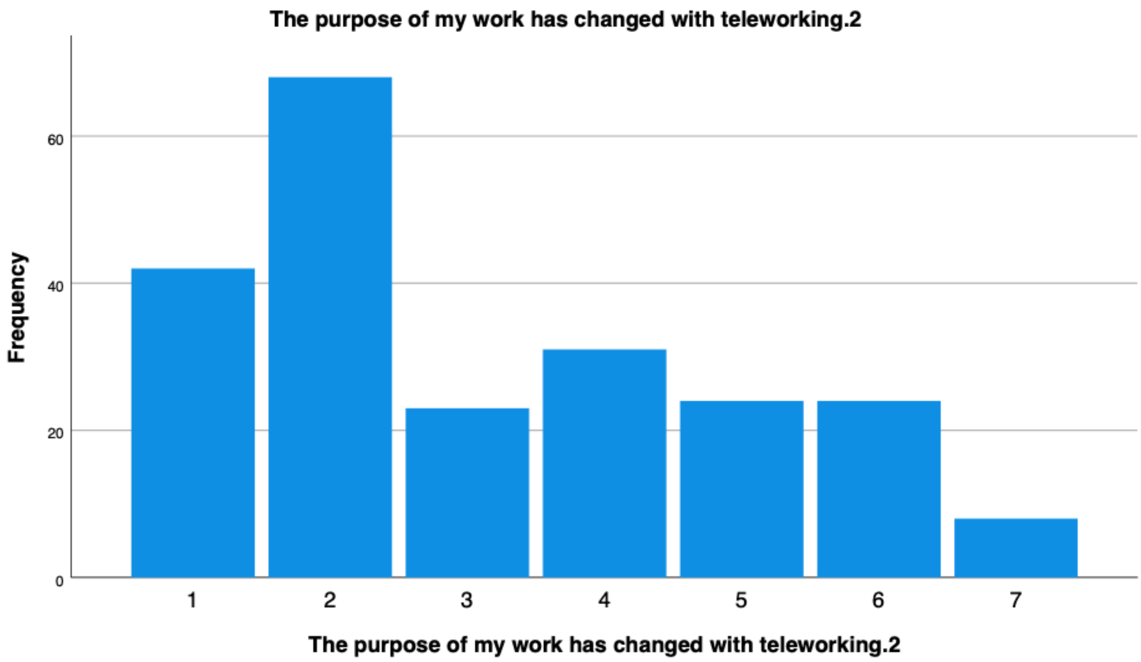
I find my job difficult to set up with teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	42	19,1	19,1	19,1
	2	73	33,2	33,2	52,3
	3	24	10,9	10,9	63,2
	4	10	4,5	4,5	67,7
	5	29	13,2	13,2	80,9
	6	30	13,6	13,6	94,5
	7	12	5,5	5,5	100,0
	Total	220	100,0	100,0	



The purpose of my work has changed with teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	42	19,1	19,1	19,1
	2	68	30,9	30,9	50,0
	3	23	10,5	10,5	60,5
	4	31	14,1	14,1	74,5
	5	24	10,9	10,9	85,5
	6	24	10,9	10,9	96,4
	7	8	3,6	3,6	100,0
	Total	220	100,0	100,0	

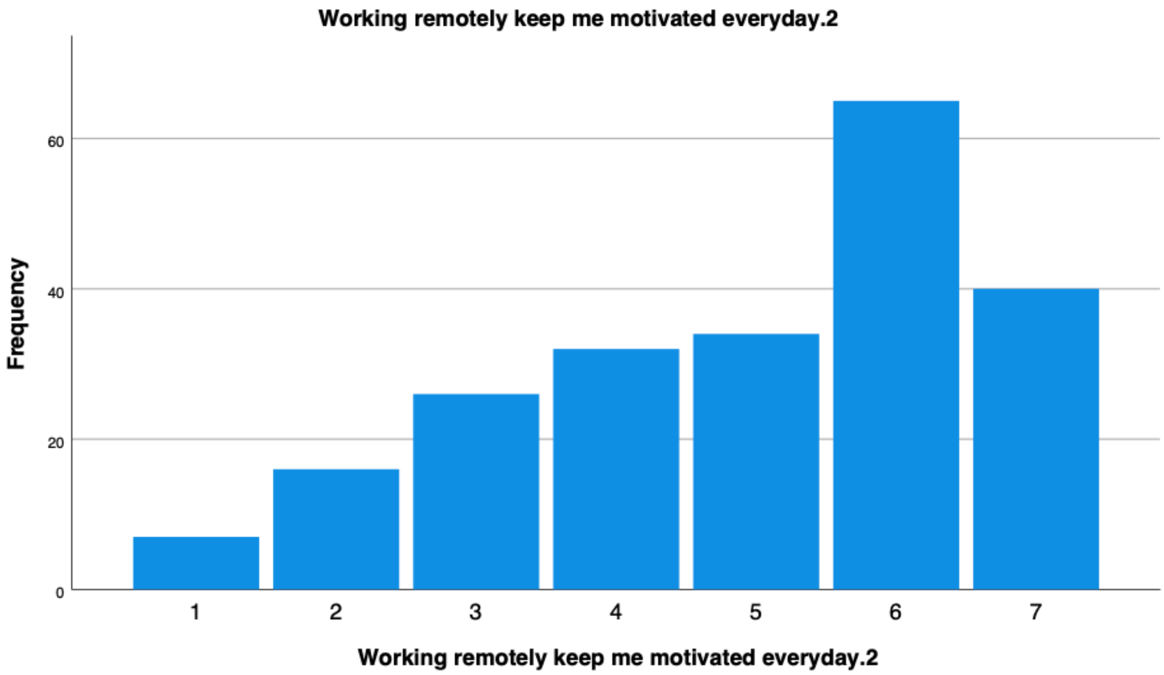


I find that my goals are achievable, even with this transition to teleworking world.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	,9	,9	,9
	3	10	4,5	4,5	5,5
	4	11	5,0	5,0	10,5
	5	31	14,1	14,1	24,5
	6	108	49,1	49,1	73,6
	7	58	26,4	26,4	100,0
	Total	220	100,0	100,0	

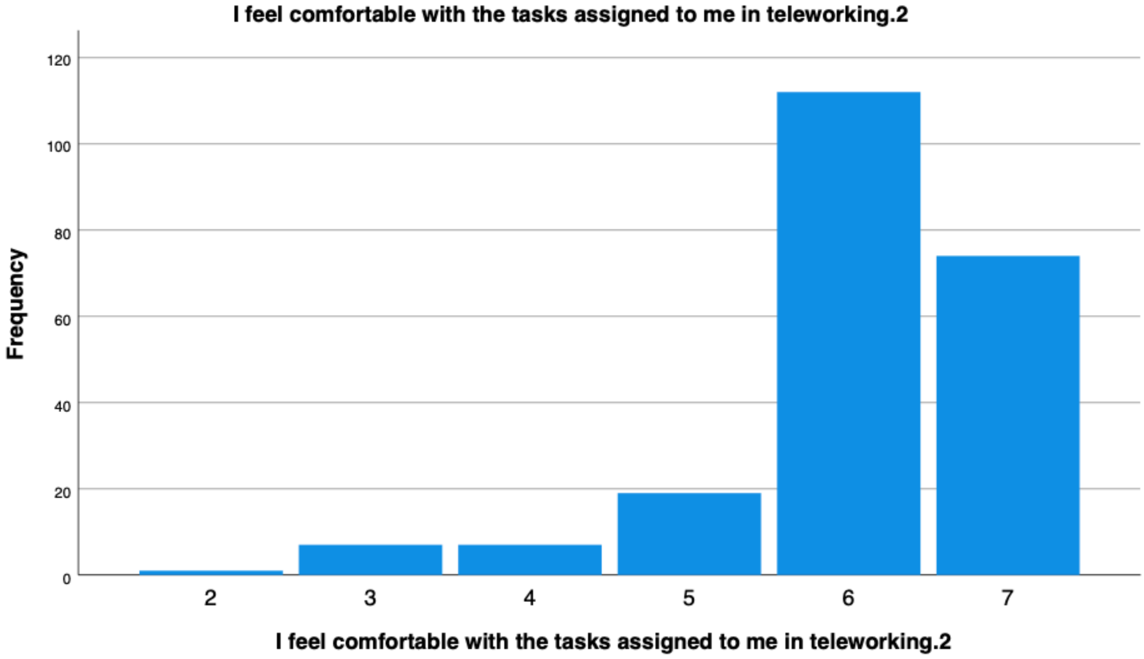
Working remotely keep me motivated everyday.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	3,2	3,2	3,2
	2	16	7,3	7,3	10,5
	3	26	11,8	11,8	22,3
	4	32	14,5	14,5	36,8
	5	34	15,5	15,5	52,3
	6	65	29,5	29,5	81,8
	7	40	18,2	18,2	100,0
	Total	220	100,0	100,0	



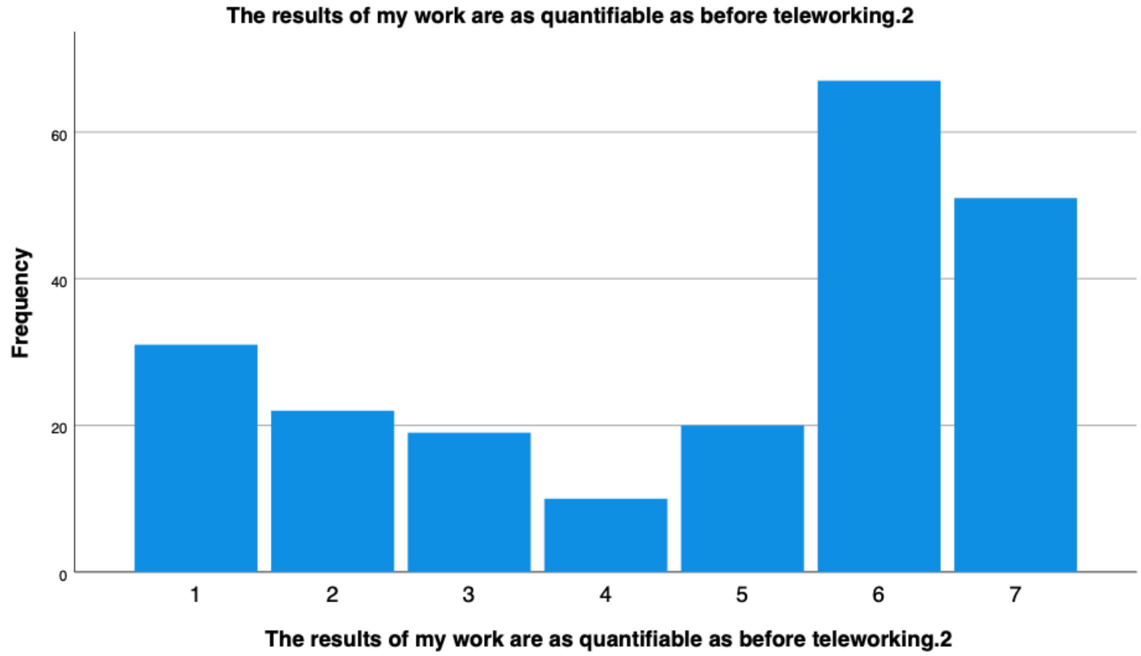
I feel comfortable with the tasks assigned to me in teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	,5	,5	,5
	3	7	3,2	3,2	3,6
	4	7	3,2	3,2	6,8
	5	19	8,6	8,6	15,5
	6	112	50,9	50,9	66,4
	7	74	33,6	33,6	100,0
	Total	220	100,0	100,0	



The results of my work are as quantifiable as before teleworking.2

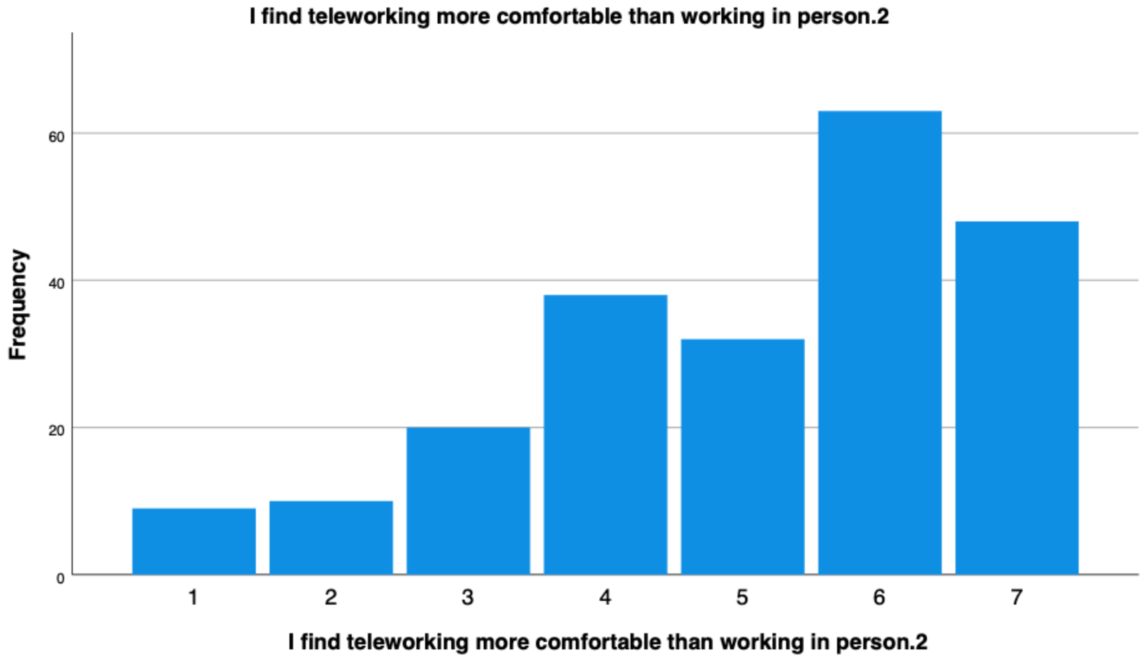
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	14,1	14,1	14,1
	2	22	10,0	10,0	24,1
	3	19	8,6	8,6	32,7
	4	10	4,5	4,5	37,3
	5	20	9,1	9,1	46,4
	6	67	30,5	30,5	76,8
	7	51	23,2	23,2	100,0
	Total	220	100,0	100,0	



(6) Global perception – physical environment satisfaction

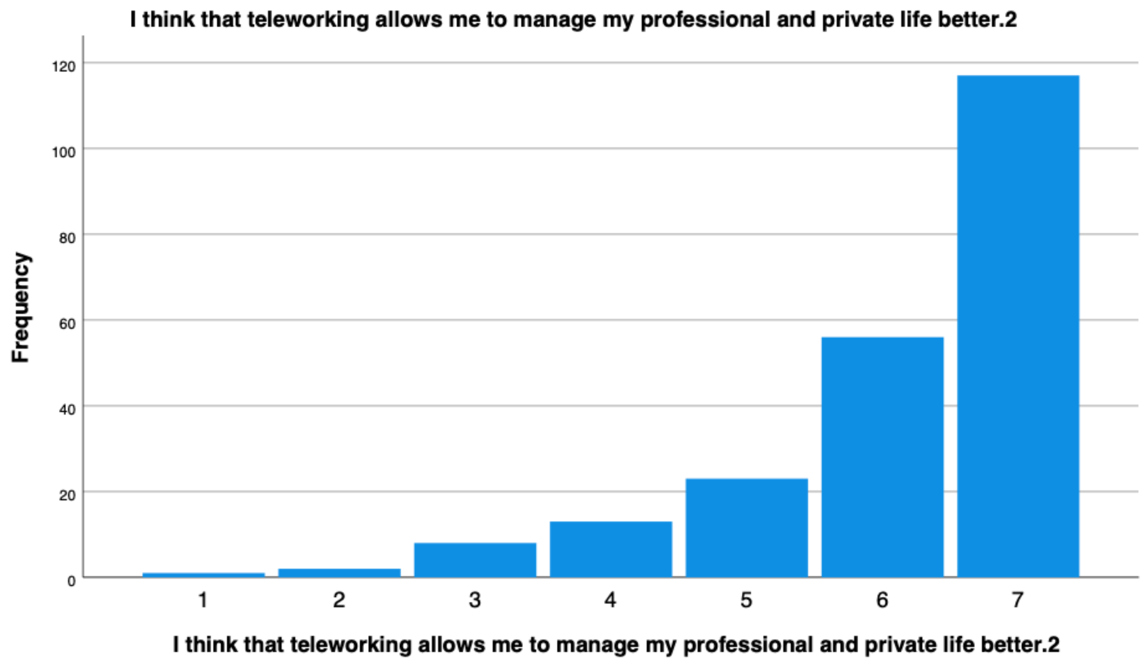
I find teleworking more comfortable than working in person.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	4,1	4,1	4,1
	2	10	4,5	4,5	8,6
	3	20	9,1	9,1	17,7
	4	38	17,3	17,3	35,0
	5	32	14,5	14,5	49,5
	6	63	28,6	28,6	78,2
	7	48	21,8	21,8	100,0
	Total	220	100,0	100,0	



I think that teleworking allows me to manage my professional and private life better.2

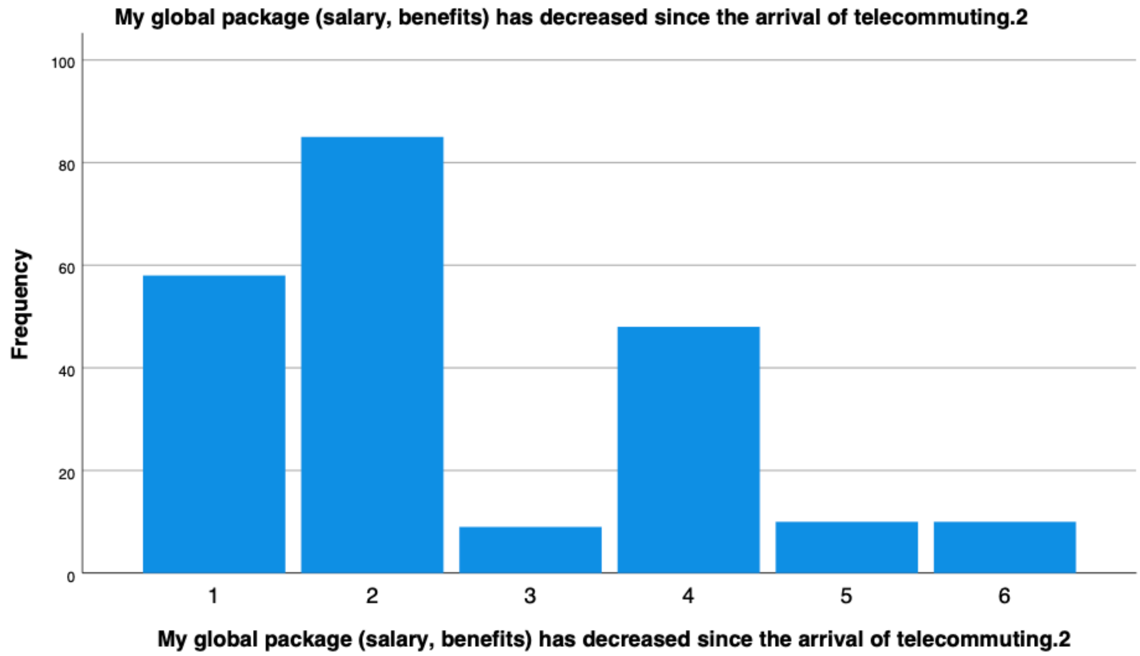
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	,5	,5	,5
	2	2	,9	,9	1,4
	3	8	3,6	3,6	5,0
	4	13	5,9	5,9	10,9
	5	23	10,5	10,5	21,4
	6	56	25,5	25,5	46,8
	7	117	53,2	53,2	100,0
	Total	220	100,0	100,0	



(7) Global perception – Salary and other materials benefits satisfaction

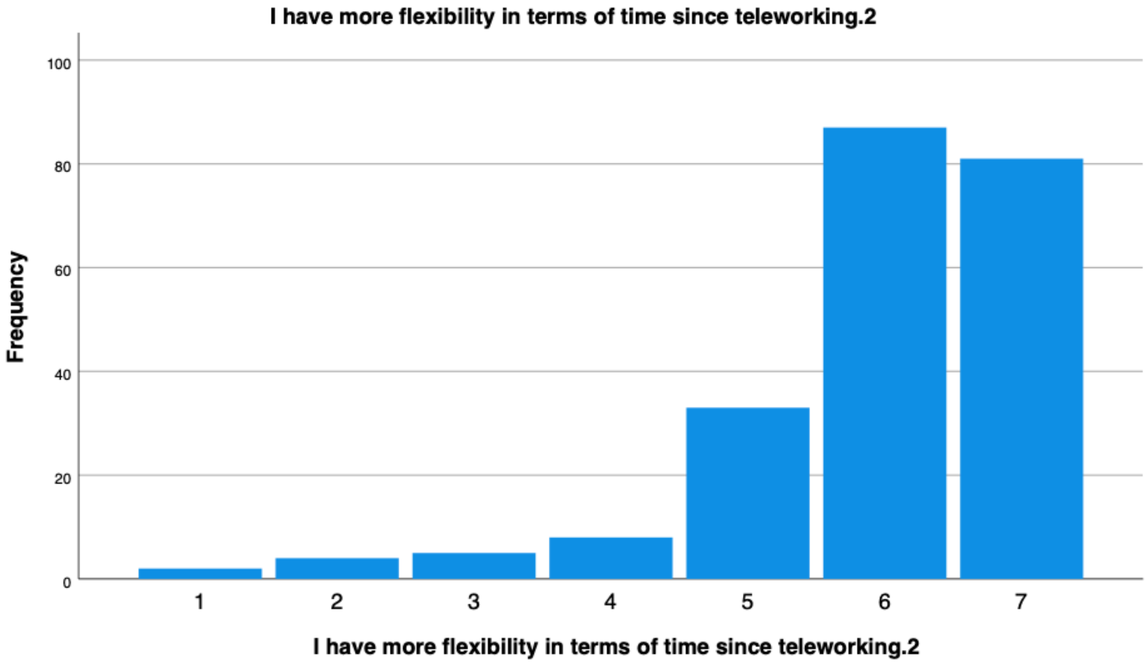
My global package (salary, benefits) has decreased since the arrival of telecommuting.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	58	26,4	26,4	26,4
	2	85	38,6	38,6	65,0
	3	9	4,1	4,1	69,1
	4	48	21,8	21,8	90,9
	5	10	4,5	4,5	95,5
	6	10	4,5	4,5	100,0
	Total	220	100,0	100,0	



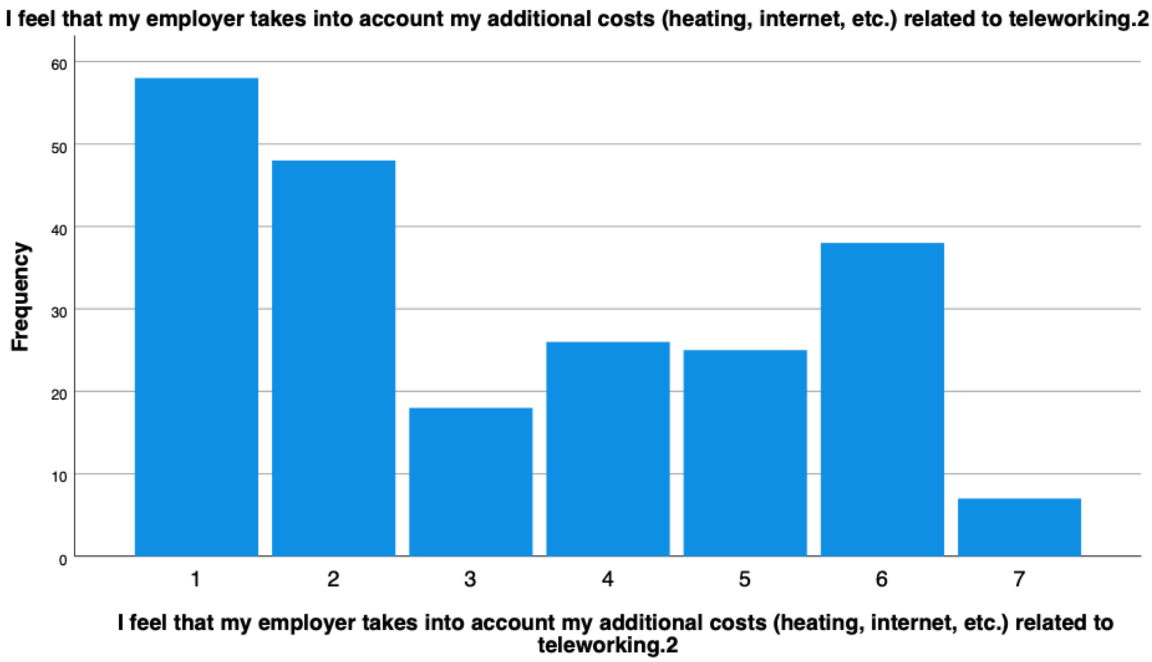
I have more flexibility in terms of time since teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	,9	,9	,9
	2	4	1,8	1,8	2,7
	3	5	2,3	2,3	5,0
	4	8	3,6	3,6	8,6
	5	33	15,0	15,0	23,6
	6	87	39,5	39,5	63,2
	7	81	36,8	36,8	100,0
	Total	220	100,0	100,0	



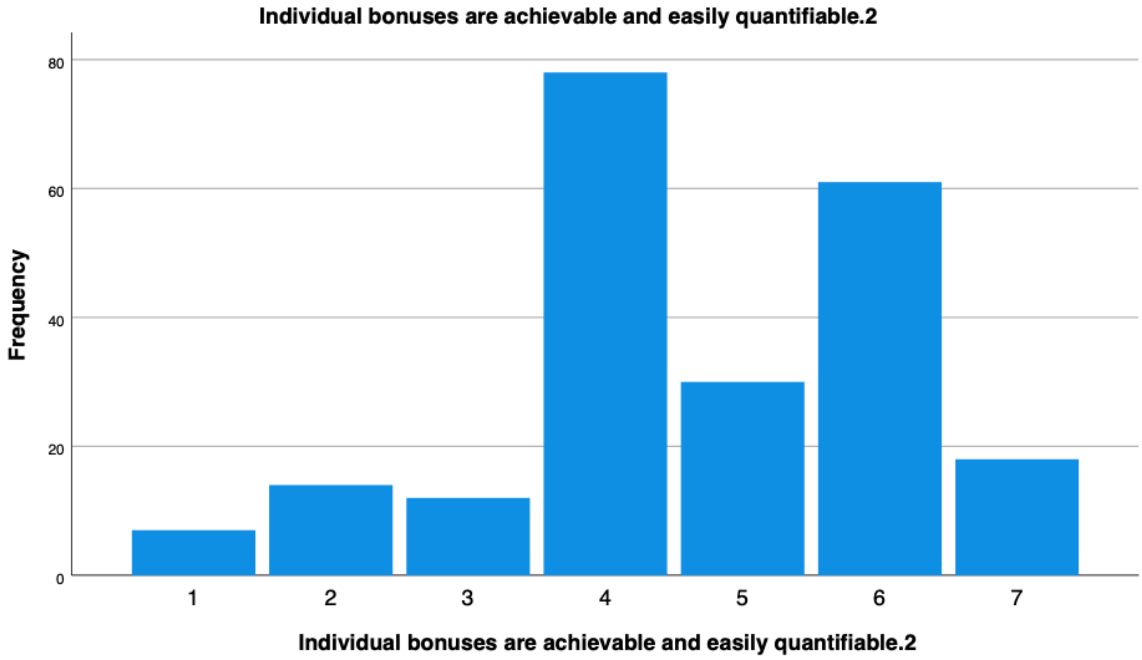
I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	58	26,4	26,4	26,4
	2	48	21,8	21,8	48,2
	3	18	8,2	8,2	56,4
	4	26	11,8	11,8	68,2
	5	25	11,4	11,4	79,5
	6	38	17,3	17,3	96,8
	7	7	3,2	3,2	100,0
	Total	220	100,0	100,0	



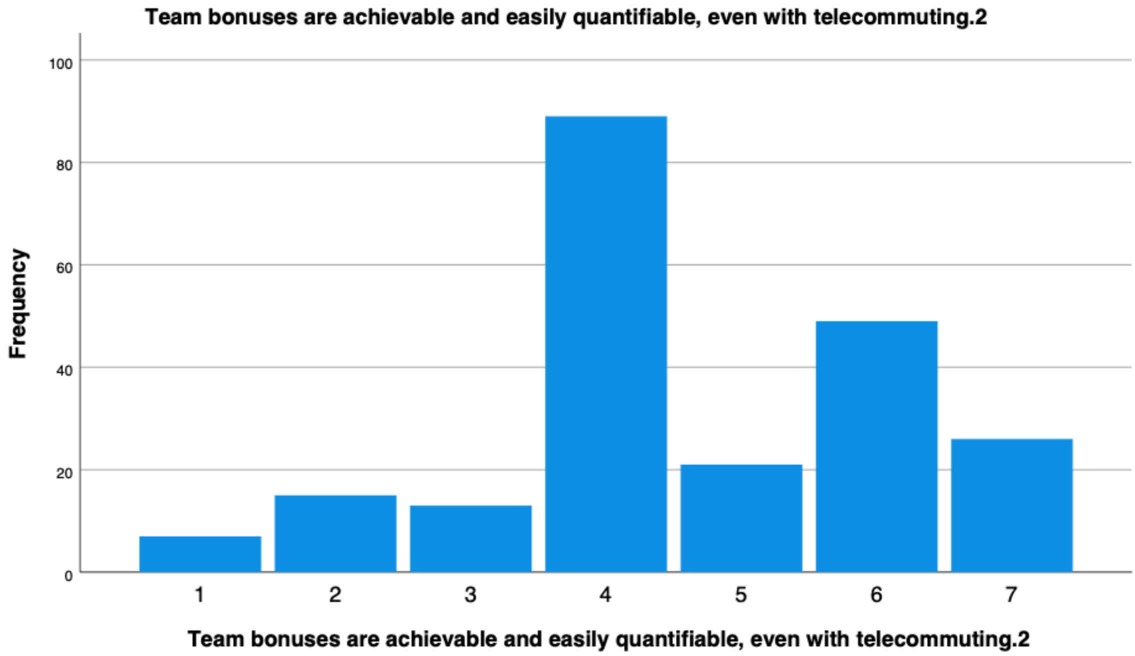
Individual bonuses are achievable and easily quantifiable.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	3,2	3,2	3,2
	2	14	6,4	6,4	9,5
	3	12	5,5	5,5	15,0
	4	78	35,5	35,5	50,5
	5	30	13,6	13,6	64,1
	6	61	27,7	27,7	91,8
	7	18	8,2	8,2	100,0
	Total	220	100,0	100,0	



Team bonuses are achievable and easily quantifiable, even with telecommuting.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	7	3,2	3,2	3,2
	2	15	6,8	6,8	10,0
	3	13	5,9	5,9	15,9
	4	89	40,5	40,5	56,4
	5	21	9,5	9,5	65,9
	6	49	22,3	22,3	88,2
	7	26	11,8	11,8	100,0
	Total	220	100,0	100,0	



(8) Mann-Whitney tests for gender comparison

Test Statistics[a]

	I think that the management is well executed remotely. 2	I do not feel that my suggestions have lost their impact on management decision making with remote working. 2	I feel that vertical mobility is possible even with this telecommuting transition.2	I feel that my N+1 is still remotely accessible.2
Mann-Whitney U	5792,000	5400,500	4882,500	5875,500
Wilcoxon W	10643,000	10251,500	9733,500	13378,500
Z	-,415	-1,303	-2,445	-,231
Asymp. Sig. (2-tailed)	,678	,193	,014	,817

Test Statistics[a]

	I feel that the tasks I am assigned are no different from those I had before teleworking.2	I find my job difficult to set up with teleworking.2	The purpose of my work has changed with teleworking.2	I find that my goals are achievable, even with this transition to teleworking world.2
Mann-Whitney U	5773,500	5797,000	5895,500	5793,000
Wilcoxon W	10624,500	13300,000	10746,500	10644,000
Z	-,456	-,396	-,180	-,425
Asymp. Sig. (2-tailed)	,648	,692	,857	,671

Test Statistics[a]

	Working remotely keep me motivated everyday.2	I feel comfortable with the tasks assigned to me in teleworking.2	The results of my work are as quantifiable as before teleworking.2	I feel that it telecommuting allows the employee to collaborate in an efficient way.2
Mann-Whitney U	4993,000	5885,000	5374,000	4994,000
Wilcoxon W	9844,000	10736,000	10225,000	9845,000
Z	-2,143	-,218	-1,318	-2,138
Asymp. Sig. (2-tailed)	,032	,828	,188	,033

Test Statistics[a]

	I keep socialising with my colleagues even through teleworking.2	Collaboration with my colleagues is easier with remote working.2	I feel that my colleagues are happy to work remotely.2	I am satisfied with the "remote" relationship I have with my colleagues.2
Mann-Whitney U	5277,500	5870,000	5518,500	5881,000
Wilcoxon W	10128,500	13373,000	10369,500	10732,000
Z	-1,520	-,234	-1,019	-,213
Asymp. Sig. (2-tailed)	,128	,815	,308	,832

Test Statistics[a]

	I find teleworking more comfortable than working in person.2	I think that teleworking allows me to manage my professional and private life better.2	My global package (salary, benefits) has decreased since the arrival of telecommuting.2	I have more flexibility in terms of time since teleworking.2
Mann-Whitney U	5308,000	5024,500	5561,500	4800,000
Wilcoxon W	10159,000	9875,500	13064,500	9651,000
Z	-1,460	-2,228	-,929	-2,669
Asymp. Sig. (2-tailed)	,144	,026	,353	,008

Test Statistics[a]

	I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking.2	Individual bonuses are achievable and easily quantifiable.2	Team bonuses are achievable and easily quantifiable, even with telecommuting.2
Mann-Whitney U	5896,500	5790,000	5871,500
Wilcoxon W	10747,500	13293,000	10722,500
Z	-,177	-,415	-,237
Asymp. Sig. (2-tailed)	,859	,678	,813

a. Grouping Variable: Gender

(9) Kruskal-Wallis tests for status comparison

Test Statistics[a,b]

	I think that the management is well executed remotely. 2	I do not feel that my suggestions have lost their impact on management decision making with remote working. 2	I feel that vertical mobility is possible even with this telecommuting transition.2	I feel that my N+1 is still remotely accessible.2	I feel that the tasks I am assigned are no different from those I had before teleworking.2
Kruskal-Wallis H	,331	,126	2,430	3,268	,648
df	2	2	2	2	2
Asymp. Sig.	,847	,939	,297	,195	,723

Test Statistics[a,b]

	I find my job difficult to set up with teleworking.2	The purpose of my work has changed with teleworking.2	I find that my goals are achievable, even with this transition to teleworking world.2	Working remotely keep me motivated everyday.2	I feel comfortable with the tasks assigned to me in teleworking.2
Kruskal-Wallis H	2,609	3,918	,817	2,447	2,714
df	2	2	2	2	2
Asymp. Sig.	,271	,141	,665	,294	,257

Test Statistics[a,b]

	The results of my work are as quantifiable as before teleworking.2	I feel that it telecommuting allows the employee to collaborate in an efficient way.2	I keep socialising with my colleagues even through teleworking.2	Collaboration with my colleagues is easier with remote working. 2	I feel that my colleagues are happy to work remotely.2
Kruskal-Wallis H	2,334	4,013	3,584	3,165	8,985
df	2	2	2	2	2
Asymp. Sig.	,311	,134	,167	,205	,011

Test Statistics[a,b]

	I am satisfied with the "remote" relationship I have with my colleagues.2	I find teleworking more comfortable than working in person.2	I think that teleworking allows me to manage my professional and private life better.2	My global package (salary, benefits) has decreased since the arrival of telecommuting. 2	I have more flexibility in terms of time since teleworking.2
Kruskal-Wallis H	9,066	3,824	,520	,287	2,849
df	2	2	2	2	2
Asymp. Sig.	,011	,148	,771	,866	,241

Test Statistics[a,b]

	I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking.2	Individual bonuses are achievable and easily quantifiable.2	Team bonuses are achievable and easily quantifiable, even with telecommuting. 2
Kruskal-Wallis H	4,700	6,252	6,607
df	2	2	2
Asymp. Sig.	,095	,044	,037

(10) Kruskal-Wallis tests for age category comparison

Test Statistics[a,b]

	I think that the management is well executed remotely. 2	I do not feel that my suggestions have lost their impact on management decision making with remote working. 2	I feel that vertical mobility is possible even with this telecommuting transition.2	I feel that my N+1 is still remotely accessible.2	I feel that the tasks I am assigned are no different from those I had before teleworking.2
Kruskal-Wallis H	2,378	1,301	,720	1,030	,804
df	2	2	2	2	2
Asymp. Sig.	,305	,522	,698	,597	,669

Test Statistics[a,b]

	I find my job difficult to set up with teleworking.2	The purpose of my work has changed with teleworking.2	I find that my goals are achievable, even with this transition to teleworking world.2	Working remotely keep me motivated everyday.2	I feel comfortable with the tasks assigned to me in teleworking.2
Kruskal-Wallis H	1,696	2,436	,618	3,608	5,130
df	2	2	2	2	2
Asymp. Sig.	,428	,296	,734	,165	,077

Test Statistics[a,b]

	The results of my work are as quantifiable as before teleworking.2	I feel that it telecommuting allows the employee to collaborate in an efficient way.2	I keep socialising with my colleagues even through teleworking.2	Collaboration with my colleagues is easier with remote working. 2	I feel that my colleagues are happy to work remotely.2
Kruskal-Wallis H	11,572	11,500	7,316	3,210	9,598
df	2	2	2	2	2
Asymp. Sig.	,003	,003	,026	,201	,008

Test Statistics[a,b]

	I am satisfied with the "remote" relationship I have with my colleagues.2	I find teleworking more comfortable than working in person.2	I think that teleworking allows me to manage my professional and private life better.2	My global package (salary, benefits) has decreased since the arrival of telecommuting.2	I have more flexibility in terms of time since teleworking.2
Kruskal-Wallis H	9,874	2,406	,857	4,442	4,137
df	2	2	2	2	2
Asymp. Sig.	,007	,300	,652	,109	,126

Test Statistics[a,b]

	I feel that my employer takes into account my additional costs (heating, internet, etc.) related to teleworking.2	Individual bonuses are achievable and easily quantifiable.2	Team bonuses are achievable and easily quantifiable, even with telecommuting.2
Kruskal-Wallis H	3,582	1,536	1,786
df	2	2	2
Asymp. Sig.	,167	,464	,409