What is the current and future impact of artificial intelligence on managerial practices?

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Résumé

Mots clefs : intelligence artificielle, manager, confiance, relation, perception

Seulement 50% des entreprises actives dans le monde utilisent l'intelligence artificielle (IA) dans son activité [91] mais 85% de ces mêmes sociétés considèrent l'IA comme le facteur X de l'industrie du futur (Pupion, P.C., Trébucq, S., 2020) [66].

Il existe donc une énorme différence entre la théorie et la réalité : pourquoi les entreprises ont-elles autant de difficultés à réaliser leurs transitions technologiques ?

Nous avons identifié le point commun que partagent toutes ces entreprises qui est le management.

Notre étude théorique nous mènera à nous questionner sur la relation de confiance actuelle entre manager et IA qui représente un des enjeux les plus importants à surmonter pour parvenir à débuter la phase de migration massive des entreprises vers l'IA. Grâce aux modèles de TQM (Total Quality Management) de D. Samson et B. Terziovski (1999) [72], de confiance accordée à l'IA de L. Chong & co (2022) [14] ainsi qu'une définition précise du manager de Katz (1974) [41], nous avons pu établir des bases solides pour les futures avancées dans le domaine.

Les résultats obtenus favorisent une transition technologique saine et durable des entreprises vers l'utilisation de l'intelligence artificielle dans leurs activités.

Abstract

Keywords: artificial intelligence, manager, trust, relationship, perception

Only 50% of companies worldwide use artificial intelligence in their business [91], but 85% of these same companies consider AI to be the X factor in the industry of the future (Pupion, P.C., Trébucq, S., 2020) [66].

So, there's a huge gap between theory and reality: why are companies finding it so difficult to make their technological transitions?

We have identified the common factor shared by all these companies, which is management.

Our theoretical study will lead us to question the current relationship of trust between manager and AI, which represents one of the most important issues to be overcome if we are to succeed in beginning the phase of mass migration of companies to AI. Thanks to the TQM (Total Quality Management) models of D. Samson and B. Terziovski's TQM (Total Quality Management) (1999) [72], L. Chong & co's trust in AI (2022) [14] and Katz's precise definition of the manager (1974) [41], have established a solid foundation for future advances in the field.

The results obtained support a healthy and sustainable technological transition of companies towards the use of artificial intelligence in their activities.

Introduction

“We can easily forgive a child who is afraid of the dark; the real tragedy of life is when men are afraid of the light.” - Plato.

The infinite possibilities offered by artificial intelligence are as fascinating as they are frightening.

It's a highly complex technology, which for a long time remained closed to the general public, as the projects involved did not allow for widespread use and understanding.

However, over the last twenty years or so, artificial intelligence has developed very rapidly, implementing real-world applications without anyone even knowing they were dealing with AI, such as when IBM's Deep Blue supercomputer beat world chess champion Garry Kasparov (1997), or the algorithms behind search engines in the 2000s.

Artificial intelligence, which for most of us was a sweet dream straight out of a science-fiction movie, or for others, the activity of a computer nerd who spends his days locked away in his bedroom, has just crossed the threshold without warning to change the course of our lives forever.

It's fun to say that, as C. Chaplin in his famous film “Modern Times” (1939): in the last century, men became machines; in the 21st century, machines want to resemble humans.

AIs such as ChatGPT, facial recognition and social networking are now ubiquitous in our daily lives.

And if we asked you to describe to us in one or two sentences, as simple as possible, what artificial intelligence really is, without giving us any examples, what would you say?

Out of 100 people, can we expect even a single duplicate answer?

This is one of the aims of our study: to re-establish an intellectual balance between AI experts and non-experts on the subject of this powerful and mysterious new technology. This means informing and educating you about this technology, which is coming at us like an unstoppable tsunami.

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Companies, meanwhile, have been more reactive to the subject, rushing to find real applications to improve their productivity (Bettache, M., Foisy, L., 2019) [7]. It's easy to see, then, that artificial intelligence is in vogue, and even considered fashionable. As evidenced by the highly significant results of the survey conducted by MMC Venture, which reports that 40% of start-ups claiming to be AI companies are unlikely to be using AI. In other words, the very term artificial intelligence attracts and sells. In 2022, according to a study published by S. Delestre [91], 50% of companies worldwide will be using artificial intelligence in their business. This figure testifies to the difficulty companies have in making this conversion.

This has begun by replacing humans with simple, redundant tasks such as chatbots, which are algorithms that answer customer questions in place of an after-sales service. In reality, these are generally ready-made answers that are arbitrarily chosen according to the keywords of the questions received. But what about jobs that require a high degree of social and human commitment, such as management?

Over the past decade, AI has broadened its scope, seeking to get closer to an emotional intelligence (Mattingly, V., Kraiger, K. (2019)) [54]. These latest advances are of particular interest to us because the singularity of the managerial profession is based on this aspect, which seems totally removed from the initial characteristics of artificial intelligence, which would no longer be of the factual order (Pastre, D., 2000) (Rai, A. & co, 2019) [60, 65].

While companies have responded proactively to the rapid emergence of artificial intelligence (Bettache, M., Foisy, L., 2019) [7], we are also witnessing a troubling paradox. Although AI offers immense potential for transforming managerial practices, there is a significant lack of both technical and managerial training worldwide (specifically France and the USA) (Goya, C., 2018) (Saphir, A., 2018) [31, 73]. This represents a major brake on the implementation of AI in companies, as the absence of a perfect command of this technology can result in significant damage: whether it is poorly implemented (death of a pedestrian in Arizona by an Uber autonomous car in 2018) or is subject to a bad external influence (Microsoft's Tay chatbot that made racist remarks because of users on Twitter) without there being a programming problem (Brendel, A.B. & co, 2021) [10, 132].

The lack of experts in this field is a cause for concern, but is this really the real problem? Experts in this field may also be frightened by the limitless power of artificial intelligence.

Indeed, one of the founding fathers of AI and winner of the 2018 Turing Award, Geoffrey Hinton, resigned in April 2023 from his position at Google because he felt completely overwhelmed by his estimates and therefore lost control of them. He fears the impact of artificial intelligence in the world through the spread of fake news, but also in the world of work [92].

Why haven't the rest of us been alerted to the looming threat, when AIs that generate modified videos have been creating a buzz on social networks since 2023?

Our study is therefore urgent and necessary. It sets out to remedy this gap by exploring how managers' competence in the sound handling of AI can become an essential pillar of business success.

What is the current and future impact of artificial intelligence on managerial practices?

To answer this question, we have conducted a literature review to gain a better understanding of the subject and propose possible answers to this ambitious problem. This quantitative study will be carried out by means of a survey of employees in companies using or not using artificial intelligence in the workplace. It will be exclusively dedicated to managers of companies in any sector of activity. This will enable us to consolidate our information gathered during the academic research work, understand fears about this technology, explore avenues to promote the healthy handling of AI in their activities and estimate the future impact of AI. As an engineering student in a major specializing in new technologies, I'm positioning myself not only as an informant, but also as a popularizer of certain complex concepts thanks to my experience.

To guide our research, we have identified four research questions to support our thinking and our understanding of the problem.

Q1: What are the current impacts of artificial intelligence on management and leadership practices?

Q2: How do managers perceive AI in their current roles?

Q3: What are the success and failure factors for the successful implementation of AI in managerial practices?

Q4: What are the ethical, social and technical limits to the use of AI in the management context?

As a first step, we will examine the available literature in order to inform ourselves and best answer our four research questions. This will enable us to extract unexplored hypotheses for our study. We will then explain our methodology and present the results of our own study. Finally, we will discuss our findings before concluding with our recommendations for future research on the subject.

Literature review

1. Managerial skills

1.1 Definition

We believe that a simple definition of what a manager really is is essential to ensure a clear understanding throughout the dissertation, and to avoid any confusion.

According to Larousse, a manager is the person who “organizes, manages something, directs a business, a service.” [93]. It is above all a function, a position of responsibility within every company. Whether this person is considered a good or bad manager, he or she will always be one!

To understand the impact of AI on the manager's role, it is essential to define the traditional skills of a manager. This is a function that has evolved over time, and tracing all its influences is necessary to understand its complexity.

At the beginning of the last century, there were two opposing conceptions of a manager: Taylor (1911) and Fayol (1916) brought an organizational vision, evoking planning, organization, command, coordination and control, while Follett (1941) favored a more socially-oriented function. Mintzberg (1973) and Boyatzis (1982) offer us a more global vision of the managerial function, dividing it into six key competencies (Managing objectives, Leadership, Managing human resources, Leading subordinates, Focusing on others, Having specific knowledge). Finally, Katz (1974) [28, 41] summarized these concepts by grouping the notion of manager under 3 pillars: technical, human and conceptual.

1.2. The diversity of management

The manager is therefore only one position within a company. As such, there are many facets to the manager. In 2023, according to Capital, there are five main categories of manager: directive, persuasive, participative, delegative and benevolent [94].

The directive manager is authoritarian, controlling and opts for top-down communication without taking his team's opinion into consideration (Goleman, D., 2017) [30, 94]. In the 1950s, this was virtually the only type of management in place. Over time, mentalities and

society itself have evolved in favor of the importance of equality. However, according to a study carried out by the Institut de l'Entreprise in 2018, 70% of managers believe that a good manager is also distinguished by his or her leadership [95]. The persuasive manager is similar, but intentionally opens discussion or debate with his or her employees with the aim of convincing them and inspiring greater trust. The delegative manager is the other extreme of the directive manager, giving a great deal of space to all team members. They enjoy considerable freedom of action and ideation. As the research article by M. Pupion and M.Trébucq (2020) [64] shows, management is evolving by pivoting from a very vertical vision of professional relationships and exchanges to an increasingly horizontal relationship. This is a perfect introduction to the last two types of management: participative and benevolent [94]. The benefits advocated by the latter are a better relationship between each individual, increasingly erasing the hierarchical distance separating the two positions. This is known as transversal management.

This current takes up the foundations of a new approach to governance called Post-New Public Management (PNPM) accompanied by Dent as early as 2005, in reaction to the basic concept which is obviously called NPM [21]. Its arrival in the private sector marked a turning point, bringing with it a wave of freshness and modernity to an environment that had long been reluctant to embrace it. Indeed, the main objective was financial: the rest came much later. The PNPM breaks new codes by taking a less rigid approach to hierarchical organization, and by succeeding in emphasizing the human side through greater collaboration and participation between colleagues. This encourages each employee to invest more in the company, both in terms of decision-making and emotion, in a healthier working environment. This clear improvement has its advantages. According to D. Bounazef & co (2020) [8], this had a direct positive impact on the quality of professional relations, by reducing stress and negativity in the hospital sector they studied. Their study confirms their hypothesis thanks to the two management policies NPM and PNPM, and reveals new connections between the notion of transversal leadership and the empowerment of each employee [8]. Boies & co (2015) [114] confirm this, adding that this new type of management considerably reduces conflictual relations between managers or others benefiting from a position of high responsibility and employees with more restricted responsibilities.

The most important distinction to make is that between the manager and the leader. As mentioned earlier, a manager is only a function, whereas a leader is someone who is able to guide, influence and inspire [99]. A manager without leadership obviously exists just as much

as a person with more leadership than his or her own manager. This is precisely the point where horizontal management is of great interest to the company itself, which benefits from any leadership input, regardless of the position or position of these people.

B. Fallery goes one step further, evoking management without managers. He tries to bring a real theoretical approach to the subject, because in his view, there are so many examples in recent history that all that's missing is more tangible proof for this concept to be validated and then assimilated by society. B. Fallery (2014) [23] openly supports Gary Hamel and his article in the Harvard Business Review, which is much clearer in its opinion, proclaiming “First, Let's Fire All the Managers” in the title [100]. In his view, the manager is the most expensive function in a company, without being the most efficient. These strong words (“Let's fire all the managers”) needed an equally strong justification. He demonstrates this by studying the case of Morning Star, a leader in the agri-food market, and more specifically in tomato processing [100]. In the words of one of the company's employees to G. Hamel: “Around here, nobody's your boss, everybody's your boss”. This can be defined as a philosophy of putting communication and coordination between all Morning Star members at the center of the table. G. Hamel tells us that the success of this leading agri-food company is based on four essential points. Firstly, each employee is fully responsible for defining and carrying out his or her role and contribution to the company's objective: to create products with tomatoes. Secondly, the creation of CLOU (Colleague Letter of Understanding): this is the concept that replaces hierarchy by setting up a system of negotiation between colleagues with the aim of establishing relationships between each team member. This brings greater freedom, spontaneity and fluidity to interactions, as each negotiator speaks as an equal. By signing CLOUs that suit both parties, they will also be more willing to respect the terms of their commitments. What's more, there is no possibility of advancement within Morning Star, because there is no hierarchy and no job title. Finally, G. Hamel's phrase is worth a thousand explanations: “Autonomy extends beyond deliverables”. Finally, while the company's structure is original and unprecedented, it is not totally devoid of the concept of management. Indeed, the employees who benefit most from CLOUs can be considered managers in their own right thanks to their responsibilities, salaries are not decided by the employees themselves but are estimated according to the results of their respective missions, and the financial autonomy advocated by G. Hamel is only a facade, as everything passes under the validation of the accounting department. But that's not the point: Morning Star's results are

significant as a leader in its field. As mentioned earlier, the word manager is only a title, and the fact is that this company has succeeded in demonstrating to the world that even without a manager, it can still become the biggest company in its sector [23, 29, 100]. This is a very important point, as it means that the position of manager within a company is not necessarily mandatory and a guarantee of success.

Let's take a look at the very essence of artificial intelligence, to understand the different relationships between management and AI.

2. Artificial intelligence

2.1. The definition

Artificial intelligence (AI): The ability of a computer system to perform tasks that normally require human intelligence. This encompasses simple actions as well as human cognitive functions such as perception, reasoning, learning, interaction with the environment, and even creativity (Pastre, D. (2000)) (Rai, A. & co (2019)) [60, 65]. However, to define it in this way would be contrary to its essence, as it is a technology that appears to have no limits (Rhine, Es. W., 1985) [68] and is constantly evolving, and some researchers (Müller, V.C., Bostrom, N., 2016) (Roser, M., 2023) [56, 70] even estimate that in the near future (2040-2050), it has a 50% chance of catching up with human intelligence [70]. It is currently following Moore's Law, which calculates that over a period of eighteen to twenty-two months, the power of AI doubles. By drawing up its growth curve, we can very clearly identify an exponential law whose finality is very difficult to determine (Smith, G., Green, M., 2018) [79].

Artificial intelligence is, however, composed solely of algorithms (set of operating rules specific to a calculation; sequence of formal rules, according to the Robert's definition). It encompasses numerous fields of activity, the best known of which are Machine Learning (ML), Natural Language Processing (NLP) and Deep Learning (DL). To put it simply, Machine Learning is a set of algorithms that act on a very large dataset and learn from its own decisions. We therefore speak of models of learning algorithms (Zhou, Z.H., 2021) [90]. This is one of the most interesting points of this technology: as long as there is a possibility of learning or finding a new path, no matter how long it takes, the AI will always eventually reach it (Rhin, Es. W., 1985) [68]. Deep Learning, on the other hand, is the even deeper

version: it uses a network of interconnected neurons, directly inspired by the human brain and all its connections [103]. In layman's terms, Deep Learning allows us to be more precise, faster and more efficient in our results, which can now also be applied to more specific types of data (videos, speech etc...) (Shrestha, A., Mahmood, A., 2019) [78].
The fields of application are infinite, enabling AI to evolve very rapidly in every sector..

2.2. The evolution of artificial intelligence

Human curiosity drives us to constantly improve the capabilities of artificial intelligence. This is demonstrated by the thunderous arrival of Nvidia, the world's largest supplier of GPUs (in other words, graphics processors used to improve a computer's computing performance) on the stock market, with growth of over 1700% in the last five years [116]. Nvidia is at the top of its field, enabling artificial intelligence developers to achieve ever faster performance by directly influencing computing capacity and speed. According to a study by F. Cordier posted on the ENS Lyon website, a typical human has a constant reaction time of around 70 ms [117]. To give you an equivalent, an eye blink lasts 100 to 150 ms [96]. That's half as fast, even though it's one of the simple gestures we can easily describe as instantaneous. Given that AIs tend to resemble humans the most, they need to be able to react as quickly as these 70ms. Given that they make all their decisions by collecting data, analyzing it and then extracting the best decision to take before finally taking the appropriate action, staying under 70ms can quickly seem like a major challenge. To be able to compare human capabilities with those of intelligent robots, Man was quick to organize a rivalry between the two camps to see which was the better. AI soon surpassed man in many fields (chess in 1997, medicine, speed of calculation, etc.). However, in some specific areas, such as creativity and flexibility, humans are still ahead of machines [101]. Unfortunately, this is no longer the case with the game of Go, which was still considered one of the greatest challenges for artificial intelligence engineers before 2015, since the victory of AlphaGo. It may come as a surprise to some, but the game of go has a googol complexity (10 to the power of 100) times higher than that of chess, a game which is already considered complex by most of us. The number of board configurations is greater than the number of atoms known today! (more than 10 to the 170th power) [102]. Winning against a professional go player without a handicap highlights not only the computing power and speed required of the AI, but also its great adaptability in response to the moves played by the professional. The latter is even described as “creativity” by Lee

Sedol, winner of 18 world go titles and also defeated in 2016 by AlphaGo [102]. It is therefore a major advance that has inspired new coding techniques to make AI even more human-like.

Technological performance is constantly evolving at exponential speed, but what will it cost?

3. Artificial intelligence and ethics

“What should we do?”, AI specialists must be asking themselves right now. This is exactly the basic question of a field of scientific philosophy: the ethical sciences (Rosen, G. & co, 2023) [69].

3.1. The main causes

Technological performance can quickly turn into a frenetic race against the competition. And concentrating forces on this constant sprint can lead to shortcomings in other equally important, but less visible, areas.

Safety is one of them, as evidenced by the avoidable incidents at Deepwater Horizon (2010), which, as the US federal authorities point out in their report, were due solely to the desire to “save money and time” [111]. Or the nuclear accidents at ThreeMile Island in 1979 and Chernobyl in 1986, which the International Atomic Energy Agency (IAEA) points out could have been avoided if operating or safety conditions had been respected during a technical test [112].

Ethics are often overlooked when it comes to success and money. This is particularly visible in the textile industry, without even needing to mention names, or in the food sector, particularly in fishing, where the NGO Sea Shepherd Conservation Society plays a leading role in advocacy. Similarly, the animal sector is affected by practices such as poaching. These are generally areas where huge sums of money are involved, and appear clean on the surface, but as soon as you dig a little deeper, you can quickly be surprised by what's really going on.

We call this the phenomenon of opacity. As university professor Y. Poullet, a university professor, artificial intelligence, and especially Deep Learning at the forefront, clearly uses this process (Poullet, Y., 2020) [63]. Firstly, thanks to the technical complexity of the model:

only experts in this very field can claim to have a clear and complete understanding of the real capabilities and powers of each AI. And even then, this can take a considerable amount of time, as each programmer has his or her own habits that may not be clear or obvious to everyone. Barocas & co (2013) [5] describe it as impenetrable and unpredictable. Slavin (2011), for his part, speaks of a technology that we write without knowing how to read. And secondly, by the very nature of this technology, which is intended to be as autonomous from humans as possible. These models react solely to their own environment, i.e. to initial data and to data collected after they have been put into service, generating new connections and interconnections. Each piece of data is crucial, and can determine the success or failure of the model.

Indeed, Microsoft paid the price in 2016. The American behemoth had launched its own chat bot called Tay on the Twitter social network with the aim of chatting with teenagers and young adults present on the app. Microsoft points out that Tay trains its models on publicly available data and therefore does not have its own dataset. It therefore learns from all its interactions on Twitter. They have, however, predefined a few strict rules, such as a ban on talking about terrorism, in which case Tay must respond with an unequivocal message. Twitter users quickly embraced their new tool and started using it en masse. But the more they talked to Tay, the more his responses changed, purely because of his many private conversations. The problem with Twitter is that it's a social network that aims to be more anonymous than the others. It also offers the option of sending tweets, which are simply public messages accessible by their communities and much more. Tay began making increasingly racist and insulting tweets to certain presidents after just 2 days after its launch, and was therefore directly removed from Twitter [132]. Nothing says that Tay's programming was bad or not. All it takes is one small detail to go wrong, and the experiment ends in a failure worth millions to Microsoft. In another context, for example with a different target age group, Tay could perhaps have been considered a success.

In this case, it would be fair to ask: who is to blame for this failure? To the AI developers who failed to make it impervious to external malicious intent? Malicious users? Microsoft? Twitter? All four?

Unless you have the help of AI development experts and access to all the AI's code, which can amount to millions of lines, from an outsider's point of view it's almost impossible to know what it's due to.

However, a single line of code or condition can transmit its intentions to an AI.

This is what T. Titareva (2021) also observes: if the programmers or sponsors of an AI have biases that can be transmitted to their algorithms, whether unconsciously or not, this can have catastrophic consequences [82]. This observation is confirmed by Weissman's (2018) study of Amazon. The American firm had decided to develop an AI that would facilitate prospecting to recruit new profiles. Its own developers then realized that the AI reproduced stereotypes by favoring male profiles in the recruitment of software developers [85]. Meanwhile, Evstratov & co (2020) refute this idea and prove the opposite [22].

3.2. Human perception of AI

Artificial intelligence is not yet perfected: its most perfect form is, for the moment, only to be found in films and series (Blade Runner (1982/2017), Ghost in the Shell (1995/2017), Her (2013)). Megan (2024, Netflix) tells the story of a prototype children's toy that acts as a “best friend”. However, the little girl who tests it has just lost her parents and quickly becomes emotionally attached to it. This causes her to become violently isolated from human interaction, which is perhaps catastrophic in a child. The robot doesn't realize this, as it doesn't yet have the capacity. It will sometimes misinterpret certain situations, and believing itself to be acting correctly, the effect of its action choices will be dangerous for the child it is supposed to protect. AIs have no notion of right and wrong. Or at least, in line with the Toulouse School of Economics article, if an AI does evil, we can consider that it has no notion of morality. However, if it always does good, we can conclude nothing [104]. In other words, perhaps the time has not yet come. We are therefore constantly waiting and fearing that the robot will deviate from its original trajectory.

This article raises an essential point: the nature of AI, which is to learn autonomously, is also one of its greatest limitations: it can be as successful as it is unsuccessful, depending on its basic data (Brendel, A.B., 2021) [10, 132] but also on the situations it encounters, from which it learns.

3.3. Regulation

At present, the notion of ethics in AI is the subject of much debate, as we do not have the technical skills to master it entirely and it depends too much on the algorithm written (Mattingly, V., Kraiger, K., 2019) (Neyland, D., 2016) [54, 58]. K. Martin (2021) [52] found the solution to this problem by creating the normative obligation of developers, which stipulates that if a company's technology, in this case AI, in any way influences one or more individuals, the company in question is 100% liable for damages.

As relayed in this article, an engineer had fun creating an intelligent drone that kills people in just a few hours [105]. The morality of the drone cannot be questioned, as it simply obeys lines of code devised by its creator. Other significant examples also address the question of life and death (Coppersmith, C.W.F., 2019) (Holford, W.D., 2022) [16, 35]. The fact that the robot can make mistakes, become uncontrollable or suffer external and internal influences gives a whole new dimension to the challenge of importing these technologies into our daily lives (Bril, A. & co, 2017) (Frey, C.B., Osborne, M.A., 2017) (Martin, K., 2021) (Mattingly, V., Kraiger, K., 2019) [10, 25, 52, 54, 132]. In a study, M. Stelios (2023) takes this point further, claiming that true artificial intelligence is undeniably associated with artificial morality [106]. In saying this, he highlights the major difference between human and machine: the moral imprint in one's own actions. As is the Turing test (a test to determine whether the AI in question thinks like a human), which is in fact a moral test, or the “streetcar dilemma” devised by the two modern philosophers Philippa Foot and J.J. Thompson (1985) [84]. Philippa Foot demands that, as the driver of an out-of-control streetcar on lane A, you choose whether or not to divert onto a fork in the road. On track A there's a group of 5 people, and on track B a single person. Once the streetcar has entered one of the two lanes, anyone on it is considered dead. In 2007, Hauser and his team (2007) [33] carried out a new variant of this very interesting moral study, which highlights the true purpose of a dilemma: to bring out the true nature of human beings. They play on the words used, distinguishing between the verb “to push” and “to divert”. In the first case, the person pushes the streetcar onto track B to kill the people there, whereas in the 2nd case, the person saves the people on track A by killing those on track B. The results of the study are striking: when the verb “to push” is used, 88% of the panel take no action, whereas when the word “to divert” is used, the opposite effect occurs, with 83% of respondents diverting the streetcar. This perfectly confirms the

theologian Thomas Aquinas' doctrine of the double evil, which states that it is understandable to commit an act considered evil in order to avoid an even worse one, if and only if the evil committed is only a side-effect of the action. The choice of verb is therefore of the utmost importance here [33]. Artificial intelligence lacks this depth of thought, and would consider the two cases studied to be the same because the result is. In other words, AI is not devoid of morality, but it does not share human morality: according to renowned AI researcher Yann LeCun (2020), it lacks common sense [108]. He claims that his next research projects will be inspired by newborn babies. According to LeCun (2020), morality is not innate, and babies can discern right from wrong simply by observing their surroundings as they grow up. He therefore came up with the idea of having his next artificial inventions watch films, so that they would acquire this experience [108].

On the other hand, Mr. Stelios also notes that, in a sense, humans are becoming increasingly accustomed to contact with machines, which influences their behavior by making them more mechanical [106]. H. A. Samani & co (2012) confirm this, citing over eighty years of daily use, using GPS as an example [71]. He believes, however, that a new method of learning AI with algorithms, known as intuitive learning, would enable greater autonomy over morality. He thus confirms that AI is slowly but surely approaching human beings in all their uniqueness [106].

But how can a technology that still has shortcomings in terms of ethics and morality support or even replace a manager in his role?

According to P. Gautrin (2021), laws should be designed to protect the impact that AI can have on humans [107].

In the same vein, back in 2017, the European commission with the help of a group of experts on “Liability and New Technologies” developed a charter that addresses legal liability directly related to the use of emerging technologies such as AI. These regulations are not designed to eliminate all risk, but rather to minimize it. The article proposes new legal adjustments such as the obligation to keep logbooks, strict liability for each actor in the experimental chain (e.g. suppliers, designers, programmers etc.), the possibility of compulsory liability insurance. The main aim of these proposals is to guarantee the user and potential victim of this technology maximum protection [113]. The fear of the damage that the R&D sector can cause to new technology companies is therefore at its greatest.

Indeed, the document points out that, generally speaking, traditional civil law systems require the judge dealing with cases of this kind to have evidence with a rate of certainty close to 100% in order to rule in the victim's favor. On the other hand, it is made clear that it is sufficient for the judge to consider that there has been damage with a probability of over 50% to give a verdict in favour of the victim [113]. Numerous measures have been taken by the European Parliament and Commission to make the development of intelligent solutions ethically and legally acceptable, while ensuring that human beings are placed at the heart of the debate [86].

4. Artificial intelligence in the professional world

4.1. Apprehensions and projections

Now that you know a little more about the fascinating subject of artificial intelligence, let's take a closer look at its application in the world of work in general. For 85% of the companies surveyed by Ransbotham & co (2017), the opinion is almost unanimous: AI is the object of all covetousness, because mastering it represents a definite advantage over the competition [66].

As far back as 1963 and J.F. Kennedy's speech announcing that: “We have a set of older workers who have been thrown out because of technology and younger ones coming in [...]. Too many individuals are entering the labor market and too many machines are ejecting workers.” [97]. So everyone knew: we were on the cusp of a technological revolution. We can assume that the former American president may have been referring to artificial intelligence, as the term was first used in 1956 at J. McCarthy's “Dartmouth Summer Research Project on Artificial Intelligence” conference. The Google Ngram site confirms this by quantifying the number of occurrences of the word in the entire bibliography offered by Google Book: the term began to be used in the world of literature and research as early as 1960 [98]. Smith and Green (2018) confirm this: the ageing population is indirectly forcing us to take the option of introducing AI with greater consideration. In their view, this has become a necessity [79], but it does entail risks [24].

In the much-cited study by C. Benedikt Frey and M. Osborne (2017), which aims to estimate the number of occupations likely to be affected by computerization such as AI, the results are significant: of the 702 occupations observed in depth in the USA during the study, 47% are

under threat [25]. Another study complementing these figures points out that 45% of tasks performed in companies do not require human action, in other words, they can be automated and therefore assigned to AIs [133]. Huang and Rust (2018) estimate that AI will only replace repetitive tasks in every profession [38]. These two figures caused quite a stir. However, in 2016, the OECD offered us a study that corresponds more closely to the reality of the world of work by taking into account that, according to them, not all jobs within a profession are identical, unlike the two previous studies. According to their research, only 9% of occupations are really at risk if we consider only occupations where the employee's tasks are repetitive and more than 70% automatable [118]. This percentage may seem low to you, but if we take the case of France, and the estimate proves to be true, it would represent 2 million more French people out of work. This could turn the fear of technological unemployment from the number one debate into the number one national problem. The OECD study adds that the percentage also depends on the level of education required for the job in question: 40% for those who left school before high school, but only 4% for those with a university degree [118].

Thanks to these studies, we can now approach the role of artificial intelligence in management more calmly, a profession that requires at least 2 years of study after the baccalauréat [119]. So, according to the OECD, it will not be considered a high-risk profession [118]. However, the study is not specifically aimed at this field and may have missed some essential variables. Frey and Osborne (2017) are, on the contrary, more pessimistic, citing a 25% probability that AI will replace managers [25].

What's more, these studies were carried out in 2013, 2015 and 2016 respectively, a period during which AI had not yet really made its appearance in all our lives. As we mentioned earlier, S. Delestre extracted significant results from his study: by 2022, only 50% of companies worldwide will be using artificial intelligence [91].

And even more astonishingly, in 2023, the OECD published a new research paper on the subject, now claiming that 27% of occupations are now at high risk of automation [120]. This 18% difference is indicative of the powerful evolution of AI development capabilities. They clearly exceed the expectations of the international organization. The latter adds that 60% of those surveyed believe they enjoy their work more with the use of AI. And 80% of workers surveyed in industry and finance noted an increase in performance using this technology. However, 60% of the panel in these same two sectors feared losing their jobs in the next ten

years to the automation of their tasks. Thanks to this study, the OECD identifies three main areas for action: equal opportunities in the face of AI, protection and training. Indeed, the organization stresses the need to train everyone in the use of artificial intelligence. It acknowledged that this technology is an integral part of our lives today and should therefore be taught to be used in the best possible way [120].

4.2. Real-life applications

One of the professional fields that has integrated AI the fastest is medical. C. Matuchanski (2019) has studied this sector and its integration of AI in depth. It very quickly placed itself in a supporting role with great success with its precision in terms of analyzing images to extract a diagnosis or prognosis [55]. The human eye cannot see everything, especially at microscopic level. This was such a success that AI then underwent numerous developments to take on more responsibilities. According to Dr. T. Ramolla, head of OR management at the Stuttgart Clinic, his operating department saw more than 4,200 surgeries using AI between November 2021 and May 2022. AI increased the rate of operations that adhered to the established end-to-end plan by 39%. What's more, AI predictions of operation duration are 30% more accurate than human predictions. On average, the duration of each operation was reduced by 6.8 minutes [115]. This represents a considerable change not only in terms of the concentration required of each player, but also the very positive impact on employees' quality of life, in a sector where overtime is the subject of debate [55].

Initially in a support role, AI began to be accepted by the various players in the field thanks to its raw qualities such as real-time data analysis. Once considered and integrated, its rapid assumption of responsibility was successful, bringing its skills to bear on work that was rendered better, and positioning itself as the solution to the delicate subject that was close to employees' hearts: an emotional bond was created [55]. This bond is the cornerstone of the successful integration of AI in a professional environment. It can be reinforced by strong trust in AI. Indeed, as L. Chong & co (2022) have experienced, the vast majority of employees immediately place their trust in AI, but lose it at the slightest mistake. To regain their trust, a long period may be required during which the AI must not make any more mistakes, at the risk of no longer being considered at all by the rest of the team [14]. In other words, we're not talking about a real relationship of trust between man and AI. Shuai Ma & co (2023) go even

further by studying the human's ability to know when to trust the AI and when to privilege his own opinion in decision-making [77].

However, C. Matuchanski (2019) still expresses doubts about the growing importance of AI because, in his view, it is impossible to imagine a world in which AI would be totally autonomous from human assistance. His main reason is the absence of clinical intelligence, represented here by the expertise of surgeons in their direct interactions with patients. He qualifies his statement, however, by not being closed to the idea that AI's place will assume greater importance in the future [55]. A. Bril & co (2017) confirm this position in their article in Medecines/Sciences [11].

4.3. Technical limitations

In addition, some researchers, including Ganascia, find it difficult to envisage a future influence of AI in all fields if we take into account what this technology requires in the way of raw materials.

As mentioned above, AI's computing power relies on GPUs (Ganascia, 2017) [27], composed of silicon, a very abundant material on Earth and not currently considered at risk of shortage. In their view, it is the quality requirements demanded by the constant evolution of AI that could slow down its own progress. Indeed, in GPU production circles, we often use the expression “silicon lottery”: this means that the realization of a so-called perfect GPU is extremely precise. This delta in performance is due to the extreme technical nature of GPU creation, at the very limit of what current human technology can produce. Each GPU is unique, and so is its performance. For two GPUs sold with the same specifications, it may be that one can run your AI with a reaction time of one second, while the other would take more than twice as long. In other words, the big AI companies are only aiming for perfect GPUs [122]. We would therefore already have to make progress in producing quality GPUs to keep up with the famous Moore's Law [79]. E. Brynjolfsson (2017) describes current AI as “weak AI”. Although AI is used extensively by companies, he argues that this is only a pale representation of the true power of AI and that more mature AI will arrive sooner or later [12].

5. The influential relationship between artificial intelligence and the manager

First of all, many researchers are converging on the same conclusion. There are only three possible outcomes to the arrival of AI in the world of work: the job can be totally replaced, improved or remain unchanged (Huang, M-H. & Rust, R.T., 2018) (Wilson, H.J., Daugherty, P.R., 2018) [38, 87].

The arrival of AI is therefore shaking up established managerial codes, forcing this profession to evolve (Malik, A., 2022) [51]. This technology is now an integral part of our daily lives, influencing us unconsciously [106]. As a result, our habits are changing, making it easier to accommodate AI in certain professional sectors. This transition is mandatory, according to Scarcello (2019), as AI will be one of the most important factors in business success [74].

The article by S. Benhamou and L. Janin (2018) considers that there are two likely scenarios in the integration of AI in a professional environment: the gradual diffusion scenario, which advocates a smooth technological transition with a moderate speed of propagation. This would be the subject of a preliminary study on how to implement AI within the given sector or company. If not, he evokes a disruptive AI arrival scenario with a double-edged sword: either the sector's great adaptability and compatibility will enable a lightning transition, or companies will experience severe difficulties and their survival will be jeopardized [6].

The important question is whether the management sector is AI-compatible.

As early as 1933, Keynes had already raised the fear of a drastic rise in unemployment in the United States due to the computer. The automation of many tasks through artificial intelligence is replacing humans on a massive scale. This began with relatively simple tasks such as cashiering, after-sales service or accounting. A complementary study confirms this fear, estimating that 47% of jobs on American soil are at risk of being reached and partially or fully replaced by artificial intelligence (Frey, C.B., Osborne, M.A., 2017) [25].

Every sector of the professional world will be affected in one way or another by AI, and only the scenario it follows will determine whether or not AI will be a major player in this field of activity.

Let's turn now to management, which will be one of the activities most affected, as it is present in almost every major company in today's world.

According to some researchers, it is more a matter of support and complementarity than of major replacement [7, 46, 59, 134]. Managers themselves are open to joining forces on both sides to improve their company's productivity and performance (Amico, R., Thomas, J.R., Kolbjørnsrud, V., 2016) [4]. To take up the idea of S. Benhamou and L. Janin (2018), having

this intellectual curiosity makes it possible to directly begin the technological transition with a progressive serene scenario [6].

Artificial intelligence currently has a number of concrete applications in the professional world, including: task automation, prediction and decision support (ADMAs) (Galaitsi, S.E., 2019) [26], thanks to the study of huge amounts of data; generation, recommendation and personalization; and security [60, 65, 109]. But are they really compatible with the skills required of a manager? Let's take a look at those dictated by Katz (1974) in the following 3 broad categories: technical, conceptual and human [28, 41].

Now we can explore in detail where AI can replace humans in the role of manager.

5.1. A technical manager

According to Katz (1974), a manager needs to have a strong technical understanding of the business he's managing, especially in a field that requires a great deal of knowledge. He has several technical roles within the company: he is more likely to be present as a support to the team and, in the event of a problem, to contribute his experience and knowledge developed beforehand.

This can be quantified in terms of team performance and productivity [121]. These two factors measure the amount of work produced in a fixed period of time.

The influence of AI on employee productivity in the field of software development and business writing has been demonstrated by two studies (Peng, S. & co, 2023) (Shakked, N., Zhang, W., 2023) [61, 76], which report an increase of 126% and 59% respectively thanks solely to the use of AI. It should be noted that in these two experiments, only the use of a generative AI (such as chatgpt) was authorized. An exchange therefore mainly composed of questions and answers, which can be likened to the role of a manager.

But what about the amount of work involved?

To quantify this, the study by S. Noy and W. Zhang (2023) asked specialists to rate the work produced from 0 to 7. The average score with AI was 4.5, compared with 3.8 without [76].

The results are therefore clear: in this field, AI enables us to produce more and better. It should be noted that the first study did not include results on the quality of work rendered [61].

One of the things that the studies have in common, and which may surprise you, is that generative AI reduces the gap between the best-performing employees and those experiencing more difficulties. It is an almost infinite well of skills that can, for example, make up for a lack of experience or knowledge [121]. It reduces the initial gap from two to three points out of seven to a difference of just one point with AI [76]. And reduces the gap by p=0.06 in the study of software developers [61]. Generative AI helps to homogenize the overall level of a team [121].

A manager's role is also made up of administrative tasks, which account for up to 50% of his or her working time [32]. These tasks are generally identical and require no special skills. At the same time, the computing power and speed of artificial intelligence is constantly increasing, making it possible to handle repetitive tasks that require nothing more than discipline, thanks to automation [4]. This feature of AI could save managers precious time. The study by Amico and Kolbjørnsrud (2016) confirms this, with 86% of managers (out of 1,770 surveyed) favoring the idea of working with AI as support for administrative tasks [4]. We call this management by algorithms [47]. Teodorescu & co (2021) add that this automation of tasks by AI will most certainly result in lower costs linked to this new activity, but will also bring with it new constraints for managers, such as monitoring what the AI produces [81]. These skills are seen by Demlehner & Laumer (2021) as a real added value, as AI would enable precisely those tasks to be accomplished that humans are incapable of. However, this brings with it other important changes and will mark the start of a real revolution on the managerial side, such as relying on AI's objectivity on the quality of work, seeing this technology as a colleague and not an enemy, giving more freedom to its creativity as well as further developing its social skills [6, 62]. This may seem surprising, as they argue that the integration of AI into management will not make the profession more automated or emotionless, but rather the opposite: each entity is unique and has its own characteristics, and AI will do just that, freeing up even more of Man's own side in his social activity by taking care of the tasks that prevent him from doing so [6, 62].

5.2. A conceptual manager

The term conceptual evokes a manager's ability to strategically apprehend each complex situation in its entirety, taking into account all the stakeholders involved to find the best solution, and to develop creativity, adaptability and a certain leadership.

Here, then, we are dealing with notions of AI's ability to think. We call this predictive artificial intelligence (Huang, M-H., Rust, R. & Maksimovic, V., 2019) [39]. This facet of AI relies on huge quantities of historical data to successfully predict all possible scenarios and analyze the most likely ones. It can therefore advise the user on the best decision to take, based on the past events it has been able to process. The sector in which this technology is most trusted is market finance. This is a discipline that is very much focused on statistics and patterns of repeating curves, which generally correspond to a sell or buy signal. Predictive AI in this environment relies on all historical trends to detect an explanation for its pacing, and then applies it live to predict the stock market price. These tools are known as trading robots (Mathur, M. & co, 2021) [53]. This is a field that is strongly based on the financial aspect, and each error or hesitation can represent a large sum of money. Indeed, the expression “to err is human” does not apply to a successful algorithm: the precision of the work required of AI is close to perfection [110]. Or at any rate, AI obviously makes mistakes, but once it learns that it's a mistake, it won't make them again. Every field, such as management, that requires major decision-making can be supported by predictive AI. All that's needed is a large database that can be exploited by the AI.

What's more, this technology can prove highly inventive (Reigeluth, T., 2018) [67]. Not least thanks to the arrival of a new class of algorithms that are clearly inspired by the TRIZ methodology (Russian acronym for “Theory of Inventive Problem Solving”). TRIZ is based on a set of concepts for creating contradictions and ideas, with the aim of boosting creativity in any situation. This type of AI is highly flexible in its thinking and highly creative (Akbari, M., 2005) (Norman, D., 2017) [1, 59].

AI decision support can provide a new point of view by studying large datasets, something that humans are incapable of doing on their own. This would offer a different way of thinking, by exploring every probable solution very quickly and extracting the best ones: we could call it brainstorming, and it would lead the team in question to make better choices [4, 5, 8, 59].

This is what S. Akter & co (2016) address in their study [3] and Krcil (2020) sums it all up by announcing close collaboration between AI and the manager in decision-making [45].

In the current literature, the relationship between artificial intelligence and leadership is the subject of many divergent opinions. We will therefore break down these opinions into three categories as suggested by T. Titareva (2021) [82]. And thanks to Yukl's (2012) article, we can divide leadership into fifteen forms to refine our research [89].

5.2.A. Prospects for improvement and collaboration

AI and humans are complementary in the notion of leadership in business, and can improve current results (Young, J., Cormier, D., 2014) [88].

As a result of his research, Jones (2018) manages to clearly dissociate the evolution of our environment through AI and leadership, which remains unchanged. He considers that human leadership is different from that which an AI can have [40]. De Jong (2020) goes even further, submitting his own conceptual equation for leadership of the future: SFL (Sustainable Future Leadership = AI (Appreciative Inquiry) + AI (Artificial Intelligence) [19]. According to him, leadership will henceforth be made up of AI as an aid to in-depth understanding of the increasingly complex world around us, while emphasizing values, cooperation and creativity within the company. While aware of the evolving performance of AI, citing leading companies in this sector, De Jong (2020) concludes that certain human singularities such as imagination, empathy, understanding etc. will never be achieved by AI, which is purely logical [19]. Artificial intelligence has not yet reached emotional intelligence, claims Smith and Green (2018) [79]. What is certain is that AI-manager collaboration directly leads to a decline in the power granted to managers (Lee, M.Y., Edmondson, A.C., 2017) [48]. Some researchers (Nahavandi, S., 2019) even speak of a phenomenon called Industry 5.0, focused on the synergy between humans and robots. They redefine future industries by focusing on the social needs of individuals rather than the continuous development of systems [8, 10, 59]. To meet this challenge, managers must evolve and acquire skills to be compatible with AI [20], optimizing their effectiveness. From now on, a good manager will also stand out for his or her ability to understand and use AI wisely (Dejoux, C., 2020) [20].

However, as early as 2012, H. A. Samani & co (2012) predicted that a new form of leadership would upset the current state of equilibrium. These AIs were no longer to be seen as mere robots, but rather as future robots with strong decision-making responsibilities [71].

5.2.B. Replacement scenario

This scenario is more clear-cut, as it believes that AI will eventually completely replace humans in the most total form of leadership, especially when it comes to important strategic business decisions. They are generally of the opinion that AI has no technical limits and that, at some point, it will completely surpass the human brain [18, 36, 44]. According to a study by the World Economic Forum (WEF), respondents expect AI to make a striking entry into the highest decision-making spheres of business as early as 2026. Artificial intelligence has thus begun to have such an impact on society and public perception that it is imagined to play one of the most important leadership roles in the world [109]. A far cry from the supporting or helping role present in the collaborative perspective. Harms (2019) analyzes in depth the impact that AI can have on the fifteen forms of leadership described by Yukl (2012). He estimates that only three of them are still unattainable by our current AI skills: network, vision of change and representation. The difference between man and machine is therefore diminishing, in his view [34, 89]. Smith and Green (2018) even warn companies to remain highly flexible to the potential transition of AI into corporate leadership. And that if this happens, they advise going back to the very basics of leadership to mitigate as much as possible the side effects this change may cause [79].

5.2.C. Skeptical perspective

The final category is that of skeptics who believe that AI is just passing through and that its current influence is overrated. De Cremer (2019) is categorical: artificial intelligence as we know it can outperform Man in any field, but only when it focuses on that single field. According to him, taking on a leadership role within a company is still too complex a domain, combining many varied skills that AI cannot manage all at once.

Particularly when it comes to emotions and empathy [18], he adds that the leadership style used in business needs to be calm and responsible: two constraints that make it even harder to imagine an important role for AI in this field [18].

5.3. A human manager

A human manager, according to Katz (1974), is someone who possesses the skills to work effectively with people, creating an environment of cooperation and trust [28, 41].
Human interaction is clearly the focus of this section.
This set of skills is called “Cognitive Technologies”. It is the way in which an AI manages to reproduce the action of thinking and acting like a real human [13].

Kolbjørnsrud & co (2017) consider that AI should focus more on high autonomy: acting, feeling, interacting and understanding the world around it [44]. Demlehner & Laumer (2021) are of the same opinion: the form of AI we know is too rigid, responding and obeying a set of pre-established rules for it to act intelligently. In other words, it doesn't think for itself.

But how far has artificial intelligence really come in exploring the human mind?

First of all, Natural Language Processing (NLP) is one of the great AI developments of recent years. This includes text comprehension, translation, interpretation and emotion analysis [43, 83]. These functionalities enable it to interact with humans or other intelligent robots. The most widely used NLP tool in our society is foreign language translation, led by Google translation, which has evolved from a word-by-word translation method (PBMT) to a current AI-based version to take context into account and provide the most accurate translation possible [123]. The study by Tan & co (2022) analyzed in detail, on a variety of texts (Twitter, IMDB, Sentiment 140...), the performance of a hybrid model resulting from the fusion of two widely used models (roBERTa and LSTM). The results are brilliant, ranging from 89 to 93% accuracy [80]. An excellent, fast translation can also serve to break the distance between members of an international work team.
Empathy and quality of expression are two essential parameters for confirming or refuting our second hypothesis.

The facial recognition capability of AIs [125] is also supported by IDEMA's recent study on the victory of its own AI, 1:N, in the latest NIST FRVT1 test. It achieved 99.88% accuracy on 12 million faces [124].

Reading emotions, however, is one of AI's current challenges. According to MBAMCI, it falls into two main categories: contact (e.g. sensors) and non-contact (text, video, voice etc.). For the purposes of our study, we will focus solely on the second category [127]. S.K. Khare & co (2023) draw up an exhaustive inventory of all the studies on the subject of emotion detection, some of which achieve 100% success in tests (7 times so far) [42]. However, they add a nuance: each test is independent and is only applied to one set of data. The AIs in question will not retain this accuracy in all tests, and certainly not in real life [42]. However, the research article remains optimistic about the future application of AI in the workplace, and cites a number of promising fields (health, education, etc.) [42]. An experiment to detect symptoms of depression in a written conversation was a great success and testifies to the power that AI can have [126].

Indeed, professional relationships are largely based on a spirit of collaboration and trust between each individual.

This is only made possible by the fact that artificial intelligences are becoming better and better at synthesizing human characteristics, such as communication (translation tools) and emotion reading (Affectiva) - crucial qualities for a manager, just like leadership, which is also affected, as these programs can provide in-depth data analysis to help managers make informed decisions at the expense of their own intuitions [49, 88].

6. Managers' perceptions

After this literature review, we can see that one of the overriding factors is the acceptance of artificial intelligence by the key players in our study: managers.

Without it, the manager-IA association will be much harder to make work.

One study confirms this trend: 76% of managers (out of 1,770 surveyed) (Amico, R., Thomas, J.R., Kolbjørnsrud, V., 2016) say they are ready to trust advice from artificial intelligences for important decisions [4]. A year later, Kolbjørnsrud & co (2017) add an important nuance with their study: they managed to uncover a divergent opinion within managers themselves. According to their study, 42% of the most senior managers were completely in favor of the

idea that their work could be monitored and evaluated by an AI, whereas only 15% of managers with less responsibility agreed [44]. This reveals the divisive nature of artificial intelligence, even within a panel with essentially the same characteristics.

A significant case study by J. Young and D. Cormier (2014) goes even further, experimenting with a robot taking on the role of manager in opposition to a human. The results showed that, even though the human enjoyed greater authority, 46% of participants followed the robot to the end. It is important to note that the researchers pointed out a potential internal error in the robot before the end of the experiment to test participants' trust and loyalty to the robot [88]. This is one of the key points to be explored: whether or not humans can consider an intelligent robot as one of their own. If this is not the case, there is little hope of seeing a world in which the two entities can truly coexist, and thus, by the same token, in the world of management.

However, study 1 by Newman (2020) tells us that employees are still more likely to listen to a human manager because they consider themselves unaware of what data a robot has chosen to privilege in coming to its decision: they see this as lacking transparency and impartiality [57]. Here, Newman (2020) addresses a key point in our study: the reliability of the intelligent robot. M.C. Claudy & co (2022) confirm this very detail. However, they note that, in practice, we realize that AIs are more reliable than humans, although we still find it difficult to favor them at our expense [15, 22].

As these last two studies show, opinions are divided. A company includes a great deal of diversity within it, and the fact is that if a company chooses to use AI in its business, all employees must follow this transition regardless of their opinion on the matter. This can create an internal divide.

S. Benhamou and L. Janin's (2018) so-called gradual diffusion scenario would therefore be the most suitable so that both sides of the equation manage to bind a collaborative spirit over time [6].

Layne Thompson, Director of ERP Services at a US Navy IT organization sums it up well: “More often than not, managers think of what they are doing as requiring judgment, discretion, experience and the capacity of improvise as opposed to simply applying rules. And if one of the potential promises of machine learning is the ability to help make decisions, then we should think of technologies as being intended to support rather than replace managers”

[4]. ("More often than not, managers see what they do as requiring judgment, discretion, experience and the ability to improvise, rather than simply applying rules. And if one of the potential promises of machine learning is the ability to help make decisions, then we should consider that technologies are intended to support rather than replace managers.").

In conclusion, the impact of AI on managerial practices is already perceptible, with managers having to adapt to working closely with this constantly evolving technology. This transformation highlights the need for managers to acquire new skills while maintaining a balance between AI use and human nature.

Our exhaustive literature review has enabled us to answer as precisely as possible our problem identified at the start of the dissertation, as well as our four research questions. However, some points remain unexplored, which leads us to set out our hypothesis that will direct our study:

H: How can managers create and maintain a healthy and lasting relationship of trust with artificial intelligence?

To facilitate the empirical study and answer this question, we have extracted four underlying hypotheses that are more easily converted into questions. They represent our four lines of research and will guide our study.

H1: Managers see AI solely as a tool for performance and precision.

H2: Managers see AI as the best way to improve their profession.

These two hypotheses are linked by a model: Total Quality Management (TQM), broken down into six main categories by D. Samson and B. Terziovski. Terziovski (1999). We then decided to reduce them to four, keeping only those compatible with our study.

- People management

- Information use and analysis

- Process improvement

- Strategic planning and quality

What attracts us here is the fact that these two researchers were able to correlate these concepts with company performance [72] as well as with improved managerial practices.

H3: Managers always value their own opinions more than those of AI.

H4: Managers perceive AI as a technology that requires human oversight and guidance to be effective.

Finally, L. Chong & co (2022) have successfully adapted W. Hu & co's (2019) model for quantifying trust in AI. According to them, it is divided into three factors:

- Experience

- Accumulated trust

- Prejudice

According to these researchers, trust is built up experience after experience. They consider that each AI has a greater or lesser bias at the N = 0 stage. However, they will be influenced by the experiences that have occurred: B(N) is not equal to B(N+1) [14, 37].

These concepts will be considered as our measurement variables in the empirical study we are about to present.

Methodology

This study explores managers' perceptions and adaptations to the introduction of artificial intelligence (AI) into management. It examines which companies have already adopted this technology, and which have yet to do so. We have chosen to use a survey to obtain global trends on specific topics. This survey will enable us to relate these trends to our theoretical study and draw relevant conclusions. The results will enable us to confirm or qualify our hypotheses on the impact of AI in management.

Our aim is to collect at least two hundred responses to ensure the most reliable possible interpretation of the data. The panel will be made up of managers only: thanks to the use of a filter question at the start of our survey, we'll be able to collect only the responses of managers, while others will see the questionnaire stop. We are looking for quality profiles to enable us to obtain accurate and consistent results. The number of responses expected is relatively small: we have therefore decided to restrict our study to France. The survey will, of course, be anonymous. However, in order to be able to identify trends and disparities within the panel itself, we were obliged to question each individual in order to draw up several characteristic profiles.

As B. Selznick & co (2022) point out, academic studies are based more on the technology itself than on people and their perceptions of it [75]. Now warned of this drift, we have ensured that our study focuses on managers' expectations, knowledge and perceptions of AI.

The survey includes open-ended questions, true/false questions and MCQs that are divided into three main categories: basic knowledge of AI by our panel, artificial intelligence in management and managers' future projection. It will cover topics such as the role of AI in management, the use of this technology and the relationship of trust between managers and AI. The survey aims to gain a better understanding of current and future issues for managers, highlighting gaps observed in existing literature.

This variety of questions will capture a wide range of perspectives. Participants will be divided into two groups: managers from companies that use AI, and those from companies that do not. We will ensure a balanced number of participants in each group to guarantee fair results.

This study will provide a realistic vision of the introduction of AI into management, and suggest avenues for sound developments in the corporate world. The results, derived from a

quantitative approach, will be presented in the form of statistical graphs for better understanding.

The survey will be distributed via a link sent out via LinkedIn, with a response deadline of April. In the event of a low response rate, we are committed to using specialized platforms that gather relevant profiles, while guaranteeing the impartiality of the results..

Results

1. Introduction

Following our review of the current literature and the identification of four hypotheses, we have created a survey that will enable us to confirm or refute these four lines of research.

It's still early April. So we're well on schedule. We've just finished creating the survey using Google Form, a Google tool that lets us create questionnaires free of charge: our survey is ready for distribution.

2. A look back at the survey data collection phase

Our data collection took place in three distinct stages.

Firstly, via our friends and family: thanks to them, we obtained 43 responses (N = 43). Unfortunately, only fourteen responses (N = 14) could be processed, as the others were not or had never been managers. This is very important, as it gives us an idea of the response rate, which we'll set at 35%. In other words, if we expect 200 responses, we need to plan to question 570 individuals. The survey was circulated among the three companies where I did an internship during my training at the Pôle Léonard de Vinci. We quickly turned to the professional social network LinkedIn, which is full of interesting profiles for our study. Our only option on this platform was to send a private message to these people in the hope that they would reply. The total number of responses we could process was 91 (N = 91). As time was running out and responses were becoming increasingly rare and spaced out, we decided to pursue the third option, which was to use an internet platform specializing in survey responses on a given population segmentation. The only constraint we communicated to the site was that the panel surveyed had to be French or have worked on French soil, to avoid skewing our study. To complete the number of responses already collected, we asked the site manager to propagate it to a panel of three hundred and thirty people, as we had to take into account the rate of negative responses to our filter question on having already been a manager, as well as a certain margin of error so as to only have to propagate it once. We opted for the SurveyMonkey site, one of the most famous in this field, to guarantee a high quality of responses. Responses were received within a few hours of the survey being sent out. Only

those surveyed via SurveyMonkey were paid for their response time. This brought us to a total of two hundred and seven responses (N = 207): the data collection phase is officially closed.

We then devised a python code to bring together our three different Excel files of responses and, at the same time, process the open-ended answers, as some people put dots between each keyword, others spaces or commas: this helps to harmonize the format of responses and thus obtain more meaningful results.

3. Panel presentation

3.1. Main characteristics and variables

We collected data from a panel of 208 managers (N = 208) who had worked in France:

- 52% (N = 105) are men, 44% (N = 87) are women and 4% (N = 8) preferred not to specify.
- 45% (N = 86) of the panel are over 50, 20% (N = 40) are between 32 and 50, 16% (N = 34) are between 24 and 32, 8% (N = 15) are under 24 and 5% (N = 9) are retired.
- 25% of the panel (N = 50) have studied for more than 5 years after the Bac, 55% (N = 111) have a Bac +5, 20% (N = 40) a Bac +3, 4% (N = 7) a Bac +2 and only one person has not continued after the Bac (N = 1).
-

The panel surveyed also shows a wide diversity of business sectors, with a balanced weighting, though dominated by the commercial and technology sectors, with 22% (N = 45) and 21% (N = 43) respectively.

In order to make the best possible use of the questionnaire results, we have identified our categorical study variables, which will serve as the basis for our analyses.

Operational efficiency:

This variable is essential to our study, as it represents the direct influence of AI in management. It is characterized by one of our questions: “Do you think AI can help improve your team's operational efficiency?”

To measure it, we linked it to the following ordinal variables: “How often do you use AI at work?”, “What is your general attitude on AI adoption?” and “How confident are you in AI recommendations?”, which allow us to address every important aspect of the notion of operational efficiency.

To complete our study, we will also link it with the second categorical variable in our study, which is:

Improving management skills:

In the context of our study, AI must play a key role in improving current managerial practices; the opposite would obviously be irrelevant.

This categorical variable becomes quantifiable thanks to the results collected to the question “In your opinion, would the use of AI help you improve your management qualities?” then put in relation to the following two ordinal variables: “How often do you use AI at work?”, “What is your general attitude on the adoption of AI?” as well as the textual variable “What managerial skills do you think you could improve thanks to AI?” and the continuous variable “How long have you worked as a manager?”.

These, then, are our two main measurement variables for dealing with Hypotheses 1 and 2, which were devised with the help of the TQM model by D. Samson and B. Terziovski (1999) [72].

Confidence in AI:

This variable plays a key role in our research. A review of the current literature has enabled us to understand that, without confidence in this technology, the possibility of collaboration between AI and manager is eroded. To explore this point further, we have identified three categorical variables symbolized by the following research questions: “Since the arrival of ChatGPT, have you started to consult the AI to compare your ideas?”, “As a manager, are you in the habit of consulting your team when a decision has to be made?” and finally “How do you react when the AI gives you an answer far removed from your expectations?”. These variables will then be related to the ordinal variables: “How much confidence do you have in the AI's recommendations?” and “In your opinion, how often should safety or control measures check the AI's activity?” in order to extract statistically significant results.

This measurement variable will be used to find answers to hypotheses 3 and 4. The final model co-constructed by L. Chong (2022), W. Hu & co (2019) on trust suggests a more holistic approach to the concept, taking into account accumulated trust, biases and experience [14, 37]. With this in mind, we will use the same variable for H3 and H4, but for different purposes.

Now that we've managed to clearly identify the measurement variables in our study, we can start processing the results on the specialized statistical software SPSS.

Please note that to be able to use SPSS, we had to convert each answer into numbers so that the data collected could be analyzed. Beforehand, we had ordered our proposed answers in our questionnaire so as to always have negative responses first and then positive ones. In other words, an average response of 3.5 on a question with four choices corresponds to a very high average with very favorable responses.

3.2. Their knowledge of artificial intelligence

The panel surveyed therefore comes from a variety of professional sectors: so it's not surprising to find that 45% of the sample claim to have touched any form of AI for the first time after 2021. It's worth noting that it's very often the same AI names that are cited first, as evidenced by 75% of responses containing ChatGPT, in an open-ended response asking respondents to name three AIs they know. More generally, 85% of responses are generative AIs: Gemini, Copilot, Midjourney or Mistral. NLP (Natural Language Processing) AIs [43], which are generally familiar from translation tools, with Google Translate and Deepl topping the list with 26% of occurrences. Voice assistants such as Google's Alexa and Apple's Siri complete the podium (22%).

We can also note that 12% of responses are incorrect and are not considered AI at all. These are generally names of companies in the technology field (Apple, Microsoft) or digital objects (phones, computers).

Figure 1. word cloud.

The larger the font size, the greater the number of occurrences.

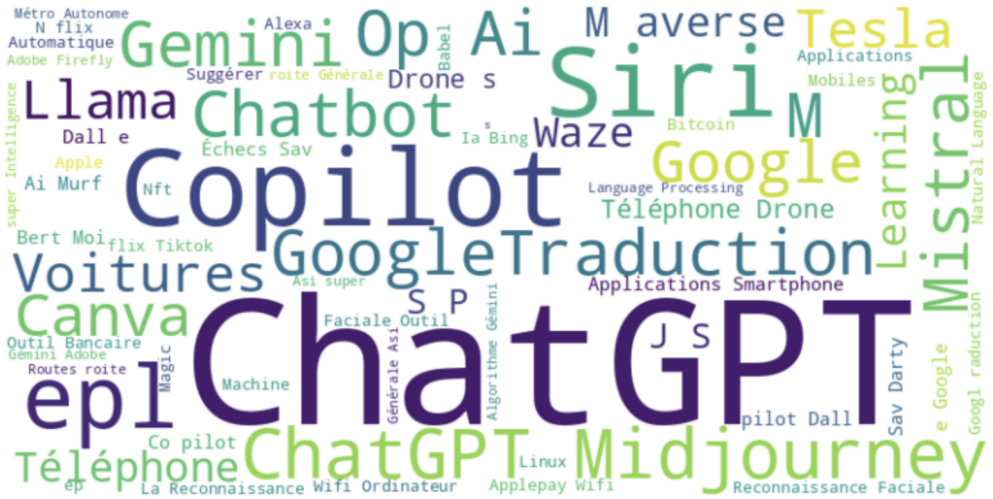


Figure 1 was created using the Python libraries pandas, wordcloud and matplotlib. Beforehand, we cleaned up the column of answers by removing as many extraneous words or characters as possible, as well as different formats for the same answer, and kept only the best quality answers. This enabled us to easily identify the words that best define artificial intelligence in France: ChatGPT: 156 times Copilot: 26 times Siri: 21 times out of a population of N = 208. The aim here is to gauge the level of awareness of a sample of the population on the subject of artificial intelligence. By specifying that the interlocutor was a child, all technical words were removed from the answers.

Most of the answers were coherent, enabling a complete definition of AI to be drawn up, with the most recurrent words: Programming, Robot, Computer, Brain, Imitation. It should be noted that 11% of the panel decided to respond with a constructed sentence that went beyond the five words requested. These responses are impossible to process in a word cloud, but we decided to keep them, as they always contained interesting keywords.

Now that we've laid the foundations of our sample, we can turn our attention to the responses collected, with the aim of confirming or rejecting our hypotheses. To this end, we have downloaded all the responses obtained in an Excel file. However, we had opted to ask our panel a few open-ended questions, but their non-homogeneous format made their analysis more complicated.

We therefore created a Python program to process the data, removing all unnecessary punctuation, transforming each word so that it has a capital letter followed only by lower case, and deleting all definite and indefinite articles. This will enable us to know exactly the occurrences of each word used to extract trends.

Then, to analyze our responses, we'll use IBM's SPSS software to compile all the statistics required for our study.

4. Presentation of results

For our hypothesis 1, which aims to assert or not that managers see AI solely as a tool for performance and precision, we decided to opt for seven variables collected during our questionnaire to find out precisely its ins and outs:

Figure 2: Table showing the different variables used to test Hypothesis 1

Categorical variables	Label	Ordinal variables	Label
"Do you think AI can help improve your team's operational efficiency?"	EfficaciteOpé	"How often do you use AI at work?"	FréquenceUtilisation
"In your opinion, would the use of AI help you improve your managerial qualities?"	AmélioriationIA Management	"What is your general attitude on the adoption of AI?"	OpinionGénérale
"Have you ever used Artificial Intelligence in a professional context?"	Utilisation	"What degree of confidence do you have in AI recommendations?"	DegréConfiance
"What Managerial Competencies Do You Think You Can Improve Thanks To AI?"	CompétencesIA_ GestionTemps		

Figure 3: Means of five variables studied in H1

		Quelle Est Votre Attitude Générale Envers L'adoption De Nouvelles Technologies Comme L'ia ?	À Quelle Fréquence Utilisez-vous Des Outils Ou Des Systèmes Basés Sur L'ia Dans Votre Travail ?	Pensez-vous Que L'ia Peut Aider À Améliorer L'efficacité Opérationnelle (performance Productivité) De Votre Équipe ?	Selon Vous L' utilisation De L'ia Vous Aiderait À Améliorer Vos Qualités De Management ?	Quel Degré De Confiance Avez-vous Envers Les Recommandations Fournies Par L'ia ?
N	Valid	208	208	208	208	208
	Missing	0	0	0	0	0
Mean		2.48	2.57	3.22	2.89	3.06

The five variables we chose have response options ranging from 1 to 4. Their mean values range from 2.48 to 3.22. Our two categorical variables both have a median of 3, showing that the central value of the responses is towards the top of the scale. The standard deviations of these variables are 0.699 and 0.830 respectively, suggesting a moderate, but not excessive, dispersion of the data. EfficaciteOpé, which is of particular interest to this hypothesis, has the highest mean (Mean = 3.22).

We conclude the short overall analysis by examining the binary variable CompetencesIA_TimeManagement, which collected 65% of "Yes" votes.

These basic statistics helped us to approach more serenely the step of searching for correlations between each study variable of the hypothesis.

We then carried out a 1-Way ANOVA test, taking the dichotomous variable Utilisation as the factor and age, gender, sector of activity and experience as the dependent variables. Age and occupational field have a p-value of less than 1%, with F = 29.721 and F = 21.919 respectively. The other two variables show p-values above the accepted correlation threshold.

Figure 4: Correlation table for the three ordinal H1 study variables

		À Quelle Fréquence Utilisez-vous Des Outils Ou Des Systèmes Basés Sur L'ia Dans Votre Travail ?	Quel Degré De Confiance Avez-vous Envers Les Recommandations Fournies Par L'ia ?	Quelle Est Votre Attitude Générale Envers L'adoption De Nouvelles Technologies Comme L'ia ?
À Quelle Fréquence Utilisez-vous Des Outils Ou Des Systèmes Basés Sur L'ia Dans Votre Travail ?	Pearson Correlation	1	.051	.406**
	Sig. (2-tailed)		.467	<.001
	N	208	208	208
Quel Degré De Confiance Avez-vous Envers Les Recommandations Fournies Par L'ia ?	Pearson Correlation	.051	1	-.297**
	Sig. (2-tailed)	.467		<.001
	N	208	208	208
Quelle Est Votre Attitude Générale Envers L'adoption De Nouvelles Technologies Comme L'ia ?	Pearson Correlation	.406**	-.297**	1
	Sig. (2-tailed)	<.001	<.001	
	N	208	208	208

It should be noted that in a statistical correlation, the results are highly significant when the p-value (Sig. (2-tailed)) is strictly less than 0.01. This means that chance has no place, given that the precision is less than 1%. The variables DegreeConfidence (degree of confidence) and FrequencyUtilization (frequency of AI use) are therefore not correlated with each other, since the p-value is 0.467, i.e. greater than 0.01. In contrast, the variable GeneralOpinion (the individual's general attitude towards AI) is highly correlated with the other two variables studied ($p < 0.001$).

The variables GeneralOpinion and FrequencyUse have a Pearson coefficient of 0.406 and a p-value strictly less than 0.01. In contrast, the variables GeneralOpinion and DegreeofConfidence obtained a less significant negative Pearson coefficient of 0.297.

Figure 5: Chi-Square test on our two categorical variables: EfficaciteOpé and Amélioration IA Management

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	215.107[a]	9	<.001
Likelihood Ratio	189.848	9	<.001
Linear-by-Linear Association	103.615	1	<.001
N of Valid Cases	208		

Our two categorical variables therefore have a p-value strictly below 1% on the three different Chi-Square tests. These values are very important, as they will enable us later to interpret our results more precisely. In addition, both variables have a Pearson coefficient value of 215.107 for a Chi-Square test. The higher this coefficient, the stronger the correlation.

To complete our research, we performed a Spearman correlation between the variables DegreeConfidence and EfficaciteOpé to test their dependency. However, the results were not significant, with a p-value of 0.124. We note that the correlation coefficient is negative, reflecting a weak inverse-proportional relationship.

As a result of our study, we can therefore confirm managers' tendency to see AI as a tool for performance and precision. Our first hypothesis is therefore validated.

To address hypothesis 2 of our study, entitled “Managers see AI as the best way to improve in their profession”, we decided this time to work with seven categorical variables, two ordinal, one textual and finally one continuous, which we present below:

Figure 6. Table showing the different variables used to test hypothesis 2

Variables Catégorielles	Label	Type de variables	Variables	Label
“Selon vous, l’utilisation de l’IA vous aiderait-elle à améliorer vos qualités de manager ?”	AméliorationIA Management	Ordinale	“À quelle fréquence utilisez-vous l’IA au travail ?”	FréquenceUtilisation
“Avez-vous La Sensation Que Le Management Actuel Est Adapté Au Monde D’aujourd’hui ?”	ManagementAdaptéMondeActuel	Ordinale	“Quelle est votre attitude générale sur l’adoption de l’IA ?”	OpinionGénérale
“Que Provoque L'IA Chez Vous ?”	IA_Provoque_Curiosité	Continue	“Combien de temps avez-vous travaillé en tant que manager ?”	Expérience
“Selon vous, ressentez-vous le besoin de vous former davantage à l’utilisation de l’IA pour maximiser vos résultats ?”	VolontéFormationIA	Textuelle	"Quelles compétences managériales pensez-vous pouvoir améliorer grâce à l’IA ?”	CompétencesIAPrécises
“Selon Vous Sur Quels Aspects Du Management Une IA Peut Remplacer Complètement Un Manager ?”	IARemplaceAspectManagement			
“Comment Percevez-vous L'impact du manager sur la performance Globale De Votre Entreprise Ou De Votre Équipe ?”	ImpactManagerEntreprise			

“L'utilisation de L'IA Vous Permettrait-elle De Vous Concentrer Sur Des Tâches Plus Stratégiques Ou Créatives ?”	StratégiqueEtCréative			

We were directly interested in a descriptive analysis of our AméliorationIAManagement categorical variable, which has a range of responses from 1 to 4, so its mean of 2.89 and median of 3 are relatively high. What's more, the standard deviation of 0.83 is not excessive and describes fairly homogeneous responses. The other categorical variable in this study, ManagementAdaptéMondeActuel, has a range of responses from 1 to 3 and a mean of 2.56. These two variables were subjected to a Pearson correlation test, which proved to have a p-value of 0.045: the test is therefore significant. We would add that the “Strongly” responses to the question “Do you feel that current management is adapted to today's world?” represent only 5.8% of the total, i.e. N = 12. To better understand the impact of this clear-cut response, we performed a Spearman correlation between CurrentWorldAdaptedManagement and TrainingWillIA : the infinitesimal p-value indicates that it is positively significant. However, it is not related to ImpactManagerEntreprise, with a correlation p-value of 0.212. Whereas 77.4% of managers surveyed consider that their profession has a strong impact on their company's overall performance.

The dichotomous variable IA_Provokes_Curiosity therefore has, by definition, a range of responses from 0 to 1 and an average of 0.51.

The variable IARemplaceAspectManagement is extracted from a multiple-choice question (MCQ), and we first display the response frequencies: 84.2% answered “Technical”, 3.6% “Human”, 55.8% for “Management” and 32.7% for the “Strategy” aspect. We then perform a Pearson correlation with each of the answer choices with the variable TrainingWillIA, which gives us a significant result with all options except that of replacing the human side.

The StrategicAndCreative variable confirms these results, with 81.2% of responses favorable or very favorable and N = 0 of “Not at all”. To take this further, the p-value of the Spearman correlation between StrategicAndCreative and WillingnessToTrainIA is below the 1% error threshold, and the coefficient is 0.531.

With regard to the two ordinal variables, the option of a bivariate analysis was the most coherent to test their correlation and thus verify whether or not managers who use AI are more inclined to discover new intelligent technologies. The statistical results remain highly encouraging, with a p-value strictly below 0.001.

To complete this analysis, we performed an independent Chi-Square test between our AméliorationIAManagement categorical variable and the respondent's sector of activity. Both variables show a significant p-value (<.001) and a very large Pearson Chi-Square coefficient (137.54). We therefore repeated the calculation, adding the option to recover the value of Phi (0.813), which indicates the strength of the correlation and its sign.

In view of the results obtained, we then decided to investigate further by carrying out a One-Way ANOVA. AméliorationIAManagement will be tested here by segmentation variables: gender, age, experience and industry.

Figure 7. Statistical results of the One-Way ANOVA between AméliorationIAManagement and the four following segmentation variables: gender, age, experience and sector of activity.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Quel Âge Avez-vous ?	Between Groups	82.672	3	27.557	19.379	<.001
	Within Groups	290.092	204	1.422		
	Total	372.764	207			
De Quel Genre Êtes-vous ?	Between Groups	4.305	3	1.435	4.473	.005
	Within Groups	65.459	204	.321		
	Total	69.764	207			
Combien De Temps A Duré Votre Expérience Professionnelle En Tant Que Manager ?	Between Groups	16.227	3	5.409	5.167	.002
	Within Groups	213.542	204	1.047		
	Total	229.769	207			
Dans Quel Secteur D' activité Avez-vous Travaillé En Tant Que Manager ?	Between Groups	147.128	3	49.043	6.139	<.001
	Within Groups	1629.636	204	7.988		
	Total	1776.764	207			

The ANOVA table obtained is very interesting: we quickly notice that age and sector of activity offer us a highly significant p-value (<.001). What's more, the F-ratio of these two variables is well above 1, with values of 19.379 and 6.139 respectively. Note that these are the two highest F-ratio values. This indicator is used to assess whether differences between groups are statistically significant.

Based on all the results obtained, we can conclude that managers wish to improve their practices, and that they consider AI to be the best way of achieving this: hypothesis 2 is fully validated.

We are now going to try and draw the best conclusions from the results linked to the search for answers to hypothesis 3, which states: “Managers always attach more importance to their opinions than to those of AI”. To this end, we have chosen six categorical variables and one ordinal variable to put them into perspective.

Figure 8. Table showing the different variables used to test hypothesis 3

Variables Catégorielles	Label	Variable ordinale	Label
“Depuis l’arrivée de ChatGPT, avez-vous commencé à consulter l’IA pour confronter vos idées ?”	ConfrontationIdéesIA	“Quel degré de confiance avez-vous envers les recommandations de l’IA ?”	DegréConfiance
“En tant que manager, avez-vous l’habitude de consulter votre équipe lors d’une décision à prendre ?”	ConfrontationIdées		
“Comment réagissez-vous lorsque l’IA vous donne une réponse éloignée de vos attentes ?”	ReactionMauvaiseRep		
“Avez-vous l’habitude de vérifier les réponses que vous donne l’IA ?”	VérificationRéponsesIA		
“Selon vous, ressentez-vous le besoin de vous former davantage à l’utilisation de l’IA pour maximiser vos résultats ?”	VolontéFormationIA		
" Savez-vous techniquement comment fonctionne une IA ?”	CompréhensionFonctionnement		

To best address the answers to Hypothesis 3, we began by looking at the overall statistics of the categorical variables.

Figure 9. Statistical results of response occurrences for the variable ReactionMauvaiseRep

		Responses		Percent of Cases
		N	Percent	
Reactions_IA[a]	Réaction_Reformulation	85	31.3%	50.9%
	Réaction_RemiseEnQuestion	52	19.1%	31.1%
	Réaction_ChngtInformateur	94	34.6%	56.3%
	Réaction_Colère	20	7.4%	12.0%
	Réaction_Toutes	7	2.6%	4.2%
	_Autre	14	5.1%	8.4%
Total		272	100.0%	162.9%

Given that the ReactionBadRep factor was a Multiple Choice Question, it's quite normal to have a higher total of responses than those obtained previously (272 > 208). We can see that the majority of the panel's reactions were to rephrase the question and change the informant, with 31.3% and 34.6% respectively. An angry reaction, on the other hand, represented only 7.4% of the panel.

Let's take the analysis of ReactionBadRep a step further, by studying Pearson's correlations with the ordinal variable DegreeConfidence, response by response. There is a strong correlation between the responses “Reformulation” and “Questioning”. However, “Anger”, “Change of informants” and of course “Loss of confidence” show p-values between 0.2 and 0.8. Exactly the same results when we challenge the UnderstandingFunctioningIA variable with these five responses.

The VolontéFormationIA variable is dichotomous: either Yes or No. It has a very high mean of 1.83 with a standard deviation of 0.375. The responses of the population questioned are very homogeneous and therefore lean towards Yes.

The ConfrontationIdeasIA and ConfrontationIdeas variables always have a response range from 1 to 4, with the same choices “Not at all”, “Rather no”, “Rather yes”, and “Totally”: this will make it easier for us to compare these two factors. They respectively have a mean of 1.9 and 3.14 and a standard deviation of 1.052 and 0.843.

Then, to benefit from more comparison material, we performed a Chi-Square test between these two variables and the only ordinal variable of H3: DegreeConfidence. This test examines whether there is an association between these variables.

Of the three coefficients returned by the test, Pearson's Chi-Square, the Linear-by-Linear Association and the Likehood Ratio all had p-values strictly below 0.1%. Most importantly, we performed a Chi-Square test between the two variables ConfrontationIdeasIA and ConfrontationIdeas. The results show a very low p-value (<0.001) and a Phi coefficient of 0.618.

To verify the latter two statistics, we ran a bivariate analysis between DegreeConfidence and ConfrontationIdeasIA, which returned very satisfactory p-values (<.001).

To clarify the results obtained, we then checked the correlations between ordinal and categorical variables using Spearman's method. First, we run the test between DegreeConfidence and ChecksAnswersIA , which gives us a significant p-value of 0.03 and a positive correlation coefficient of 0.15. At the same time, we keep the same ordinal variable to check its correlation with the categorical variable TrainingWillIA to determine whether there is a correlation between AI confidence and the need for training. The p-value of this test is 0.058, with a negative Spearman correlation coefficient of -0.131.

Finally, to benefit from all the information available during the interpretation phase, we completed our calculations with an independent T-Test to observe whether there is a difference in confidence in AI as a function of gender.

Note that this type of statistical test can only be carried out on two groups: we had to choose the two most strongly represented genders: women and men. We based our T-Test on a sample of 199 people (N = 199). We note that women have a mean of 2.87, while men have a mean of 3.14. The respective standard deviations are 1.086 and 0.786. According to the T-test, the p-value is significant as it is strictly less than 1%. What's more, Levene's test gives us an F-value of 14.098, which is considered very high.

All this statistical data is very interesting and will enable us to obtain precise interpretations and promising avenues for improvement.

The trends analyzed in our study confirm our hypothesis number 3. However, they also shed light on shadowy areas that deserve to be addressed in another dedicated study. We will, of course, address these in the discussion section.

To address hypothesis 4 of our research, which states that “Managers perceive AI as a technology that requires human oversight and guidance to be effective”, we determined four ordinal and five categorical variables.

Figure 10. Table showing the different variables used to test hypothesis 4

Variables Catégorielles	Label	Variables ordinales	Label
“Comment réagissez-vous lorsque l’IA vous donne une réponse éloignée de vos attentes ?”	ReactionMauvaiseRep	“Quel degré de confiance avez-vous envers les recommandations de l’IA ?”	DegréConfiance
“Quelles sont vos plus grandes méfiances concernant l'IA ?”	MéfianceIA	“Selon vous, à quelle fréquence les mesures de sécurité ou de contrôle devraient-elles vérifier l’activité de l’IA ?”	VérifierIAFréquence
“Avez-vous l’habitude de vérifier les réponses que vous donne l’IA ?”	VérificationRéponsesIA	“Selon Vous Comment L'IA Impacte-t-elle La Sécurité De L’entreprise ?”	IAImpactSécu
“Selon vous, sur quels aspects du management une IA peut remplacer complètement un manager ?”	Aspect_Remplacer_Humain	“Que provoque l'IA chez vous ?”	IA_Provoque_Crainte
“Êtes-vous Capable Actuellement D'imaginer Un Futur Avec Des IA Qui Ont Complètement Remplacé Les Managers ?”	ProjectionIAManagement		

The ProjectionIAManagement variable is of great interest to us, as its responses are very clear-cut: 0% of the panel answered “Yes” and only 14.9% said “Rather yes”. It therefore has a mean of 1.69 and a standard deviation of 0.731.

We then opted for a Pearson correlation analysis between this variable and VérifierIAFréquence and obtained an infinitesimal p-value and a Pearson coefficient of -0.417, indicating a negative relationship between the two factors studied.

Figure 11. Statistical results of response occurrences for the variable MistrustIA

		N	Percent
$Méfiance_All[a]	Méfiance_Opacité	79	19.6%
	Méfiance_Biais	74	18.3%
	Méfiance_PerteControle	89	22.0%
	Méfiance_Fiabilité	52	12.9%
	Méfiance_Sécu	71	17.6%
	Méfiance_Autre	18	4.5%
	Méfiance_Toutes	21	5.2%
Total		404	100.0%

This question, also a MCQ, offers us a total of 404 ticked answers (N = 404). The number of occurrences of the answers “Opacity”, “Bias”, “Loss of control” and “Security” ranged from 17.6% to 22.0%.

We then performed a bivariate analysis between the two ordinal variables DegreeConfidence (test) and VerifyIAFrequency (grouping). The p-value is 0.139 and therefore not significant. Following this result, we had to look for another explanation and correlation for the VerifyIAFrequency variable. We opted for MéfianceIA and compared it with a bivariate analysis.

Figure 12. Spearman's bivariate analysis between the categorical variable MistrustIA and the ordinal variable VerifyIAFrequency.

			Selon vous, à quelle fréquence les mesures de sécurité ou de contrôle devraient vérifier l'activité de l'IA ?	Méfiance_Opacité	Méfiance_Biais	Méfiance_PerteControle	Méfiance_Fiabilité	Méfiance_Sécu	Méfiance_Autre	Méfiance_Toutes
Spearman's rho	Selon vous, à quelle fréquence les mesures de sécurité ou de contrôle devraient vérifier l'activité de l'IA ?	Correlation Coefficient	1.000	.281**	.192**	.279**	.107	.031	.097	.325**
		Sig. (2-tailed)	.	<.001	.005	<.001	.122	.656	.160	<.001
		N	211	211	211	211	211	211	211	211

This analysis enables us to correlate VerifyIAFrequency with the MistrustIA sub-variables corresponding to the different response choices. A significant correlation is present between the VerifyIAFrequency variable and the responses concerning algorithm opacity and bias, as well as loss of human control over AI, as they have a p-value below 5%, the accepted error threshold. Moreover, their respective Spearman correlation coefficients are 0.281, 0.192 and 0.279. In contrast, the algorithm reliability and program security variables have too high a p-value.

At the same time, we checked the potential correlation between the ordinal variable VerifyIAFrequency and the categorical variable VerifyIAResponses. Spearman's method is the most appropriate given the type of variables studied. We note that the p-value obtained is 0.314, clearly above 5%, and the Spearman correlation coefficient is negative.
As a result of our research for Hypothesis 3, we had learned that the variables DegreeConfidence and VerificationAnswersIA are well correlated, a result we will also use for H4.

Finally, we have deliberately chosen two dichotomous and therefore categorical variables: IA_Provokes_Fear and Aspect_Remplace_Human to test whether they are correlated with the ordinal variable VerifyIAFrequency. To do this, the most suitable statistical model is ordinal logistic regression. We observe that the variable Aspect_Remplacer_Humain has an associated p-value of 0.112, and its 95% confidence interval ranges from negative to positive: it therefore contains the 0 in this interval, whereas the variable IA_Provoke_Fear has a totally negative 95% confidence interval and shows us a p-value of less than 1%. We added a correlation to this last variable and DegreeConfidence: once again, we obtain a significant p-value with a Pearson coefficient of 0.23.

The results of our fourth hypothesis are relatively clear and confirm it.

At the end of the questionnaire, we collected data on two open-ended questions dealing with our panel's perceived image of AI. We asked them what were the craziest projects that AI could achieve in two and ten years' time. These questions are designed to provide highly representative information on how each individual feels about the limits of AI. However, the answers cannot be processed statistically, as they are all different in format and length. It

should be noted that 22% of the answers were blank, or meant that the individual was unable to imagine the impact of AI in 10 years' time.

Now that we've carried out a very substantial statistical analysis of our questionnaire results, we can now begin the phase of interpreting these statistics and drawing up current trends in the issues surrounding the place of artificial intelligence in management.

Discussion

1 Panel presentation

1.1. Main characteristics and variables

We collected data from a panel of 208 managers (N = 208) who had worked in France:

- 52% (N = 105) are men, 44% (N = 87) are women and 4% (N = 8) preferred not to specify.

According to a study by M. Davidson and R. Burke (2004), between 24% and 35% of managers in developed countries such as Australia, the UK and Canada were women [17]. A more recent study confirms this inequality, but shows a slight improvement, stating that by 2021 in France, exactly 37% of managerial positions would be held by women [128]. The fact that we obtained approximately the same number of individuals of each gender as in the previous demographic survey is very encouraging for the quality of our panel and our future interpretations.

- 45% (N = 86) of the panel are over 50, 20% (N = 40) are between 32 and 50, 16% (N = 34) are between 24 and 32, 8% (N = 15) are under 24 and 5% (N = 9) are retired.

The age breakdown is fairly honest: a dominance of the “over 50s” was to be expected, as being a manager requires a great deal of practical experience in the field in question. There is therefore a minority of people under 24, as expected. A Valtus study dated 2023 confirms this data, estimating the average age of managers in France at 56.3 years [131].

25% of the panel (N = 50) had more than 5 years' study after the Bac, 55% (N = 111) had a Bac +5, 20% (N = 40) a Bac +3, 4% (N = 7) a Bac +2 and only one person had not continued after the Bac (N = 1).

In France, it is generally expected to have a minimum of two years post-Baccalauréat to be able to work as a manager: over 99% of the panel confirmed this (Thomas, R.) [83].

We can already be very satisfied with the sample surveyed, which seems to faithfully represent the current French management population.

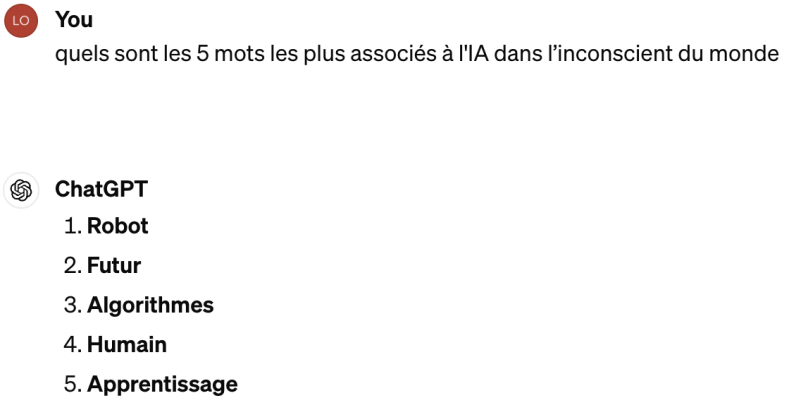
1.2. Their knowledge of artificial intelligence

First of all, it's worth noting that the best-known and most widely used AI is unquestionably ChatGPT. According to a 2023 study by S. Sarkar, this AI alone accounts for 60% of traffic over a ten-month period between 2022 and 2023 worldwide. The number of site visits during this study period is 14.6B, or 1.5B monthly [129]. To give you a comparative example, the Wikipedia site (en.wikipedia.org), the Internet leader in the information available to all sector, attracts 1.1B monthly visitors on average over the last three months (January to March 2024) [130]. Less than ten months after its launch in November 2023, ChatGPT far surpassed it.

ChatGPT's thunderous arrival in our lives is surely the reason why 45% of the sample claim to have touched any form of AI for the first time after 2021. Although its use is democratizing, artificial intelligence retains its very unknown and inaccessible aspect in the eyes of our society. This interpretation is confirmed by an unequivocal result: when asked to name three AIs they know, 85% of answers contain chatGPT. This generative AI has led to the emergence of many other AIs of the same type in everyday life. 85% of responses are generative AIs: Gemini, Copilot, Midjourney, Mistral and, of course, ChatGPT. But what about the other types of AI known to the majority of the panel? So-called NLP (Natural Language Processing) AIs [43], most of which take the form of translation or text processing tools such as Google translation and Deepl, top the list with 15% of quotes. Voice assistants such as Google's Alexa and Apple's Siri complete the podium (8%). To date, these three types of tools represent the AIs that have truly succeeded in establishing themselves as indispensable daily aids to humans: so it's only logical to see them so well represented.

However, we note that 12% of responses are incorrect, and are not considered AI at all. These are generally names of companies in the technology field (Apple, Microsoft) or digital objects (telephones, computers). These responses reflect the difficulty people have in discerning which of the tools that are an integral part of their lives are AI-based.

Figure 13. Conversation with chatGPT.



By analyzing the results obtained in figures 1 and 12, we can easily identify repetitions in the panel's responses and draw up trends. The aim here is to gauge the level of awareness of a sample of the population on the subject of artificial intelligence. By specifying that the interviewer was a child, we were able to remove all technical words from the answers.

The interest of this question lies more in the fact that it provides a complete definition of AI, with the most recurrent words: Programming, Robot, Computer, Brain, Imitation than to see its validity. We were surprised to find that AI returned five words similar or identical to those collected (*Figure 2.*). The panel's image of the AI is therefore more or less representative of reality, confirming our belief that the panel will provide us with sensible answers. Note that 11% of the panel decided to respond with a constructed sentence. Surprisingly, these answers seem less precise, and all focus on explaining a single type of AI rather than its entirety.

This significant difference raises a question: the results of this question are not necessarily representative. Indeed, describing AI as a child does not determine whether the respondent has mastered the term. We should have broken the question down into two parts: the first collecting only the three key words to define AI to a child, and the second a one-sentence definition to an adult.

The next question confirmed our doubts: over 85% of the panel had little or no knowledge of how artificial intelligence actually works. But is it really important to have this skill in order to use it properly? Certainly not. But knowing how to define it is essential.

Let's turn now to the statistical results obtained, and relate them to the literature review and our research hypotheses.

2. Discussion of results

This study required in-depth research to discover how to maintain a healthy and lasting relationship of trust between managers and artificial intelligence.

To do this, our investigation led us down several avenues of exploration: managers see AI solely as a means to performance *(1)*, artificial intelligence is seen by managers as the solution to improving their practices *(2),* managers place more importance on their opinions than on AI recommendations *(3)* , and according to managers, AI needs human supervision and guidance to perform well *(4)*.

First of all, we had to confirm what Kolbjørnsrud & co (2016) considered essential [4]: that AI be adopted by managers, which translates into the need for them to be open, willing and express a strong desire to learn about this new technology. This uncertainty was quickly dispelled by the majority of participants. Not least thanks to the curiosity they felt about the new technology.

This is undoubtedly the source of the increase in the use of artificial intelligence in the workplace, from the 50% estimated by S. Delestre in 2022 to the 68% obtained in our study [91].

In fact, the more a manager uses artificial intelligence in the workplace, the more he or she is in favor of integrating it into the company. It is therefore through its repeated and convincing use that AI will become an indispensable tool in management. This confirms the hypothesis raised by S. Benhamou and L. Janin (2018) of the progressive AI diffusion scenario [6]. This very important phase of patience and adaptation is clearly the most appropriate in this field, where practical experience with AI is still very unbalanced. It depends essentially on the age of the manager. Given that AI is a technology much more widely used by a young or even very young population, it's therefore no surprise that management is a field a little further behind on widespread use of AI in the workplace. The individual's sector of activity is also a very important factor to take into account: it's no surprise that we note the unequal

opportunities for access to AI depending on the company itself. A company operating in technology will obviously be much more savvy about AI, and for the most part will even have various AI tools already integrated into their internal operations. It's worth noting that the commercial sector is very well informed about this technology, and therefore has great potential for growth. Managers working in these areas currently using AI have enabled them to gain skills and clearly stay ahead of those who don't have access to it. We're talking in particular about the education and public services sectors. The latter will also benefit from many future opportunities with AI, but are currently lagging behind.

This gap was also felt when we challenged our participants by asking them to imagine the craziest project that AI could achieve in two and then ten years' time. The most experienced AI experts couldn't come up with an answer, because in 10 years' time, the one And the least experienced left their imaginations wide open, with ideas such as an “AI that stops all wars”, “that finds a vaccine for all existing diseases” or one that “creates life on another habitable planet”.

Who will be closest to reality by 2034? Most certainly the group of the craziest projects, because when we stop putting up barriers and obstacles in our projects, we always arrive at a rationally unreachable place. Especially when it comes to artificial intelligence.

However, these various sectors have no influence on the fact that managers see artificial intelligence (AI) as an essential tool for improving their individual performance and also that of their company, in line with the findings of the study by S. Noy and W. Zhang (2023) [76, 87], which was in the field of IT and business development. This technology enables them to produce higher quality work in greater quantities.

Our sample of managers testifies to a very positive view of AI's ability to improve operational processes and results, affirming its vital role in optimizing teams' present and future performance.

Interestingly, this perception is accompanied by a strong willingness to learn and adapt among our panel of managers. These professionals recognize that their current functions are not fully aligned with the demands of today's professional world, and express the need for some adaptation. They therefore see AI as an essential means of perfecting their professional practices.

94.2% of managers clearly feel this need for evolution, considering that their profession is not adapted to today's world. And the very interesting detail of this percentage is the fact that these same managers express the wish to train in the use of AI.

We can also see that managers want to grow both in terms of skills and influence.

Similarly, a negative correlation is observed between the degree of confidence in AI and the desire for further training in its use. This indicates that managers who have less confidence in AI are also more inclined to feel the need for more training.

In short, they feel that their position has a strong impact on their company's performance, but that their job functions and practices deserve some adjustments and adaptations to be truly effective and productive.

Managers demonstrate a genuine intention to improve, and are therefore ready to begin their own transition to AI-driven management.

But to what extent?

At present, it's impossible for our managers to project themselves into a near future in which their job would be totally replaced by an AI (0%). They even show signs of reluctance, as 84.1% of the panel answered this question in the negative. However, it is interesting to note that, using Katz's (1974) definition of a manager [28, 41], 7.2% or fifteen managers are now able to imagine a world in which managers are totally replaced by AIs. This discrepancy may reflect both a high margin of error and a poor definition of the managerial function.

Thanks to this definition, we can interpret our answers more accurately. The precision with which AI can perform repetitive tasks is, by far, the most important feature for the panel of managers. The latter also consider with great interest the management functions it can provide, as well as any link with the predictive universe as an aid to strategic decision-making.

Although it may sound like it, the fact that AI is taking over a number of tasks has nothing to do with laziness: these clear intentions are simply linked to the desire to keep learning and to practice the most appropriate form of management today.

To measure this, time is clearly the best factor for quantifying performance [121], and managers are well aware of this [4]. So, at this stage, they would prefer to use an intelligent management system based on AI. This tool would enable them to save precious time and be more efficient on other tasks. We're talking here about the technical side of the profession.

80% of the managers in the sample felt that AI would help them focus on their strategic responsibilities. Mainly around the decisions they have to make on a regular basis, which, in their view, have a strong impact on the health of their company. Once again, these same managers demonstrate a willingness to train themselves in order to use AI in a healthy and controlled way.

New skills are emerging, as shown by the appearance of new professions such as AI prompt or prompt engineer, which consist in knowing how to write requests to generative AI (ChatGPT, MidJourney etc...). Two requests to an AI that may seem identical to you will inevitably obtain two different results. Knowing how an artificial intelligence works therefore makes it possible to extract the most accurate results possible [135].

Let's now return to the central point of our research, which is trust.

L. Chong & co (2022) had already pointed this out to us: AI users in the workplace tend to place their full trust in the technology at first, only to experience a phase of immense doubt as soon as the AI malfunctions for the first time. This period is very often fatal, and the bond of trust broken [14].

But what about managers?

Two distinct camps emerge: on the one hand, those with a certain understanding of how AI works, who react calmly and composedly when AI makes a mistake. These managers will decide to rephrase their own question to the AI in order to clarify it and get a more precise answer from it. On the other hand, managers will respond more forcefully when the AI makes a mistake. They will switch informants to websites or forums, get angry or just lose confidence in the AI, which they will no longer want to use again.

All these same individuals have little or no knowledge of how AI actually works.

This confirms the conjecture made by Dr. T. Ramolla (2023), who succeeded in establishing the use of AI in his clinic in Stuttgart. He had opted for a slow transition where each team member could adapt and tame the AI tool. This allowed everyone to experiment at their own pace and gradually build trust [72].

We can therefore identify a very clear trend: the more managers know about the AI tool they are using, the more confidence they have in this technology, and the more willing they are to keep faith in artificial intelligence even when it makes a mistake.

This nuance confirms the study by L. Chong & co (2022) in management and effectively complements it by adding the knowledge dimension [14].

We can also add that female managers tend to trust AI less than men.

What's more, as we mentioned at the start of the literature review, there are several types of manager who can be roughly divided into two broad categories if their management is horizontal or vertical. And the difference lies mainly in communication [30]. This distinction is very important: managers who use a vertical method are much more likely to act the same way with AI, avoiding the confrontation of ideas. They are therefore more reticent and closed to the idea of a robot being given more responsibilities than those of managing repetitive tasks. These behaviors can slow down the progress of AI in management. This is in contrast to those who advocate more horizontal communication, and show a strong desire to include AI in strategic team discussions. M. Pupion and M.Trébucq (2020) reassure us by asserting that future management tends to become increasingly horizontal [33]. Age confirms this: younger people are more likely to take constructive criticism of their own work from an AI. This directly creates distance and makes it more difficult to establish a relationship of trust between the two entities.

In order to maintain our directional line during the four hypotheses, we have not mentioned this during the presentation of our results. However, the responses to the question “In what form would you be most likely to trust AI?” were significant. 82% voted for an interactive screen. So today's managers are not yet ready to face humanoids in the workplace. However, they are now in favor of discovering new forms of AI other than a cat.

All these human cognitive biases are very interesting, because the unknown generates completely different reactions depending on age, gender or life environment. And although AI, thanks in particular to ChatGPT, has made a disruptive arrival in our lives, it is not yet universally accepted.

Although trust is subject to many factors depending on each individual, they are nevertheless virtually unanimous on the fact that it is currently unthinkable that in the near future, robots will have completely replaced managers.

In our literature review, we also raised the fears of certain specialists regarding the potential total replacement of managerial practices by robots. In particular, Frey and Osborne (2017)

predicted a 25% chance of this happening [25]. Managers are therefore absolutely adamant about this eventuality: the human side, mainly represented by leadership, creativity and empathy, is irreplaceable by AI. Only a win-win collaboration for the manager is therefore conceivable, in their view. What's more, managers are currently unable to give an AI a task without coming back to check it once completed. This reaction is perfectly normal. It therefore betrays a clear link between the fear they have of AI and the degree of trust they place in it. Unfortunately, this goes against the very essence of artificial intelligence, which tends to be totally autonomous from human action.

This desire for control expresses, in effect, a lack of confidence in the tool. But it is also an underlying thought of the panel, which confirms that, at present, most people see AI solely in terms of the performance and precision it offers. One of the benefits of using AI is that the work produced by the manager is delivered in a shorter timeframe.

We hope, however, that this is not the only advantage to its implementation in management in people's unconscious, and that its use will serve to develop many other aspects of current managerial practices.

Looking at segmentation variables such as age and industry sector, we found significant differences in how managers view AI as a tool for professional improvement.

For example, younger managers may be more inclined to embrace AI, while those working in particularly high-tech sectors may have a different perception of its usefulness.

Overall, our results clearly indicate that managers see AI as an effective way of enhancing their professional skills and practices. However, this perception may be influenced by various demographic and professional factors, highlighting the need to take these nuances into account when implementing AI in managerial practices.

Despite this, these results will enable companies wishing to organize their technological transition with the incorporation of AI, to use it to make it as smooth and successful as possible.

The fact that women managers seem to have less confidence in AI than men also merits further study. Our results indicate that they are very poorly represented in the technology sector (16%), which, as its name suggests, is the most conducive to the use of AI. The only

other response was the possibility of replacing the human side of the manager with AI, which was unanimously rejected.

Conclusion

Artificial intelligence, one of the hottest topics in recent years, still seems to be gaining momentum. Once a distant dream, artificial intelligence quickly became a reality, with ChatGPT at the top of the list. To say that we used it could arouse embarrassment or even shame, but over time this technology has become an essential part of our lives. It was a major challenge to standardize its use, but what does AI have in store for us now?

It's worth noting that every sector in existence can be targeted! So we opted for one that was close to our hearts, since it's at the heart of our training: we began with a theoretical and documentary analysis of the current and future relationship of influence between artificial intelligence and managers. One of the main aims of the dissertation was to make the subject as comprehensible as possible to a reader with no particular knowledge of AI. However, simply defining AI or explaining how it works can quickly become a real ordeal. An ordeal also experienced by the panel of our study questionnaire, which aimed to discover how managers can create and maintain a healthy and lasting relationship of trust with artificial intelligence. Thanks to this study and our highly representative sample, we have already been able to estimate an increase in the use of AI in management and more generally in companies, reaching 68%. This testifies to the very strong willingness of these same managers to be trained in its use, even though most of them evolve in a world where AI currently has very little place. But they do express a desire for change in their managerial practices, and are aware that this will most certainly involve the use of AI. However, managers are going to require, not least because of their age and sector of activity, a significant transition period of skill-building and homogenization in this field to experiment and establish a solid relationship of trust with AI. This is essential in a world where responsibilities are considerable. This period will also enable us to manage all the adaptations that need to be made to ensure that the collaboration works and lasts.

We were also surprised to find that managers have no particular fear of AI replacing them completely, because they can't even conceive of it.

Our dissertation is therefore a warning against the excessive use of AI and its application, which can quickly turn into a catastrophe [66]. It therefore serves as an orange alert for the key decision-makers and players in the inevitable next technological transition in

management. We have succeeded in identifying one of the crucial points of this operation with the relationship of trust that managers must develop with AI. And we raised the importance of setting up a scenario for the gradual diffusion of AI in management [6].

Despite the satisfaction of the results obtained, our study has certain limitations. Firstly, the generalizability of the results may be restricted by the specific nature of our sample or the methodology used. Indeed, the term “only” used in our first hypothesis merited additional questions to clarify how AI is actually perceived. We opted for a quick response questionnaire to maximize the response rate. What's more, other factors not studied could also influence managers' perceptions of AI, such as their previous experience or training. What's more, the panel we managed to assemble is fairly representative of the French population, but the fact that it includes more than nine business sectors makes the results less precise. What's more, the number (N = 208) did not allow us to divide them by field either, as this would have constituted an unrepresentative sample.

We could also have checked whether the conclusion of an OECD study, which states that employees experience more pleasure at work when using AI, also applied to managers. This could have a significant impact on managers' perceptions and thus directly influence their confidence in AI [84].

A subject as vast as this cannot be covered by a single study. Nevertheless, each study represents an essential and complementary resource for further research. Ours is part of this continuity, building on the methods devised in previous research by D. Samson and B. Terziovski, Katz and L. Chong & co [14, 28, 37, 41, 72]. By improving the study parameters, we could initially obtain results of better quality and precision. Then, to make significant progress in this research into the links of trust between managers and AI, we would advise opting for a practical methodology with a real case of manager-IA. Today's world is not sufficiently warned and aware of the very essence of this mysterious technology: pure future projections in a poorly mastered field can render the results null and void. Following J. Young and D. Cormier's methodology, which pits a manager against an AI-manager, enables us to experiment on a human scale with the scope that AI can have in management [88]. The results are very surprising, and mark a certain departure from more theoretical studies. Humans generally need to practice and learn by doing, and in a field as delicate as trust, a long-term study will be, in our humble opinion, the best solution.

Our study has therefore identified the two main stumbling blocks in the current sustainable and healthy relationship of trust between manager and artificial intelligence, and then analyzed the links and connections between these obstacles.

Our greatest reward would be if this study could contribute to the smoothest and most effective technological transitions in companies that feel ready to take the plunge.

Glossary

Chatbot: A computer program that simulates and processes a human conversation (written or spoken), enabling humans to interact with digital terminals as if they were communicating with a real person.

Fake news: This refers to false information, which is often deliberately falsified.

Nerd: A person who is passionate about science and technology, particularly computing, and devotes most of his or her time to it.

Ethical sciences: Sciences that deal with the principles that regulate action and moral conduct.

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Appendix

List of figures: