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# The impact of artificial intelligence implementation on job satisfaction and its moderation by locus of control

Bárbara Bragard

Dissertation written under the supervision of Cristina Mendonça

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## **Abstract**

**Title:** The impact of artificial intelligence implementation on job satisfaction and its moderation by locus of control

**Author:** Bárbara Azevedo Bragard

Leveraging the great advances in technology, such as robotics, machine learning, and Artificial Intelligence (AI), organizations have been able to optimize processes, improve decision-making, and lower costs. The automated workplace has become an inevitable path, which raises the concern of how employees will react to it and how companies can create a healthy automated work environment. This dissertation aimed to study the relationship between job satisfaction and the use of AI, based on employees' perception of control, and a correlational study was conducted to fulfil this aim. In an online survey, currently employed people were asked to indicate their job satisfaction, then to imagine that they were working with AI, and finally to indicate their job satisfaction again. The results revealed that locus of control is an important variable to explain differences in job satisfaction among people, but it does not influence how much more or less satisfied each person will feel after the introduction of AI in the workplace. This might be due to this research's limitations, which is why more studies need to be conducted before definitive conclusions can be made. The current study, however, already represents a contribution for organizations to start understanding the optimal way to implement AI in the workplace and also serves to foster future exploration of the field.

**Keywords:** artificial intelligence, locus of control, job satisfaction, workplace, automation

## **Sumário**

**Título:** O impacto da implementação de inteligência artificial na satisfação no trabalho e sua moderação pelo locus de controle

**Autor:** Bárbara Azevedo Bragard

Graças aos grandes avanços na tecnologia, como a robótica, a aprendizagem automática e a Inteligência Artificial (IA), as organizações têm conseguido otimizar processos, melhorar a tomada de decisões e reduzir custos. O local de trabalho automatizado tornou-se um caminho inevitável, o que suscita preocupações sobre como os funcionários reagirão e como as empresas podem criar um ambiente de trabalho automatizado saudável. O objetivo desta dissertação era estudar a relação entre a satisfação no trabalho e o uso da IA, com base na percepção de controle dos funcionários, a para alcançá-lo foi realizado um estudo correlacional. Através de um inquérito online, pessoas atualmente empregadas foram convidadas a indicar a sua satisfação no trabalho, depois a imaginar que estavam a trabalhar com IA e por fim, a indicar a sua satisfação no trabalho novamente. Os resultados revelaram que o locus de controle é uma variável importante para explicar diferenças na satisfação no trabalho entre as pessoas, mas não influencia quão mais ou menos satisfeito cada pessoa se sentirá após a introdução da IA no local de trabalho. Isso pode dever-se às limitações desta pesquisa, razão pela qual são necessários mais estudos antes que conclusões definitivas possam ser tiradas. O estudo atual, no entanto, já representa uma contribuição para as organizações começarem a entender a melhor forma de implementar a IA no local de trabalho e também serve para incentivar a exploração futura do campo.

**Palavras-chave:** inteligência artificial, locus de controle, satisfação no trabalho, local de trabalho, automação

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## 1. Introduction

“By far, the greatest danger of Artificial Intelligence is that people conclude too early that they understand it.”

— Eliezer Yudkowsky (2008, p. 1), co-founder and research fellow at the Machine Intelligence Research Institute

Artificial Intelligence (AI) has been delivering several benefits to society and its advances have prompted a new wave of AI development and applications. AI models are becoming more mature and organizations have realized that they can use AI to significantly increase their performance and productivity (Rabelo et al., 2017). Thus, it is safe to say that automation in the workplace is an inevitable path which is why it is of extreme importance for people to have a better understanding of what it represents and what impacts it may have, in order to be prepared for the changes that have already begun and to learn how to take advantage of them.

Nowadays, technology is widely used to make human life and everyday tasks easier (Chowdhury & Sadek, 2012), but it was not overnight that people learned to use it to their advantage. Like everything new, it took a lot of effort, testing, and adaptation to make it work. Skilton and Hovsepian (2018) did an overview of the history of AI. These authors noted that in the 18th century, the industrial revolution made it possible to increase productivity in various sectors by replacing manual labor with machines. Today, these authors consider we are facing an extension of this reality: The machines that currently replace manual tasks are intelligent and independent. The progress made by the previous three industrial revolutions, where steam, electricity, and then electronics took society from mechanical production to mass production and then automation, will be continued by the so-called fourth industrial revolution (Skilton & Hovsepian, 2018). The workplace and its processes are being completely transformed by automation since it is no longer restricted to manufacturing environments and is now permeating a wide range of work domains (Baldauf et al., 2021). This level of advancement that we are heading towards is noted for innovative technologies such as robotics, artificial intelligence, and machine learning (Skilton & Hovsepian, 2018). Over the years, new research branches have risen to allow the current agents to perform activities such as learning, reasoning, negotiating, and self-organizing, which were previously only associated with humans (Skilton & Hovsepian, 2018).

As futuristic as it may sound, AI is already widely present in our lives, from a simple chatbot that helps online customers with their doubts to the perplexing creation of cars that do not need drivers. In organizations, there are numerous ways in which AI is being applied, which include making processes more efficient, optimizing existing products and services, creating new products and services, improving decision-making, and lowering costs (Benbya et al., 2020). However, the more AI develops and explores new fields of action, the more concerns and split opinions arise regarding the interaction between humans and computers capable of thinking like them. As new technologies are rapidly adopted in the workplace, especially robotics and artificial intelligence, the goal of many researchers is to determine what effects they may have on employees.

So far, a large amount of the population seems to be concerned with this rapid pace of technological change and how their lives will be affected (McClure, 2018). According to Autor (2015), the time has never been better for workers with special skills and the right education, since these people can leverage technology to create and capture value. In contrast, the time to be a worker with ordinary skills has never been worse, considering that computers, robots, and other digital technologies are rapidly acquiring these skills and abilities (Autor, 2015). Amidst uncertainty, Oosthuizen (2019) states that the future workforce will be shaped based on complex and changing forces and that there will be a wide range of factors influencing the transition to an automated workplace. Those factors include governmental policy and law and broad trends in consumer, citizen, and employee sentiment, but the speed at which that transition will happen is hard to predict (Oosthuizen, 2019). Lichtenthaler's (2019) study shows that employees prefer to work together with real humans than have digital co-workers, such as robots. However, if a specific use of AI turns out to seem beneficial to them, it is likely for them to show positive attitudes toward AI (Lichtenthaler, 2019). This ambiguous attitude shows that, depending on the situation, the same employee can have positive or negative attitudes toward AI (Lichtenthaler, 2019).

Considering this paradoxical situation and the fact that the interaction and cooperation between humans and AI will be a key driver of competitive advantage in the future, it is imperative for companies to start thinking of ways to implement AI smoothly and successfully, in order to create a healthy automated work environment (Lichtenthaler, 2019) and to keep employees motivated and satisfied. Regardless of the doubts and concerns involving the use of AI in the workplace, one of the few certainties is that employees' job satisfaction will be affected, either for better (Axtell et al., 2002) or worse (Schwabe & Castellacci, 2020). Whether employees will feel more or less satisfied with their jobs may depend on their beliefs regarding

control and on the way they assign responsibility for life events (i.e., their locus of control). This question of how job satisfaction can be affected by the use of AI in the workplace, depending on different perceptions of control, will be addressed in this thesis.

## **2. Literature Review**

### **2.1. Artificial intelligence**

Some words are so frequently used and heard by people that, after creating a general idea of their meaning and internalizing it, it may become hard, or even pointless, to state their definition. This is exactly the case with the word *intelligence*, which plays a vital part in understanding what AI is all about, and has been, for decades, an important topic of debate within the psychological community. Over the last few decades, a number of approaches to defining intelligence have emerged, and, although there is no consensus, most definitions meet Simonton's (2003) view of intelligence as a series of cognitive abilities, such as memory and problem-solving, that enables one to adapt and thrive in an environment of any type (Legg & Hutter, 2007).

The use of the term intelligence to describe machines was first seen in Turing's (1950) work *Computing machinery and intelligence*. What today is known as the Turing test was initially called the imitation game and symbolizes one of the first attempts to test if computers have the ability to think like humans. It consists of an experiment in which the participant needs to distinguish whether a response was given by a human or a machine. Shortly after that, the widely known father of AI, John McCarthy, came up with the term AI and defined it as the science and engineering behind the creation of intelligent machines (McCarthy, 2004). McCarthy (2004) described AI to be similar to computers being used to understand human intelligence, with the difference that AI is not limited to biologically observable methods. In simpler words, AI refers to systems or machines that can perform tasks by understanding human intelligence and that can continuously improve their performance based on the information collected and learned. Different from what many think, AI is not only about simulating human intelligence, but also observing and studying the problems and challenges that the world presents to intelligence and providing solutions that may involve a level of computing far beyond what people can do (McCarthy, 2004).

Depending on the level of intelligence achievable by the machine, AI can be divided into three categories: narrow, general, and super AI (Benbya et al., 2020). According to Dickson (2017), artificial narrow intelligence, also known as weak AI, refers to machines that can simulate human behavior under a specific and limited set of conditions and can perform one

activity at a time. Those activities comprise facial recognition, speech recognition in voice assistants, and recommendations based on users' online activity (e.g., movie recommendations on Netflix). Above narrow AI is artificial general intelligence, which is the level where machines can not only replicate the human mind but also genuinely understand it, and are able to think, learn, and apply their intelligence and skill set to solve complex problems (Dickson, 2017). This type of AI has not yet been achieved, but there is already some progress under study and testing (Benbya et al., 2020). Finally, on the highest and far from becoming a reality level of AI, named artificial superintelligence, machines are more intelligent than humans and, as a consequence, can perform any kind of task significantly better. In addition to understanding human feelings and experiences, super AI systems can also produce and express their own feelings, opinions, and desires, just like humans (Dickson, 2017).

According to Chowdhury and Sadek (2012), the use of AI brings a wide range of benefits, which revolves around knowledge permanency, reliability, cost minimization, life facilitating, and human safety. Knowledge permanency refers to the fact that, if a person who holds crucial knowledge for an organization decides to leave, using AI applications allows the company to incorporate this knowledge and not suffer from its loss with employee termination (Chowdhury & Sadek, 2012). These authors also state that a huge advantage of AI is that its results are based on the highest accuracy and with almost zero chance of errors. This is due to reinforcement learning, which consists of the ability to learn from observable successes and failures and thus increases the reliability of AI's results. The biggest advantage of using AI might be the optimization of tasks and of the time allocated to them (Chowdhury & Sadek, 2012), since it can be used to perform repetitive and time-consuming tasks (Osipov & Ulimova, 2013). It is also pointed out by Osipov and Ulimova (2013) that, on a daily basis, AI works as a life facilitator through commonly used applications such as maps, GPS, and personal assistants (e.g., Siri and Alexa), which both help users find solutions to their issues (e.g., the best route to take or the answer to a question), automatically and without having to think about it. Furthermore, since the decision-making process becomes automated through the use of AI, the solutions to organizations' problems, from the simplest to the most complex ones, are found much more quickly (Chowdhury & Sadek, 2012). Processes and activities with AI are not only more efficient but also safer, as AI can be the one responsible for tasks that are dangerous for human life, such as dealing with harmful substances, extinguishing fires, and others (Osipov & Ulimova, 2013). When talking about costs, implementing AI does require a high investment but, as it increases processes' efficiency, it allows operational cost minimization, which in the long run offsets the initial investment and is highly beneficial (Chowdhury & Sadek, 2012). As

stated in McKinsey Quarterly, those benefits represent typically three to ten times the cost and, therefore, staffing, managing, and leading increasingly automated organizations will become important competitive differentiators (Chui et al., 2015).

It is clear that the use of AI brings numerous advantages to society but, like every innovation, there are also some limitations around it. For example, the methodology behind AI consists of attempts to map relationships between variables in a training data set, which raises concerns about its ability to generalize those relations to situations that might not be properly represented in the data set (Chowdhury & Sadek, 2012). Another downside is that even though AI is capable of providing optimal solutions to any problem, it is hard to have access to and understand the problem and the nature of the solution, which does not allow one to do quick sensitivity analyses (Chowdhury & Sadek, 2012). It is important to remember that machines also make mistakes, and the case of AI is no different, so any slight miscalculation can trigger a series of consecutive problems (Osipov & Ulimova, 2013). Moreover, the use of AI also involves ethical issues which encompass, for example, the problem of attribution of responsibility (Coeckelbergh, 2019). Since technology and machines cannot be treated as responsible moral agents, it is hard to figure out who should be held responsible when there are any problems with the final result provided by AI, such as a recommendation for a company or a car accident caused by an autonomous vehicle. Regarding one of the main concerns when talking about AI implementation, unemployment, there is still no consensus. Some researchers say that unemployment can become a reality if robots start replacing humans in each field of activity (Osipov & Ulimova, 2013) but others share the opinion that “some classes of jobs will be handed over to the ‘immigrants’ of AI and Robotics, but more will have been generated in creative and curating activities as demand for their services grows exponentially while barriers to entry continue to fall. For many classes of jobs, robots will continue to be poor labor substitutes” (Rangaswami, as cited in Pew Research Center, 2014, p. 5). According to an analysis done by McKinsey (Manyika & Sneider, 2018), with the current technology, less than 5% of occupations can become fully automated. However, more than half of occupations could suffer automation of 30% of their constituent activities, which indicates that the current jobs and business processes will need to be significantly redefined and transformed, at least to a certain extent (Manyika & Sneider, 2018).

## **2.2. Job satisfaction**

The job that people have determines their lifestyle, social lives, well-being, and even identity. “When asked a general question, ‘What do you do?’, most people respond with their

job title” (Eid & Larsen, 2008, p. 393). This, added to the fact that approximately one-third of people’s life is spent on work, makes it safe to say that people’s job is one of the most relevant elements in their lives and it is of utmost importance for organizations to have a satisfied workforce.

Despite being a central theme in people's lives, there is still no consensus about the definition of job satisfaction. Many authors have used different approaches to define this concept, but the most commonly used ones are presented as follows: According to Hoppock’s (1935) definition, job satisfaction refers to any kind of association between psychological, physiological, and environmental circumstances that makes people say that they are sincerely satisfied with their jobs. This view emphasizes the influence of internal factors on job satisfaction and argues that, although job satisfaction is also exposed to different external factors, it has more to do with the feelings employees have towards their jobs, which is something internal. After Hoppock, Vroom (1964) came up with a new definition and stated that job satisfaction refers to the affective orientations that individuals have towards the roles they occupy at work. Later, Locke (1969) presented one of the most widely accepted definitions of job satisfaction, which is “the pleasurable emotional state resulting from the appraisal of one’s job as achieving or facilitating the achievement of one’s job values” (p. 1342). Although the definitions have some diverging details, one can see that the central meaning behind job satisfaction relates to the emotional response someone has towards their job conditions and if they are happy or not with it.

A 2015 study by Andrew Oswald found that happiness at work can increase productivity by at least 12%, so one can understand the growing need among companies to assess and invest in the work conditions provided to their employees. To do so, organizations need to find techniques to measure employees' satisfaction with their jobs, and the most common approach is to use questionnaires. Among those questionnaires, the most extensively used measures are the Job Descriptive Index (JDI; Smith et al., 1969) and the Minnesota Satisfaction Questionnaire (MSQ; Weiss, 1967). The JDI is a simple and easily applicable questionnaire that requires participants to reflect on their job in general and on five aspects of their job (work itself, environment with their coworkers, reward system, opportunities for career progression, and guidance/support from superiors) and rate their satisfaction with them. The MSQ has three forms available, namely two long forms (1967 and 1977 versions) and a short form (1967), and can be administered individually or in a group. It is a paper-and-pencil survey that measures the extent to which a job meets vocational needs and values and covers twenty work features in five levels. In the current study, the JDI will be used to measure participants’ job satisfaction.

Regarding the causes of job satisfaction, several theories have been proposed. All of them fall into one of the following three categories: situational, dispositional, and interactive theories (Eid & Larsen, 2008). Situational theories are based on the hypothesis that job satisfaction is determined by the nature of one's job or other factors in the workplace, while the dispositional approach argues that people's disposition is what determines their level of satisfaction with their jobs (Eid & Larsen, 2008). Lastly, interactive theories defend that people will be affected in different ways by the same work conditions (Eid & Larsen, 2008). This is due to the fact that people have different preferences about job features, so their satisfaction with it will only increase if there is a good match between their preferences and the work conditions (Eid & Larsen, 2008). Among the various theories, the most widely recognized ones include Maslow's hierarchy of needs (as cited in Huitt, 2007), Herzberg's motivation-hygiene theory (as cited in Alshmemri et al., 2017), and Hackman and Oldham's job characteristics model (as cited in Ali et al., 2014).

According to Maslow's theory, human needs are divided into five categories: physiological, safety, belongingness, esteem, and self-actualization needs. Before more complex needs (e.g., belongingness and esteem) can be met, essential needs (such as physiological needs and safety) need to be met first. Influenced by Maslow's theory of needs, Herzberg came up with the motivation-hygiene theory, which differentiates motivation (intrinsic) and hygiene (extrinsic) factors of a job. In this view, rather than being opposite ends of the same continuum, job satisfaction and dissatisfaction are distinct concepts, and motivation factors (e.g., pay and benefits, recognition, and achievement) improve job satisfaction, while hygiene factors (e.g., working conditions, job security, interaction with colleagues, and quality of management) reduce dissatisfaction. In 1974, Hackman and Oldham presented their Job Characteristics Model, which argues that certain work and personal outcomes, including job satisfaction, are affected by five core job dimensions: autonomy, feedback, skill variety, task identity, and task significance. Regardless of the different definitions and theories, the great certainty about job satisfaction is that it is negatively correlated to the turnover rate, so as job satisfaction increases, turnover intentions decrease (Tett & Meyer, 1993). It is estimated that the total cost of turnover represents 30% of an employee's annual salary (Cornell University, as cited in Gupta-Sunderji, 2004), which represents a substantial negative financial impact to organizations. Thus, it is understandable why organizations place such a high value on their employees' job satisfaction and why it is such an important topic of research.

### **2.3. Locus of control**

Studies on locus of control became increasingly popular after Rotter's monograph presented the concept from a social learning point of view (Hui, 1982). Rotter's study applies Skinner's (1974) concept of reinforcement, which can be either positive or negative. Positive reinforcement refers to individuals being more likely to use a response in the future if the outcome of that response in the past was favorable, while negative reinforcement states the exact opposite: people are less likely to use a response in the future if the outcome of that response in the past was unfavorable (April et al., 2012).

Locus of control was conceptualized by Rotter (1966) as a disposition to perceive what causes reinforcement (i.e., reward, a favorable outcome, goal accomplishment). In simpler words, locus of control refers to how much someone feels they have control over their own behavior and life events. Individuals are predisposed to an internal locus of control when they perceive that reinforcement is determined by their own behaviors or permanent characteristics and traits. For those individuals, there is a clear and positive correlation between one's behaviors and consequences and between outcome and personal effort (Connolly, 1980), which makes them believe that they are masters of their destiny (Boone et al., 2005). On the other hand, the concept of external locus of control stems from the perception that reinforcement is due to luck, fate, or any other factors beyond one's control (Kormanik & Rocco, 2009). People with an external locus of control show a lack of motivation to change their behavior since they do not see it as a factor with great influence in altering reinforcements (Marks, 1998). Not even when the outcome is positive do people with external locus of control take responsibility for it, but rather see it as a result of factors beyond their control, such as luck, ease of task, or help from someone (Hyatt & Prawitt, 2001).

In 1976, Lefcourt came up with a slightly different approach to define internal versus external locus of control, by using the concept of perceived control, which refers to an individual's belief in controlling one's own actions, influencing one's environment, and/or affecting the outcome of one's life (Lefcourt, 1976, as cited in Wallston et al., 1987). Lefcourt used a simple example to clarify the meaning of perceived control, by stating that, when forced to hear a predictable noise, people can either stop what they are doing and just wait until it stops or prepare themselves for its start and minimize their responses to the noise. Since there is something people can do to minimize the impact of the predictable noise, people are not as helpless as they might think, and it is precisely this sense of being able to do something that is captured by the concept of perceived control. According to Lefcourt, locus of control refers to one's personality being built on one's perception of who has control over life events and the

environment. Bandura's (1977) and Rotter's (1966) social learning theories state that having an internal or external locus of control is not an innate process but instead acquired through a pattern of reinforcements, in which one's "sense of internal control develops through previous social interactions in which one's actions on the environment are reinforced" (Cheng et al., 2013, p. 152).

According to Spector (1982), the study of locus of control is extremely important in the business context since it plays a significant role in explaining how individuals behave in organizations. Studies suggest that there are strong relationships between locus of control and several job-related factors, such as effort, performance, motivation, satisfaction, job perception, compliance with authority, and supervision style (Spector, 1982).

As cited in Spector's (1982) work, Krolick (1979) and Anderson (1977) have shown that shifts in locus of control occur as a result of experience, which shows that the relationship between behavior, experience, and locus of control is a two-way street, as not only locus of control might affect one's behaviors and experiences, it can also be affected by them. Regarding experiences in the workplace and shifts in locus of control, Andrisani and Nestel (1976) found that career success led to greater internality, despite not defining the variables contributing to those shifts.

In the workplace, it is crucial to understand the difference between internal and external locus of control, as it defines how employees approach work, both attitudinally and behaviorally (Ng et al., 2006). According to several studies (Boss et al., 1999; Judge & Bono, 2001; Spreitzer, 1995), employees with an internal locus of control, known as internals, experience a phenomenon called psychological empowerment, which makes them, compared to externals, have stronger confidence that they have control over their work and over the outcomes associated to it. As a consequence, they tend to put more effort into their work and have higher performance. Compared to externals, internals set more difficult goals and have stronger needs for achievement which, aligned with their greater ease to perceive more opportunities at work, explains their higher motivation to obtain desired outcomes (Ganster & Fusilier, 1989; Lefcourt, 1976; Yukl & Latham, 1978).

Moreover, Spector (1982) found that, besides job motivation and performance, internals also show higher levels of job satisfaction and leadership when compared to externals. Due to all the previously mentioned characteristics of internals, it becomes predictable that internal locus of control is positively related to career success (Ng et al., 2006). However, there is also a negative side associated with internal locus of control related to internals' strong belief in and pursuit of personal control. The confidence that they are masters of their destiny and the need

to keep control of their lives causes internals to show less conformity than externals and smaller to no attitude changes when exposed to a persuasive message (Crowne & Liverant, 1963). Biondo and MacDonald (1971) showed that, in addition to being resistant to influence, internals can experience extreme reactions and shift their attitudes in a completely opposite direction when they sense any signs of an attempt to influence them, which might be translated in a certain level to resistance to authority (e.g., to their managers and superiors).

As previously stated, it is crucial to differentiate between internal and external locus of control in the workplace, and for this to be possible, one can resort to some already existing scales, such as Rotter's internal-external (I-E) scale (1966) and the Internal Control Index (ICI) by Duttweiler (1984). The most widely used measure is Rotter's I-E scale, which is a forced-choice questionnaire containing 29 pairs of statements. It is measured with a self-report scale where people need to select a statement from a pair according to the one they agree more with, where one option always indicates an internal locus of control and the other is related to an external locus of control.

Even though Rotter's (1966) scale is widely used, it has been criticized for several factors, such as its low item total-score correlations, multidimensionality, forced-choice format, the inclusion of items that do not represent the construct, and the heterogeneity of the external control orientation (Prociuk & Lussier, 1975). Lefcourt (1976) stated that not only Rotter's but other locus of control measures have shown sufficient defects to make their continued use questionable. This led to the need to develop a new and more sensitive scale that could address those problems (MacDonald, 1973). Amidst this necessity, Duttweiler (1984) came up with the ICI, which consists of a 28-question-long survey in which respondents have to rate their frequency of specific behaviors in certain situations, for example, how frequently one enjoys being in a position of leadership. After reviewing the statistical analyses used in the ICI, it has been shown that it is a stronger and more reliable scale for measuring locus of control than previously developed measures, and thus its use and further development are encouraged (Duttweiler, 1984). For that reason, the ICI will be the scale used in this study to assess participants' locus of control orientation.

#### **2.4. The current study**

The current research aims to study how Artificial Intelligence (AI) is associated with job satisfaction in the workplace, according to different levels of locus of control. This was done by using the scales Job Descriptive Index (JDI; Smith et al., 1969) and Internal Control Index (ICI; Duttweiler, 1984) and by presenting participants with a hypothetical situation in

which they would have to work alongside certain types of AI and express their job satisfaction after imagining those certain types of AI had been implemented. The choice of the scales was based on their simplicity and accuracy to address the constructs. The hypotheses addressed in this study intend to allow prediction of how two different types of employees (low and high in internal locus of control) will have their satisfaction impacted when the workplace becomes broad and strongly automated with the use of AI.

A total of two hypotheses will be tested as part of the study, in an attempt to answer the main research question of whether the introduction of AI in the workplace is related to changes in job satisfaction, depending on employees' locus of control orientation.

As described in the previously presented literature, the introduction of AI in the workplace has many benefits, such as reducing the time employees spend on long tasks (Chowdhury & Sadek, 2012) and sparing them from performing repetitive and dull tasks (Osipov & Ulimova, 2013), providing quicker and more accurate solutions to organization's problem (Chowdhury & Sadek, 2012) and ensuring the safety of workers (Osipov & Ulimova, 2013). As a result of exposure to new technological implementations and their associated advantages, employees feel more satisfied with their jobs (Axtell et al., 2002). In spite of that, the possibility of working with AI also generates some concerns among workers, mainly regarding unemployment. A recent study found that workers' job satisfaction may be negatively affected if they fear that their occupation will be replaced by a smart machine (Schwabe & Castellacci, 2020). Up to this point, one can see that an automated workplace with AI has ambiguous effects on job satisfaction. Even without certainty of the direction of the effect, it becomes reasonable to hypothesize that:

*H1: The introduction of AI in the workplace will change the levels of job satisfaction among employees.*

The scale used to measure participants' job satisfaction, the JDI (Duttweiler, 1984) analyzes six different dimensions of job satisfaction: the people one works with, the work itself, the compensation system, the opportunities for promotion, the type of supervision one receives and, finally, the job in general. For each dimension, a different hypothetical scenario of working with AI was provided, so that participants could have a clearer idea of what a workplace automated with AI could be. So, since participants had to indicate their levels of job satisfaction separately for each of the six aspects of their work and the fact that they were faced with different scenarios of what it would be like to work with AI, it may be the case that introducing AI in the workplace will not have the same effect across all six dimensions of job satisfaction.

As Spector (1982) described, individuals high on internal locus of control believe in and seek personal control and are confident to be masters of their destiny, which is why they tend to show less conformity than externals. As the use of AI in the workplace may be seen by internals as an attempt to influence them, it will probably cause them to shift their attitudes in the completely opposite direction and adopt extreme reactions (Biondo & MacDonald, 1971). It is also proved by the literature that internals have higher levels of leadership than externals (Spector, 1982), so considering the possibility of being supervised by AI, individuals with an internal locus of control may show resistance to and dissatisfaction with working with AI. Thus, I hypothesize that:

*H2: Employees higher on internal locus of control will present, in general, lower job satisfaction when working with artificial intelligence instead of not working with it.*

Locus of control impacts how people behave in their jobs, social environment, and more generally, in life (Ng et al., 2006), so depending on their locus of control orientation, people have characteristics that will make them perform better in some aspects of their lives and less well in others. Employees high on internal locus of control, for example, perform better in terms of social experience, and working actively to establish and maintain positive relationships with others is more common among them than among externals (Ansari, Kapoor & Shukla, 1986; Boss & Ringer, 2000). In contrast, for constantly believing in and seeking personal control, internals tend to show less conformity and more resistance to influence. Because of these personality differences caused by locus of control and the fact that JDI analyzes job satisfaction in six different aspects, I believe that the effect of locus of control may not be the same across all six dimensions of job satisfaction.

### **3. Methodology**

#### **3.1. Research design and strategy**

I aimed to test how the use of AI in the workplace is related to job satisfaction, depending on whether the employee has an internal or an external locus of control. I conducted correlational research in the form of an online survey, through the Qualtrics platform. The reasoning behind this choice was the fact of surveys and correlational studies being the most used approach to conduct quantitative research (Queirós et al., 2017), which corresponds to the field of the research question presented. Furthermore, using a survey provides several benefits, such as convenience for the respondents, ease of data entry and analysis, question diversity, and low administration cost (Evans & Mathur, 2005).

This observational study consisted of three main parts, where firstly it was assessed whether the participants were high or low on internal locus of control. After that, the subsequent two parts were aimed at investigating participants' job satisfaction under two scenarios: satisfaction at their current job and hypothetical satisfaction after the implementation of AI at the job. In both scenarios, participants had the same scale and options for rating their job satisfaction, with the only difference being the scenario description, as in the second scenario the respondents were induced to imagine that they were working with a particular type of AI.

It is relevant to state that all respondents went through the three parts of the questionnaire with no randomization, as this was an observational study with the goal of understanding how job satisfaction changes under different scenarios for each person.

### **3.2. Participants**

Based on a power calculation using G\*Power (Erdfelder et al., 2009) with  $\alpha = .05$  and power = .80, two-tailed, and with a bivariate correlation of medium size ( $r = .30$ ), the recommended minimum sample size for the current study was 84.

The distribution of this study consisted of three different phases. Initially, the questionnaire was shared within my network of people in the labor market, during which approximately 43 responses were obtained. In the second phase, the survey was openly shared on my social networks, with the note that only currently employed people should respond to it. After that, 49 more responses were collected. Counting on the possibility of a large reduction in the number of responses after cleaning the data, to guarantee the ideal amount of 84 participants, I turned to an online crowdsourcing platform called Prolific (<https://www.prolific.co/>), which explicitly informs respondents that they will be monetarily compensated for their participation (Palan & Schitter, 2018). When participants reach the end of the study, they are required to enter in Prolific a code provided by the researcher as proof that they have completed the questionnaire, which combined with a monetary incentive increases the quality of the collected data (James & Bolstein, 1990). Prolific allows the researcher to determine certain characteristics that the participants need to fulfill to take part in the study, which allowed me to select only people who were currently employed to take part in this study.

After this last phase, a total of 133 responses were obtained. This number, however, represents the unclean sample size of the study, which needed to be properly scrutinized to keep only quality data that would effectively contribute to the study. After a manual data cleaning process using Excel, a total of 49 responses were excluded due to poor data quality. Among

these excluded responses, 42 were due to participants that did not answer the survey adequately and left some questions blank or with inconclusive answers, e.g., in a sequence of questions with three possible answers to choose from, selecting the same option consecutively (which for the scales used in the study, indicates lack of attention). The remaining seven participants were not included in the final and cleaned sample because of their indication that they were not currently employed, which automatically directed them to the end of the questionnaire as they could not contribute to this study. Among the final sample, containing 84 respondents, 49% were males, 49% were females and 2% non-binary and people who preferred not to report gender. Respondents were on average 33 years old ( $Min = 20$ ,  $Max = 66$ ,  $SD = 12.78$ ). Regarding their work experience, 36% had been working for more than eight years, 7% between five and eight years, 38% between one and five years, and 19% had one year or less of work experience.

### **3.3. Procedure**

The first page of the questionnaire contained the informed consent, which described the main characteristics of the study, such as a broad description of the aim of the study, the approximate duration, a guarantee of confidentiality and anonymity of the data collected, and an email contact in case participants wanted to ask questions or make any comments. It is important to state that, to prevent bias among participants, no concrete information about the hypothesis of the study was provided.

Initially, participants had to answer some basic demographic questions, such as gender, age, and employment status (Appendix 1). Regarding the employment status, participants had to answer whether they were currently employed or not which would redirect them to the end of the survey if the answer was negative, or to the next two questions if it was positive. The next two questions were about how long they had been employed (multiple choice) and what was their current job. With the demographic questions answered, participants moved on to the second part of the study, which aimed to assess their level of locus of control (Appendix 2). The Internal Control Index (ICI; Duttweiler, 1984) was used for this purpose, and respondents were faced with 28 questions for them to rate their frequency of specific behaviors in certain situations, for example, how frequently they enjoyed being in a position of leadership. In each statement, participants had five options to choose from (“rarely”, “occasionally”, “sometimes”, “frequently”, or “usually”). The result of the ICI could be a number between 28 and 140, with higher numbers indicating that the participant was higher on internal locus of control, lower

values suggesting a lower internal locus of control, and the value 84 (center of the scale) indicating neither high nor low internal locus of control.

After that, participants' job satisfaction was measured using the Job Descriptive Index (JDI; Smith et al., 1969) in two different scenarios. Within the six categories addressed in the chosen scale (the work itself, the environment with their coworkers, the reward system, the opportunities for career progression, the guidance/support from superiors, and the job in general), participants first had to indicate their satisfaction with their current jobs (Appendix 3). After that, a hypothetical scenario was created in which the respondents were asked to imagine that they were working with AI and to indicate their job satisfaction under these new conditions (Appendix 4). Regarding the pay that employees receive, for example, they were asked to imagine that the company they worked for used an automated reward system, operated exclusively by a smart computer. This would make their salary offers and adjustments be automatically managed according to the value that they and their skills added to the company, rather than just based on their profession's base salary in the market. In this scenario, they were also told that depending on how critical their skills were to the organization's success and on how much they were in demand in the market, their salary could suffer an increase or a decrease.

After all these phases, the respondents reached the end of the study, which contained a final acknowledgment of their participation and a brief explanation of the goal of the study.

## **4. Results**

### **4.1. Scale reliability**

The questionnaire developed for this study was based on the Internal Control Index (ICI; Duttweiler, 1984) to assess participants' locus of control and the Job Descriptive Index (JDI; Smith et al., 1969) for their job satisfaction. Even though they were already tested by the literature, I still decided to perform a total of eight reliability analyses in SPSS to test for the scales' Cronbach's  $\alpha$ . Cronbach's  $\alpha$  was chosen since it has been described as one of the most important and prevalent statistics in regard to test construction and application (Cortina, 1993). The Cronbach's  $\alpha$  for the locus of control scale was .85 and the overall job satisfaction scale presented an  $\alpha$  of .96, which is considered a good and an excellent value, respectively (George & Mallery, 2003). Besides testing the reliability of the job satisfaction scale as a whole, each of JDI's six subscales were tested for their reliability. The subscales pay, supervision, and job in general presented good Cronbach's  $\alpha$ s, as they were all greater than .8 (.88, .90, and .90, respectively), and the other three subscales, people, work, and opportunities for promotion, showed excellent  $\alpha$ s (.90, .92, and .92, respectively). When conducting a reliability analysis in

SPSS, it is also relevant to look at the column *Cronbach's  $\alpha$  if item is deleted* from the item-total statistics table, which shows the values of the overall  $\alpha$  if a certain item is excluded from the calculation. The purpose is to find out if Cronbach's  $\alpha$ , and consequently the reliability, increases with the removal of an item. Although some factors in both scales showed an overall  $\alpha$  increase if they were removed from the calculations, this increase was always below .007. Even though this removal would lead to an increment in  $\alpha$ , it would also result in a considerable loss in composite reliability (Raykov, 2007), which added to the low significance of this increment, has made me decide to keep the scales untouched.

#### 4.2. Descriptives and bivariate correlations

To provide a general view of the data and variables of the study, descriptive statistics are presented in Table 1 for locus of control and the six job satisfaction dimensions, both before and after the introduction of AI. After running a one-sample *t*-test with locus of control as the independent variable and considering that the locus of control scale scores range from 28 to 140, with 84 being the middle of the scale, this study's sample was significantly above average in internal locus of control ( $M = 103.81$ ,  $SD = 13.42$ ),  $t(83) = 13.53$ ,  $p = .001$ . Regarding job satisfaction, when comparing the means before (baseline) and after introducing AI, as seen in Table 1, it is visible that there is a decrease in job satisfaction in almost all dimensions. The only exception is opportunities for promotion, which suffers an increase in the AI scenario, when compared to the unchanged one.

Table 1

##### *Descriptive statistics*

Variable	M	SD
Locus of control	103.81	13.42
People baseline	42.95	12.02
Work baseline	37.95	14.65
Pay baseline	33.29	17.67
Promotion baseline	25.07	19.94
Supervision baseline	41.81	13.11
Job in general baseline	41.54	12.24
People AI	35.71	14.55
Work AI	35.61	15.44
Pay AI	33.21	18.82
Promotion AI	37.07	18.33
Supervision AI	34.43	13.88
Job in general AI	37.11	16.90

Note. *baseline* refers to the scenario without artificial intelligence (AI), while *AI* refers to the scenario after the introduction of AI in the workplace.

From the table in Appendix 5, which contains bivariate correlations for all variables of the study, some indications of possible correlations between them can be drawn. Age and employment time present a positive correlation with locus of control,  $r(82) = 0.2, p < .008$  and  $r(82) = .34, p = .002$ , respectively. Since employment time ranges from 0 to 3 (0 = 1 year or less of work experience, 1 = between 1 and 5 years, 2 = between 5 and 8 years, 3 = more than 8 years) and the variable age corresponds to exactly how old participants are, the positive correlation between those two variables and locus of control indicates that older employees are possibly higher on internal locus of control when compared to younger ones, and the same goes for employees with more work experience. Regarding job's technology orientation, it is relevant to remember that this data ranges from 0 to 1, where 0 means less or no technology-oriented job and 1 stands for technology-oriented jobs. With that in mind and looking at its negative correlation with locus of control,  $r(81) = -.24, p = .030$ , it is plausible to state that employees with technology-oriented jobs are the ones with a lower internal locus of control.

Among the different dimensions of job satisfaction, locus of control is positively correlated to work and pay without AI,  $r(82) = .32, p = .003$ , and  $r(82) = .22, p = .045$ , respectively, and work, supervision, and job in general with AI,  $r(82) = .35, p = .001$ ,  $r(82) = .26, p = .018$ , and  $r(82) = .27, p = .014$ , respectively. This could mean that the higher employees were on internal locus of control, the higher is their job satisfaction regarding the work itself and the payment they receive in a normal workplace. In an automated workplace, being higher in internal locus of control appears to be associated with higher job satisfaction with the work itself, the type of supervision one receives, and the job in a general way.

Another interesting correlation to point out is the one between each baseline dimension of job satisfaction is positively correlated to its correspondent AI dimension,  $r$ s ranging between .30 (pay) and .77 (work). This could lead to the conclusion that the more satisfied employees are with their jobs before the introduction of AI in the workplace, the more they will be satisfied after that change. On the other way around, if employees are already unsatisfied with their jobs, the greater the feeling will be when having to work with AI.

### **4.3. Hypothesis testing**

#### **4.3.1. The effect of artificial intelligence on job satisfaction**

According to Hypothesis 1, the introduction of AI in the workplace should change the levels of job satisfaction among employees. To test this hypothesis, I conducted a total of six one-way repeated-measures ANOVAs using SPSS, one for each job satisfaction dimension. For the pay dimension, Table 1 showed that, on average, there were almost no differences in job

satisfaction before ( $M_{\text{baseline}} = 33.29$ ,  $SD_{\text{baseline}} = 17.67$ ) and after ( $M_{\text{AI}} = 33.21$ ,  $SD_{\text{AI}} = 18.82$ ) the introduction of AI in the workplace. The results of the tests of within-subjects effects confirm it and show that job satisfaction concerning remuneration was not significantly affected by the implementation of AI in the workplace,  $F(1, 83) > 0.01$ ,  $p > .05$ .

Job satisfaction regarding opportunities for promotion increases significantly when participants were asked to imagine working with AI ( $M_{\text{AI}} = 37.07$ ,  $SD_{\text{AI}} = 19.94$ ), in comparison to their current job conditions ( $M_{\text{baseline}} = 25.07$ ,  $SD_{\text{baseline}} = 18.33$ ),  $F(1, 83) = 21.13$ ,  $p < .05$ .

For the remaining four dimensions, the effect is the opposite. Participants showed statistically significant lower levels of job satisfaction regarding their co-workers ( $M_{\text{baseline}} = 42.95$ ,  $SD_{\text{baseline}} = 12.02$ ;  $M_{\text{AI}} = 42.95$ ,  $SD_{\text{AI}} = 12.02$ ),  $F(1, 83) = 3.10$ ,  $p < .05$ , the work itself ( $M_{\text{baseline}} = 37.95$ ,  $SD_{\text{baseline}} = 14.65$ ;  $M_{\text{AI}} = 35.61$ ,  $SD_{\text{AI}} = 15.44$ ),  $F(1, 83) = 4.48$ ,  $p < .05$ , the supervision they received ( $M_{\text{baseline}} = 41.81$ ,  $SD_{\text{baseline}} = 13.11$ ;  $M_{\text{AI}} = 34.43$ ,  $SD_{\text{AI}} = 13.88$ ),  $F(1, 83) = 26.417$ ,  $p < .05$ , and the job in general ( $M_{\text{baseline}} = 41.54$ ,  $SD_{\text{baseline}} = 12.24$ ;  $M_{\text{AI}} = 37.11$ ,  $SD_{\text{AI}} = 16.90$ ),  $F(1, 83) = 8.344$ ,  $p < .05$ , after AI was introduced to their work environment. As the results show, the introduction of AI in the workplace causes changes in five of six job satisfaction dimensions, either for the better or for the worse. Since those changes are statistically significant  $H_1$  is accepted.

#### **4.3.2. The effect of locus of control on differences in job satisfaction before and after AI**

The six repeated measures ANCOVA analyses used to test Hypothesis 1 were also used to test the effect of locus of control on differences in job satisfaction before and after introducing AI in the workplace. After  $H_1$  was accepted, it is already known that the introduction of AI by itself has significant effects on job satisfaction. Having assessed participants' levels of locus of control, I have decided to include this variable in the analyses to test if employees higher on internal locus of control would present, in general, lower job satisfaction when working with artificial intelligence ( $H_2$ ). By including locus of control in the ANCOVA, the interaction between locus of control and the difference between job satisfaction before and after AI is also automatically calculated. This means that if there is a significant interaction, locus of control would moderate the impact of introducing AI. After adding locus of control as a covariate in the analyses, the results differ from those previously found, since the differences between job satisfaction before and after AI are no longer statistically significant.

For the people dimension, neither the difference in job satisfaction,  $F(1, 82) = 0.03$ ,  $p > .05$ , nor the locus of control,  $F(1, 82) = 0.77$ ,  $p > .05$ , or the interaction between them are

significant,  $F(1, 82) = 0.60, p > .05$ . This means that locus of control does not have a significant direct impact on how satisfied people feel with their coworkers.

Job satisfaction regarding opportunities for promotion is still higher after the introduction of AI, as concluded in the previous section, but now this difference is only marginal,  $F(1, 82) = 3.10, p < .10$ . Moreover, locus of control is not significant,  $F(1, 82) = 2.69, p > .05$ , nor is the interaction between it and differences in job satisfaction,  $F(1, 82) = 1.15, p > .05$ , meaning that although there is a difference in job satisfaction regarding opportunities for promotion, locus of control does neither have a direct impact on job satisfaction nor on the way people's job satisfaction is impacted by AI.

The differences in job satisfaction before and after participants were asked to imagine to be working with AI were not statistically significant for the work,  $F(1, 82) = 0.89, p > .05$ , pay,  $F(1, 82) = 0.64, p > .05$ , supervision,  $F(1, 82) = 2.06, p > .05$ , and job in general dimensions,  $F(1, 82) = 2.56, p > .05$ . Those differences in job satisfaction were also not significantly related to locus of control. This means that any differences in job satisfaction that participants show when they believe to be working with AI are not affected by their locus of control orientation, so, already at this point,  $H_2$  has no evidence in its favor and is therefore rejected.

However, different from what happens for the dimensions people and opportunities for promotion, the variable locus of control by itself is significant for work,  $F(1, 82) = 11.67, p < .05$ , supervision,  $F(1, 82) = 5.69, p < .05$ , and job in general,  $F(1, 82) = 6.61, p < .05$ , and is marginal for the dimension pay,  $F(1, 82) = 3.34, .05 < p < .10$ . In all four dimensions, locus of control and job satisfaction are positively related, with work ( $b = 11.67$ ) being the dimension that employees show, on average, the highest increase in job satisfaction for every unit increase in locus of control, followed by job in general ( $b = 6.61$ ), supervision ( $b = 5.69$ ), and pay ( $b = 3.34$ ). Considering that in the scale used in this study to measure locus of control, the Internal Control Index, higher scores indicate higher levels of internal locus of control, it becomes clear that the more internal employees are, the more satisfied they will be with the work they do, the supervision and remuneration they receive, and with their job in general. Furthermore, these results reinforce the rejection of Hypothesis 2, since the interaction of locus of control and difference in baseline in comparison with AI job satisfaction was not significant in any analysis, thus being higher or lower on internal locus of control does not appear to differ in how their job satisfaction is impacted by implementations of AI.

Thus, while locus of control has a direct significant (marginal for pay) impact on the satisfaction employees have with their work, payment, supervision, and job in general, the

difference in job satisfaction after the introduction of AI in their workplace is not impacted by locus of control (i.e., locus of control does not moderate the impact of AI implementation, against H<sub>2</sub>).

### 4.3.3. The effect of demographics on the results

After testing the effect of AI on job satisfaction and its relation with locus of control, it becomes interesting to see if any demographic variable can lead to different results. For that purpose, I have conducted another six one-way repeated measures ANCOVA analyses using SPSS, one for each job satisfaction dimension but including not only locus of control as a covariate, but also gender, age, employment time, and job's technology orientation. With the demographic variables included in the ANCOVAs, the differences in job satisfaction before and after participants believed to be working with AI remained not statistically significant for all the dimensions, except for promotion for which it remained marginal. The interaction between these differences and locus of control remains non-significant, as concluded in the previous section.

In contrast, the effect of locus of control on each dimension of job satisfaction changed somewhat after demographic data were included in the analyses. The unchanged cases are for the dimensions people, where locus of control is still non-significant,  $F(1, 77) = 1.13, p > .05$ , and work,  $F(1, 77) = 10.14, p < .05$ , supervision,  $F(1, 77) = 5.44, p < .05$ , and job in general,  $F(1, 77) = 4.71, p < .05$ , in which locus of control remains significant. For those last three dimensions, the relation between job satisfaction and locus of control is still positive, but now, after work ( $b = 10.14$ ), supervision ( $b = 5.44$ ) is the dimension that employees show, on average, the highest increase in job satisfaction for every unit increase in locus of control, and not job in general ( $b = 4.71$ ) as happened in the previous section. The big changes that the inclusion of demographics did to the results were regarding the dimensions of pay and opportunities for promotion. Before, locus of control had no effect on how participants were satisfied with the opportunities for promotion available in their jobs, but now this effect has become marginal,  $F(1, 77) = 3.53, p < .10$ . On the contrary, the effect of locus of control on employees' satisfaction with the remuneration they receive that was previously marginal, became non-significant,  $F(1, 77) = 2.11, p > .10$ . The demographics themselves and their interaction with differences in job satisfaction are not statistically significant, which means that participants' gender, age, experience level, and job's technology orientation do not have a significant direct impact on how much more or less satisfied they feel with their jobs after AI was introduced to

their workplace, but including them in the analyses does alter the previously found results regarding locus of control effect on job satisfaction.

## **5. Discussion**

### **5.1. Research findings and main conclusions**

This dissertation aimed to answer the research question of whether the introduction of AI in the workplace would be associated with changes in job satisfaction, depending on employees' locus of control orientation. As a result of the theoretical parts of this thesis, two hypotheses were developed and tested experimentally.

Hypothesis 1 predicted that the introduction of AI in the workplace would change the levels of job satisfaction among employees. The results showed that job satisfaction in regard to remuneration was not significantly affected by the implementation of AI in the workplace, while participants' job satisfaction with their opportunities for promotion had increased when they believed to be working with AI. In contrast, for the remaining four dimensions, the effect was the opposite. Participants showed lower levels of job satisfaction regarding their co-workers, the work itself, the supervision they received, and the job in general after AI was introduced to their work environment. For those reasons,  $H_1$  was accepted. Despite finding a positive association between locus of control and work, pay, supervision, and job in general, it did not explain differences in job satisfaction regarding opportunities for promotions and people, which makes it clear that locus of control affects job satisfaction dimensions differently, as previously suggested in this study. Previous studies have found that workers' job satisfaction may be negatively affected if they fear that their occupation will be replaced by a smart machine (Schwabe & Castellacci, 2020), which might be one of the reasons why the participants in my study showed lower levels of job satisfaction after the introduction of AI. In contrast, a different study concluded that, as a result of exposure to new technological implementations, employees feel more satisfied with their jobs (Axtell et al., 2002). This, even though contrary to Schwabe and Castellacci's findings, might explain why participants' job satisfaction with their opportunities for promotion had significantly increased when they believed to be working with AI. This contradiction between the two studies might be due to the multidimensionality of job satisfaction, which means that introducing AI in the workplace can have different impacts depending on the dimension analyzed and the type of AI implemented, as described in the current study.

Hypothesis 2 brings another variable into the analysis, locus of control.  $H_2$  proposed to find a relationship between locus of control and job satisfaction, by predicting that employees

higher in internal locus of control would show lower job satisfaction when working with AI compared to not working with it. After analyzing the data, it became clear that locus of control was not a determinant of how much employees would feel more or less satisfied with their jobs after the introduction of AI in their workplace, which led to the rejection of H<sub>2</sub>. Despite this, it was found that locus of control had indeed a direct significant impact (marginal for pay) on the satisfaction employees have with their work, payment, supervision, and job in general. This relation was found to be positive, meaning that the more internal employees are, the more satisfied they will be with the work they do, the supervision and remuneration they receive, and with their job in general. This result regarding the direct effect of locus of control on job satisfaction goes in line with Spector (1982). Taking into account that locus of control was found to be positively correlated with work, pay, supervision, and job in general, but did not explain differences in job satisfaction regarding opportunities for promotion or people, it was concluded that its effects were not the same across all dimensions of job satisfaction. A previous study that focused on the relationships between locus of control and several work outcomes included four specific dimensions of job satisfaction in the analysis that are common to my study: pay, promotion, supervisors, and coworkers (Ng et al., 2006). Its results are in line with part of the results of the current study, since it found that an internal locus of control was positively related to employees' job satisfaction regarding pay and supervision. However, it also concluded that the more internal employees were, the more satisfied they would be with the opportunities for promotion and with their co-workers (Ng et al., 2006), which was not found in the current study, since it found that locus of control does not explain differences in job satisfaction regarding opportunities for promotion or people. Considering that the current study concludes that internals have higher levels of satisfaction in more than half of the dimensions (4/6) and that the comparison study indicates that an internal locus of control is positively related to global job satisfaction (Ng et al., 2006), it is reasonable to state that both studies are in agreement and locus of control is an important factor in predicting job satisfaction.

An extension of the analyses was made to include participants' demographic information to see if these would cause any changes in the results. Including them in the analyses did alter some results regarding locus of control's effect on job satisfaction, more specifically for the dimensions of pay and opportunities for promotion. Before, locus of control had no effect on how participants were satisfied with the opportunities for promotion available in their jobs, but after including demographics in the analyses this effect became marginal. On the contrary, the effect of locus of control on employees' satisfaction with the remuneration they receive, which was previously marginal, became non-significant. However, it was found that the demographics

themselves and their interaction with differences in job satisfaction were not statistically significant, which means that participants' gender, age, experience level, and job's technology orientation did not have a significant direct impact on how much more or less satisfied they felt with their jobs after AI was introduced to their workplace. The same study previously used to compare the current study results used similar demographic information in the analysis (age, gender, job level, and job type) and found that none of them changed the strength of the relationship between locus of control and job satisfaction (Ng et al., 2006). However, including participants' demographic data in the current study did alter the effect of locus of control on two job satisfaction dimensions, which means that, regarding demographics, the two studies are in disagreement.

## **5.2. Implications for academic and managerial contexts**

The current study provides valuable findings for both managerial and academic contexts. Artificial intelligence has been delivering several benefits and its advances have prompted a new wave of AI development and applications. AI models are becoming more mature and organizations have realized that they can significantly increase their performance and productivity (Rabelo et al., 2017). In the workplace, those intelligent technologies can not only perform tasks that were previously assigned to humans but also generate direct interactions with a company's employee (Cascio & Montealegre, 2016). These interactions were already proven to have impacts on employees' satisfaction with their jobs, either for the better (Axtell et al., 2002) or for the worse (Schwabe & Castellacci, 2020). The different levels of satisfaction employees have with their jobs might be explained by their locus of control orientation, which is why it is crucial for organizations to assess if their employees are high on internal or external locus of control, to find the optimal way to implement AI in the workplace, so that not only them but also their employees benefit. By addressing the implications and behavior tendencies associated to different levels of locus of control, this study also allows organizations to understand that their employees have different motivations to work, with internals often being more motivated than externals. Once it is clear how employees usually behave and work depending on their locus of control orientation, it becomes easier for the company to adapt its management style and strategies to motivate and get the best out of all types of employees, meaning that greater managerial and leadership effectiveness can be achieved.

In the academic context, the current study is a valuable extension of existing studies regarding the effect of locus of control on job satisfaction. Studies on differences in job satisfaction caused by locus of control already represent a considerable amount, but none of

them analyze how the introduction of AI in the workplace interacts with these two variables. The use of AI in the workplace is a relatively recent subject of study and, for that reason, there is still no consensus about its impact on employees and on their job satisfaction. The current study provides a detailed analysis of how the introduction of AI affects employees' job satisfaction in six different dimensions, which allows organizations to take assertive measures to mitigate those impacts and create a healthy and successful interaction between human workers and AI. Regarding the interaction between introduction of AI in the workplace, differences in job satisfaction and employees' locus of control, the current study found that locus of control is an important variable to explain differences in job satisfaction among employees, but it has no effect on how much employees would feel more or less satisfied with their jobs after the introduction of AI in their workplace. Since the current study has some limitations, which will be addressed in the next section, it opens doors for future studies to explore the topic and can be used as a basis for results comparison.

### **5.3. Limitations and future research**

It is important to acknowledge that this research has some limitations that should be addressed to guide future studies. The first step is to analyze the possible causes that led to the lack of evidence that locus of control contributes to how more or less satisfied workers will feel when working with AI. One of the scales used in the current study, the Job Descriptive Index (JDI; Smith et al., 1969) is regarded as one of the most rigorous measures in terms of job satisfaction (Roznowski, 1989; Vroom, 1964). However, particularly in the work and co-workers subscales, the JDI shows significant error (Kinicki et al., 2002). For that reason, the question arises if the Minnesota Satisfaction Questionnaire (MSQ; Weiss, 1967) could provide a more accurate measure of employees' satisfaction than JDI. Yet, since there has been an apparent lack of extensive analysis of the MSQ, one cannot conclude that it is indeed superior to JDI (Kinicki et al., 2002). However, since the current study used the JDI and could not find evidence to support the relationship between locus of control and changes in employees' job satisfaction when working with AI, it might be interesting that future studies use other scales, such as the MSQ, to try to find different results.

Secondly, it is worth noting that the scale used to measure locus of control, the Internal Control Index (ICI; Duttweiler, 1984) produces scores ranging from 28 to 140, with 28 representing the least internal participant and 140 the most internal one. The lowest value obtained in the sample of this study was 71 and the highest 129, which shows that the participants were mainly distributed in the upper half of the scale score. This could be one of

the reasons why locus of control had no impact on job satisfaction changes after AI was introduced, because the sample was not representative in regards of employees low in internal locus of control. Thus, it would be highly recommended for future research to use different strategies to recruit participants. One suggestion would be to find a company willing to be studied, so that the researcher could first assess the employees' locus of control and only after that choose its sample, to ensure that the study could cover all locus of control orientations, and not just the most internal ones as the current study does.

Even though some companies are already benefiting from AI, they still represent a relatively small number and therefore not all employees have a clear idea of what working with AI could possibly look like. For this reason, to be able to analyze possible variations in employees' satisfaction after AI was introduced in their jobs, the current study resorted to creating hypothetical scenarios for each JDI sub-scale (for more detail, see Appendix 4). Even though hypothetical decisions appear to be valid based on Kühberger and collaborators' (2002) results, there is not always a perfect match between hypothetical and real decisions (Hertwig & Ortmann, 2001). The hypothetical scenarios created in this study aimed to give employees an idea of what it would be like to work with AI, so that they could reflect on what changes it would cause in their job satisfaction. However, for the results of a hypothetical experiment to be validated, it is necessary to conduct a corresponding real experiment (Hertwig & Ortmann, 2001), which was not done in the current study. The lack of a real experiment might be one of the reasons behind the fact that the locus of control does not explain the differences that exists between job satisfaction before and after the introduction of AI in the workplace. Thus, if future researchers decide to build on the current study and use the created hypothetical scenarios, it would be advisable to add one more final step, which would be to observe the actual behavior of employees before and after the implementation of a type of AI.

Although locus of control is not able to explain how much more or less satisfied employees will feel after the introduction of AI in the workplace, it does have a direct significant impact on some job satisfaction dimensions. The current study found that locus of control is positively related to the JDI's dimensions of work, supervision, pay, and job in general, meaning that the more internal employees are, the more satisfied they will be with the work they do, the supervision and remuneration they receive, and with their job in general. In contrast, no significant impact was found of locus of control on the dimensions of people and opportunities for promotion, meaning that locus of control does not determine how satisfied people feel with their coworkers and their opportunities for promotion. Considering that there was an increase in job satisfaction regarding opportunities for promotion after AI was

introduced in the workplace, it seems that all participants judged the hypothetical scenario as fairer than their current situation, regardless of their locus of control orientation. For job satisfaction with people, however, locus of control was not found to have a significant direct impact and neither were differences in job satisfaction before and after AI significant. This might have happened because, regardless of their locus of control, all participants may have found the hypothetical scenario of working with robots too difficult to imagine in reality and, consequently, could not represent faithfully how they would feel about it. In this sense, it would be interesting for future studies to use different hypothetical scenarios for the two mentioned dimensions, to obtain more accurate results.

## **6. Conclusion**

With the rapid technological advancement and the promising possibilities of using AI in organizations, it becomes crucial to analyze the feasibility of this implementation regarding acceptance by employees. This dissertation represents a promising first step to better understand how employees' job satisfaction will be affected by the introduction of AI in the workplace, depending on how much control they believe to have on their lives (i.e., locus of control). As the current study's results and limitations show, more studies need to be conducted before definitive conclusions are drawn, but the author hopes that the current study can already be able to foster such future exploration of the field.

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## 8. Appendix

### Appendix 1: Demographic questions

What gender do you identify as?

- Male
- Female
- Other \_\_\_\_\_
- Prefer not to say

How old are you? \_\_\_\_

Are you currently employed?

- Yes
- No

How long have you been employed?

- 1 year or less
- Between 1 and 5 years
- Between 5 and 8 years
- More than 8 years

What is your current job? \_\_\_\_\_

### Appendix 2: Locus of control assessment (Internal Control Index)

The Internal Control Index consists of 28 statements regarding daily and hypothetical situations, e.g., “when faced with a problem I \_\_\_\_\_ try to forget it”.

Each statement contains a blank space for which respondents have to choose one of the following options:

1. Rarely (less than 10% of the time)
2. Occasionally (about 30% of the time)
3. Sometimes (About half of the time)
4. Frequently (About 70% of the time)
5. Usually (more than 90% of the time)

For the highly internally oriented statements, the score calculation is as follows:

Rarely = 1 point

Occasionally = 2 points

Sometimes = 3 points

Frequently = 4 points

Usually = 5 points

For the low internally oriented statement, the score calculation is reversed:

Rarely = 5 points

Occasionally = 4 points

Sometimes = 3 points

Frequently = 2 points

Usually = 1 point

After summing everything up, higher results indicate higher internal locus of control orientation.

### **Appendix 3: Job satisfaction assessment (Job Descriptive Index)**

The Job Descriptive Index measures the job satisfaction regarding six aspects: people, work, pay, opportunities for promotion, supervision, and job in general. For each aspect, the respondent is faced with a short description of what he/she has to think about in order to answer the question. After that, participants are asked to read some adjectives (18 for people, work, supervision, and job in general, and 9 for pay and opportunities for promotion) and to select:

- “Yes” if they think that the presented adjective describes that aspect of their jobs;
- “No” if they think that it does not describe that aspect of their jobs;
- “?” if they cannot decide.

For the positive adjectives, the scoring is as it follows:

“Yes” = 3 points

“No” = 0 point

“?” = 1 points

For the negative adjectives, the scoring is reversed:

“Yes” = 0 point

“No” = 3 points

“?” = 1 points

After summing everything up inside each aspect, higher results indicate higher levels of satisfaction with that specific aspect.

#### **Appendix 4: Job satisfaction after introducing AI assessment (Job Descriptive Index)**

The Job Descriptive Index was also used to assess participants satisfaction after the introduction of AI in the workplace. To do so, the same adjectives and scale were used but the descriptions for each of the six aspects were altered, as it is presented below:

##### Changes in People

Imagine that now among your co-workers there are not only humans but also robots, that may or may not look like humans and perform activities much more quickly to optimize the time-task allocation among employees. Keep in mind that the robotic co-workers are also integrated into the work environment, and they may sit at a table right next to you or you may even be allocated to work with them on a project/activity.

How well does each of the following words or phrases describe your work colleagues?

##### Changes in Work

Imagine that now on your job you have access to advanced technology tools to assist you with your daily tasks and optimize the time you spend on them. You can now count on, for example, a digital assistant that helps you schedule meetings and also writes and keeps track of your to-do list for the day, or on a robot that saves you time and energy by analyzing and comparing tons of extensive reports that your manager has asked you to do.

How well does each of the following words or phrases describe your work under these conditions?

##### Changes in Pay

Imagine that now your company's reward system is automated and operated exclusively by a smart computer. The salary offers and adjustments are automatically managed according to the value that you and your skills add to the company, rather than just based on your profession's base salary in the market. In this scenario, depending on how critical your skills are to the organization's success and on how much it is in demand in the market, you may face an increase or a decrease in your salary.

How well does each of the following words or phrases describe your present pay under this circumstance?

### Changes in Opportunities for Promotion

Imagine that you now have a Digital Career Coach: a platform in which you can monitor your career progression. In this platform, you are able to find new job opportunities inside the company, see what skills are required to apply, and get a personalized roadmap of how close you are to it and the steps you should take to have higher chances of conquering it.

How well does each of the following words or phrases describe the opportunities for promotion that you have under these conditions?

### Changes in Supervision

Imagine that now a significant amount of your supervisor's responsibilities have shifted to a robot and he/she only steps in to solve more urgent and serious issues. The robot is now the one responsible for: performance evaluation, feedback (giving and receiving), and decision-making regarding daily issues.

How well does each of the following words or phrases describe the kind of supervision that you get on your job under these circumstances?

### Job in General

Now, please imagine that all the previously mentioned AI technologies have been implemented in your workplace.

How would you classify your job in general?

## Appendix 5: Bivariate correlations

Table 1

*Bivariate correlations*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Gender	-																
2. Age	-.02	-															
3. Employment time	.01	<b>.74</b>	-														
4. Job tech orientation	<b>-.34</b>	<b>-.27</b>	-.14	-													
5. Locus of Control	.20	<b>.30</b>	<b>.34</b>	<b>-.24</b>	-												
6. People baseline	.17	-.09	-.08	.05	.14	-											
7. Work baseline	.05	.14	.14	-.03	<b>.32</b>	<b>.42</b>	-										
8. Pay baseline	.05	.20	.21	-.05	<b>.22</b>	<b>.37</b>	<b>.42</b>	-									
9. Promotion baseline	.03	.01	.06	.12	.21	<b>.38</b>	<b>.51</b>	<b>.47</b>	-								
10. Supervision baseline	.01	.01	.03	.09	.19	<b>.56</b>	<b>.58</b>	<b>.45</b>	<b>.52</b>	-							
11. Job in general baseline	.12	.11	.09	-.04	.21	<b>.50</b>	<b>.73</b>	<b>.44</b>	<b>.57</b>	<b>.70</b>	-						
12. People AI	.07	-.09	-.05	.02	.03	<b>.42</b>	<b>.40</b>	<b>.24</b>	<b>.42</b>	<b>.49</b>	<b>.47</b>	-					
13. Work AI	-.02	.08	.09	-.04	<b>.35</b>	<b>.33</b>	<b>.77</b>	<b>.36</b>	<b>.48</b>	<b>.53</b>	<b>.64</b>	<b>.44</b>	-				
14. Pay AI	-.10	.05	.08	.03	.10	.06	.20	<b>.30</b>	.07	.17	<b>.22</b>	<b>.22</b>	<b>.26</b>	-			
15. Promotion AI	-.02	-.05	-.06	.02	.09	.19	<b>.36</b>	.09	<b>.45</b>	<b>.32</b>	<b>.35</b>	<b>.41</b>	<b>.37</b>	<b>.28</b>	-		
16. Supervision AI	.03	.07	.09	-.05	<b>.26</b>	<b>.27</b>	<b>.50</b>	<b>.25</b>	<b>.43</b>	<b>.53</b>	<b>.50</b>	<b>.50</b>	<b>.62</b>	<b>.45</b>	<b>.40</b>	-	
17. Job in general AI	.08	.13	.05	-.13	<b>.27</b>	<b>.29</b>	<b>.51</b>	<b>.30</b>	<b>.23</b>	<b>.40</b>	<b>.58</b>	<b>.43</b>	<b>.62</b>	<b>.51</b>	<b>.30</b>	<b>.79</b>	-

Note. *baseline* refers to the scenario without artificial intelligence (AI), while *AI* refers to the scenario after the introduction of AI in the workplace. For all values in bold  $p < .05$ .

## Appendix 6: Testing the effect of artificial intelligence on job satisfaction (6 ANOVAs)

Table 2

*Analyses of variance in job satisfaction with artificial intelligence*

Variable	F	df	Sig.
People	21.13	1	.000
Work	4.47	1	.037
Pay	.00	1	.976
Promotion	29.81	1	.000
Supervision	26.42	1	.000
Job in general	8.34	1	.005

## Appendix 7: Testing the effect of locus of control on differences in job satisfaction before and after AI (6 ANCOVAS)

Table 3

*Analyses of covariance in job satisfaction with artificial intelligence considering locus of control*

Variable	Without locus of control			With locus of control			b
	F	df	Sig.	F	df	Sig.	
People	.03	1	.854	.60	1	.440	.77 <sup>a</sup>
Work	.89	1	.348	.46	1	.498	.001 <sup>b</sup>
Pay	.64	1	.425	.66	1	.419	3.34 <sup>c</sup>
Promotion	3.10	1	.082	1.15	1	.286	2.69 <sup>a</sup>
Supervision	2.06	1	.155	.623	1	.432	5.69 <sup>b</sup>
Job in general	2.56	1	.114	1.54	1	.219	6.61 <sup>b</sup>

<sup>a</sup>not significant

<sup>b</sup>marginal ( $p < .10$ )

<sup>c</sup>significant at level .05

## Appendix 8: Testing the effect of demographics on the results (6 ANCOVAS)

Table 4

*Analyses of covariance in job satisfaction with artificial intelligence considering locus of control and demographic data*

Variable		People	Work	Pay	Promotion	Supervision	Job in General
Locus of control	F	.68	1.19	.08	.72	.19	1.47
	df	1	1	1	1	1	1
	Sig.	.412	.280	.780	.399	.661	.230
	b	1.13	10.14 <sup>a</sup>	2.11	3.52 <sup>b</sup>	5.44 <sup>a</sup>	4.71 <sup>a</sup>
Gender	F	.98	1.74	1.63	.47	.15	.31
	df	1	1	1	1	1	1
	Sig.	.326	.191	.205	.497	.697	.582
	b	.94	.05	.33	.02	.00	.32
Age	F	.68	.44	.63	.01	.02	.45
	df	1	1	1	1	1	1
	Sig.	.411	.510	.428	.916	.88	.507
	b	.34	.15	.06	.00	.00	.99
Employment time	F	.60	.04	.001	.50	.05	1.01
	df	1	1	1	1	1	1
	Sig.	.442	.834	.979	.480	.826	.317
	b	.06	.05	.25	.07	.01	.68
Job tech orientation	F	.72	.41	.06	1.65	1.26	.57
	df	1	1	1	1	1	1
	Sig.	.400	.527	.814	.203	.265	.451
	b	.35	.20	.07	1.15	.51	.00

<sup>a</sup>significant at level .05

<sup>b</sup>marginal ( $p < .10$ )