Training strategies and innovation in organizations and employee satisfaction

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TRAINING STRATEGIES AND INNOVATION IN ORGANIZATIONS AND EMPLOYEE SATISFACTION

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Abstract

To date, numerous studies have explored different training strategies in organizations and their impact on employee satisfaction. However, there is limited research that specifically investigates the relationship between these training and development (T&D) strategies and innovation in organizations. Thus, this study aims to contribute to the empirical understanding of training strategies, beyond the traditional and commonly studied approaches, by examining the relationship between technological innovation (TI), management innovation (MI) and employee satisfaction.

Data were gathered from a sample of 413 participants via an online questionnaire. An exploratory factor analysis, descriptive and correlational analyses, along with multiple linear regression analysis, were employed to examine the associations among the variables of interest.

The results indicate that increased investment in online training as T&D practice is associated with a higher likelihood of organizations becoming technologically innovative and management innovative. Similar positive and significative relationships were found for coaching and the utilization of applications, while job rotation demonstrated a strong association with management innovation. On the other hand, face-to-face training has been found to exhibit a weak association with both TI and MI.

In addition to exploring the relationship among the mentioned variables, this present study aims to underscore the importance of recognizing and emphasizing the interaction between T&D and employee satisfaction. It is noteworthy that online training and coaching demonstrate a notably positive and substantial impact on employee satisfaction with the organization's T&D practices. In contrast, face-to-face training, while positive, exhibits a comparatively less significant impact on employee satisfaction. Moreover, the company's initiative towards training also contributes to employees' satisfaction with T&D practices.

Keywords: Training and Development Strategies; Technological Innovation; Management Innovation; Employee Satisfaction; Face-to-face training; Online Training; Coaching

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1. Introduction

"Knowledge is the driver of today's economy."

(Kasraie & Kasraie, 2010, p. 59)

Currently, there are various factors that contribute to the advancement of organizational and national structures (Mikolajczyk, 2022). Knowledge acquisition stands out as one of the critical mechanisms in this regard. Companies and countries recognize the significance of ongoing learning and continuous training to fortify their infrastructures, enabling them to withstand any potential shocks or changes in market dynamics, economic circumstances, or societal transformations. Education plays a pivotal role in promoting knowledge, encompassing teaching activities in schools, universities, and other educational institutions. However, what happens once individuals complete their formal schooling and academic journeys?

This is where organizations come into play. It is widely acknowledged that in order for employees to enhance their value within an organization and continuously update their skills, it is crucial to adopt policies and practices that facilitate and integrate continuous training into the organizational culture. Training and development (T&D) remain a fundamental component for the long-term success and profitability of organizations. Lifelong learning is recognized as a means to enhance and expand workers' competencies in their respective roles (Manresa et al., 2019). Therefore, it is imperative for organizations to recognize the advantages of promoting and providing training opportunities to their employees.

There is limited research examining the influence of, for example, organizational size or industry on T&D decisions, as evidenced by studies such as O'Connell and Byrne (2012). Additionally, studies have shown the impact of corporate strategy, market factors, organizational culture, financial performance, and the regulatory environment on investments in T&D, as demonstrated by Sung and Choi (2018). Building upon Sung and Choi (2018) work on these factors, our study aims to analyse how innovation, specifically technological and management innovation, can affect strategic decision-making in T&D. To conduct this analysis, we will review various T&D strategies, ranging from traditional face-to-face training to the utilization of virtual reality (VR) for training purposes.

As highlighted by Batalla-Busquets and Pacheco-Bernal (2013), training within organizations involves two key stakeholders: the organization itself and the trainees. Therefore, it is essential to consider not only the factors influencing companies' decisions but also the perspectives of the trainees in this context.

The primary objectives of this study are: (1) to assess the impact of innovation on T&D strategies, and (2) to examine the extent to which T&D strategies can enhance employee satisfaction, taking into account the organization's commitment to T&D.

This theme and the chosen approach for the study are highly relevant, as training proves to be a mechanism with a substantial impact (Sorgenfrei & Smolnik, 2016). Nevertheless, there is still room and opportunity for further investigation into this influence, considering it is an area of increasing importance with factors that warrant thorough examination to bridge the existing knowledge gap (Garavan et al., 2010).

Simultaneously, it is imperative to address this topic, not only for its scholarly contribution but also for the guidance it can provide to policymakers within organizations, enabling them to make informed and consistent strategic decisions based on empirical studies, as intended in this research.

While the literature often approaches the theme of training and learning from an educational perspective within school and university environments (e.g., Kasraie and Kasraie, 2010; McGill et al., 2014; Kibuku et al., 2020), it is crucial to explore this subject from the standpoint of the work environment. Thus, this study holds relevance in examining the topic from the perspective of the world of work.

To achieve the stated objectives, a comprehensive literature review will be conducted to explore various T&D strategies, investigate the influence of innovation on T&D, and examine the significance of employee satisfaction. Additionally, a questionnaire will be administered to workers who have participated in T&D programs within their current employing organization. The questionnaire aims to ascertain trainees' perspectives on the impact of (technological and management) innovation on the organization's investment decisions regarding T&D. Furthermore, it seeks to understand how different T&D strategies and the organization's commitment to T&D relates with trainees' satisfaction.

This research proposal is structured into five main sections: the introduction, the literature review, the methodology, the results and the conclusions. The literature review section follows a logical sequence: it begins by providing an understanding of T&D within organizations. Subsequently, it explores the various T&D strategies available today, ranging from traditional approaches to innovative training methods. The review then focuses on the topic of innovation in T&D, especially technological innovation (TI) and management innovation (MI), examining the existing literature on this subject. Finally, it delves into the examination of employee satisfaction with T&D practices. The methodology section outlines the approach adopted to achieve the declared objectives. It encompasses the description of the research design, data collection procedures, and analysis techniques employed. The subsequent section presents the findings of the study, followed by a comprehensive discussion of the results. Finally, the paper concludes by highlighting the main conclusions and contributions of the study, addressing its limitations, and providing suggestions for future research.

2. Literature review

In this section, we will review the state of art applied to the themes of interest to the study.

2.1. Training & Development (T&D)

It is widely recognized that organizations cannot thrive without their human resources. Given the ongoing technological, social, and environmental changes, organizations must equip their workforce with great flexibility to adapt to the evolving needs of consumers, clients, and partners (Anguelov & Angelova, 2022). Training the human resources of an organization is considered essential to ensure not only its survival but also its development and prosperity (Anguelov & Angelova, 2022). Therefore, the focus of this study is on T&D in organizations.

T&D practices in human resource management aim to enhance an organization's capacity to achieve positive outcomes (Ismael et al., 2021). Training contributes to continuous improvement of human abilities and skills, fostering personal development and enhancing interpersonal interactions (Hameed & Anwar, 2018). On the other hand, development involves preparing individuals to tackle future challenges, anticipating demands, and taking a long-term perspective (Anwar & Ghafoor, 2017).

In Portugal, the percentage of enterprises providing training to their employees has increased from 44.1% in 2005 to 75.6% in 2020 (Eurostat, 2022b). However, there is a difference in training rates based on the size of organizations, with smaller companies providing training to a lower percentage of their employees (72.2%) compared to larger companies (90% or more) in 2020. Despite this disparity, the overall trend indicates an upward trajectory in employee training (Eurostat, 2022b).

To ensure the effectiveness of training policies, organizations should consider training as a well-planned corporate policy aligned with strategic goals, rather than an ad hoc activity (Anguelov & Angelova, 2022). Investing in training is viewed as a competitive advantage, as it leads to a skilled workforce that contributes to the organization's success in the marketplace (Salas et al., 2012).

In the context of corporate T&D, different terms are associated with the concept, such as Vocational Education and Training (VET), Lifelong Learning, Adult Learning, and

Continuing Vocational Training (CVT) (Choi et al., 2019; Pilz and Regel, 2021; Terziev, 2019; Beier, 2022; Brion, 2022; Terziev, 2017; Wiss, 2017). In this review, we will focus on CVT, which refers to training procedures aimed at developing or improving existing skills and acquiring new ones (Eurostat, 2022a). In Portugal, the participation rate in CVT programs among employees reached 42.6% in 2020, with higher rates observed in larger companies (56.5% for companies with more than 250 employees) (Eurostat, 2022d). Promoting employee participation in T&D initiatives is crucial.

When designing training activities, organizations should prioritize acquiring specific knowledge that provides unique value and cannot be easily replicated by competitors (Hagemeister and Rodríguez-Castellanos, 2019; Pelucha et al., 2019).

Pelucha et al. (2019) analyzed the effects of public funding on training, especially, the European Social Fund (ESF), in companies in Czech Republic. They combined qualitative technique with quantitative analysis, more especially, through Counterfactual Impact Evaluation (CIE) and Qualitative Comparative Analysis (QCA). The CIE is a method that compares the results of two groups: the control and treatment groups. The control group has not experienced an event and the treatment group has experienced an event, but both have the same characteristics, according to European Commission . The QCA represents the use of "*standard statistical techniques and the quasi-deterministic assumptions*" to analyze different conditions (Pelucha et al., 2019, p. 147). From this methodology, Pelucha et al. (2019) concluded that employee training has a positive effect on earnings per employee. This means that, by providing the employees with more knowledge, it is possible for their productivity to increase and consequently their salary.

The decision-making process regarding T&D can be examined from two perspectives: economic-rational and institutional (Esteban-Lloret et al., 2018). The economic-rational perspective emphasizes how training enhances human capital and skills to improve organizational performance. The institutional perspective considers broader contexts and motivations that go beyond economic considerations, including social acceptance and legitimization of the company in society. Esteban-Lloret et al. (2018) discovered through questionnaires that organizations incorporate employee training not solely for competitive advantages and financial outcomes but also for societal recognition and influence.

Another important aspect highlighted by Hagemeister and Rodríguez-Castellanos (2019) is the need for different management approaches to safeguard investments in trained employees and achieve a return on investment.

2.2. Training & Development strategies

Once the concept of T&D has been introduced, it is essential to explore the various strategies that can be employed to achieve the objectives of this study. In light of the evolving work landscape, characterized by remote and hybrid work arrangements, it is crucial to adapt training practices to meet the changing needs of employees. Glass (2022) suggests that organizations should embrace greater flexibility in their training approaches, particularly considering the growing trend towards online training. Therefore, this study will examine both face-to-face training and online learning strategies, taking into account the shifting preferences and demands of employees.

2.2.1. Face-to-face training

Face-to-face training, also known as in-person training, represents a traditional learning strategy wherein a trainer and trainees engage in direct, physical interaction within the same location. This mode of training enables immediate feedback, interpersonal contact, and collaboration, which can enhance the learning experience (Kirschner et al., 2006). Face-to-face training is recognized as the most effective method for fostering interaction, sharing experiences, conveying emotions, cultivating relationships, offering personalized feedback, assessing skills, and providing guidance to both trainers and trainees (Allal-Cherif et al., 2022). Additionally, it facilitates greater motivation and more comprehensive explanations on the part of course instructors (Batalla-Busquets & Pacheco-Bernal, 2013).

While the effectiveness of face-to-face training has been extensively studied in the context of university-based learning, replicating its efficiency in other training strategies, such as online training, has proven challenging (Salahshouri et al., 2022). Moreover, students tend to prefer face-to-face classes over online lessons (Rodriguez-Ortiz & Moreno-Perez, 2022).

2.2.2. Online training

Online training, also known as distance learning, e-learning, or remote learning, encompasses educational methods delivered remotely with the aid of technology. It allows for self-paced or instructor-led learning, enabling learners to participate in training regardless of their

physical location (Simonson et al., 2019). Online training has the potential to enhance human resources within organizations and can be particularly valuable in unexpected circumstances, as exemplified by the COVID-19 pandemic (Ananchenkova et al., 2019; Davis et al., 2021).

There are two primary types of online training: asynchronous and synchronous. Asynchronous training does not require instructors and participants to be present simultaneously in the same virtual environment. It offers learners the flexibility to set their own schedules and progress at their own pace. Typically, participants have access to course materials and engage in discussion forums at their convenience. In contrast, synchronous training involves real-time interaction between trainers and learners, providing immediate feedback and encouraging communication. This mode often involves live lectures, webinars, or video conferences where participants actively participate in discussions (Simonson et al., 2019).

The profound impact of a global pandemic highlighted the challenges posed by volatility and the need to swiftly navigate uncertain situations. Such shocks can significantly affect businesses, economies, societal behavior, and decision-making processes (Mikolajczyk, 2022). Mikolajczyk (2022) conducted a study to explore how approaches to work changed during the COVID-19 pandemic and found that the current conditions for professionals to engage in lifelong learning are more favorable than ever before. Employees themselves expressed a heightened desire to pursue diverse topics for personal and professional development.

The evolution of training methodologies over time has been accompanied by changing terminologies, as documented by Aparicio et al. (2016). The concept of Computer-Assisted Instruction (CAI) emerged in 1960, referring to the use of computers to address educational and training challenges. Subsequently, terms like Computer-Based Education (CBE) in 1963 and Computer-Assisted Education (CAE) in 1970 gained prominence. In 1983, White introduced the notion of e-learning, defining it as knowledge acquisition through available technological resources such as computers and televisions (White, 1983). Over the years, alternative definitions have emerged, with Gaebel et al. (2014) describing e-learning as all learning and teaching supported by information and communication technologies (ICT).

A blended learning approach, proposed by Singh (2003), combines online training with in-person classes. Other technological innovations in education and training include Massive

Open Online Courses (MOOCs) in 2009 and Small Private Online Courses (SPOCs) in 2013. MOOCs serve as online platforms that connect individuals from various parts of the world, while SPOCs supplement traditional in-person classes by focusing on a specific audience (Aparicio et al., 2016).

Examining data from Eurostat (2022c), there has been an increase in the percentage of individuals in Portugal utilizing the internet for online courses. A notable peak occurred in 2021, likely due to the impact of the pandemic. Although the percentage decreased in 2022, it remained higher than pre-2020 levels. For individuals residing in rural areas, the percentage utilizing the internet for online courses increased from 2.75% in 2015 to 11.14% in 2022. In comparison, the corresponding figures for individuals in urban areas were 5.20% in 2015 and 23.74% in 2021. These findings suggest that individuals in urban areas exhibit higher usage of the internet for online courses and that internet-based learning experienced significant growth, particularly in 2020 and 2021.

2.2.3. Face-to-face training vs. Online training

The optimal approach for providing training to employees, particularly in the field of medicine, remains a subject of controversy (e.g., Khayat et al., 2022; Nisar et al., 2022). While online training appears more efficient in certain areas, face-to-face training is deemed preferable in other domains, as demonstrated by Gaudin et al. (2022).

From an economic standpoint, Druhmann and Hohenberg (2014) conducted a case study in a small and medium enterprise (SME) in Germany. They developed a cost structure and employed Visualization of Financial Implications (VoFi) calculations to determine that online training offers positive financial benefits. However, the authors also noted a lack of trainee support, especially in self-paced courses, and highlighted potential higher implementation costs associated with technology-based training programs.

Taking a different perspective, Strother (2002) emphasized the importance of evaluating training programs for their efficiency and effectiveness, considering the quality of the outcomes rather than solely the financial and economic aspects. Strother (2002) argued that there is no significant difference in terms of knowledge acquisition between traditional and online training methods. However, the author also acknowledged the challenge of measuring

the quality of online training programs, particularly in terms of the resulting behaviors and outcomes of the trainees.

In a study by Kimiloglu et al. (2017), a questionnaire was administered to 500 Turkish companies, with 106 responses received. The findings indicated that companies view online training as a complement to traditional training, with a preference for blended learning. The surveyed companies perceived several advantages of online training, such as enhanced employee commitment, cost-efficiency, and convenience. However, Kimiloglu et al. (2017) also identified disadvantages, including limited interaction and reduced socialization facilitated by technology-based training. In contrast, face-to-face training allows for greater interaction (Gaudin et al., 2022).

One of the perceived advantages of adopting online training methods is their adaptability, as employees can access training content from anywhere in the world as long as they have access to technological resources (Fake & Dabbagh, 2020).

Considering the aforementioned review of T&D, as online platforms and internet usage continue to grow, organizations must adopt practices and policies that support their employees in these environments (Eurostat, 2022c). Consequently, the work environment itself is increasingly demanding new T&D strategies to ensure ongoing efficiency and productivity, keeping pace with market competitors (Mikolajczyk, 2022). Employees' ability to adapt to constant changes is diminishing, leading to a demand for greater workplace flexibility (Urdan & Weggen, 2000).

2.3. Training & Development methods

To facilitate the development and implementation of the aforementioned T&D strategies, it is essential to explore the methods that can be employed in both face-to-face and online training within organizations.

One such method is **coaching**, which involves a specialized and systematic developmental process aimed at assisting individuals or teams in achieving specific goals and enhancing performance in various areas such as leadership, relationships, and well-being. Coaching can be provided by either internal or external coaches and may incorporate elements such as feedback, reflection, questioning, counseling, and emotional support (Grant & Cavanagh, 2016).

A common training methodology that places emphasis on real-world experience and simulations is known as **shadowing**. Shadowing is a training method wherein an instructor or trainer provides employees with practical examples and simulations to facilitate the learning process of task execution or skill development (Martins & Cruz, 2019). In the context of T&D, shadowing plays a critical role as it allows participants to learn through observation and hands-on experience (Salas et al., 2012).

Job rotation involves the movement of individuals across different job roles and tasks within an organization (Guest, 2017). The objective is to broaden employees' knowledge, skills, and experiences while promoting their career development and motivation. Job rotation holds significance for several reasons, such as: (1) employee and career development, (2) employee engagement, and (3) knowledge transfer. These benefits stem from the following outcomes: job rotation can assist employees in acquiring new skills and knowledge; enhance exposure to diverse job positions and responsibilities, thereby expanding their professional prospects; potentially increase employee engagement by providing learning and development opportunities and demonstrating the company's commitment to their personal growth; and facilitate the sharing of information and best practices across different departments or functions (Martins & Cruz, 2019).

According to Eikenberry (2017), there are technological advancements that can emerge as training opportunities for employees. In the context of this study, the following technologies are highlighted:

(1) **Mobile devices**: The ubiquity of mobile devices among employees presents an opportunity to leverage this "powerful computer" (Eikenberry, 2017, p. 262) for learning purposes.

(2) **Mobile and computer applications**: Downloadable applications can be utilized by employees to enhance both organizational training and personal learning. These applications are user-friendly, from their creation to their implementation and usage.

(3) **Gamification**: The use of gamification can be appealing to employees due to its engaging nature. Gamification involves incorporating game elements into an environment to improve the user experience and foster greater engagement in pursuit of specific goals (Deterding et al., 2011).

(4) **Video-based learning:** The utilization of videos provides an opportunity to share best practices and leverage experiences across an organization.

These technologies offer potential avenues for enhancing T&D initiatives within organizations (Eikenberry, 2017).

Similarly, Eikenberry (2017) emphasizes the significance of various platforms, in addition to the aforementioned technologies, that can facilitate new training strategies. These platforms include e-readers, podcasts, and Short Messaging Service (SMS).

Organizations can leverage e-readers as "online libraries" to provide a wealth of information that contributes to improved employee performance and productivity. Additionally, the use of podcasts allows knowledge to be disseminated in audio format, enabling employees to engage with learning materials even during more relaxed moments. Moreover, the Learning Short Messaging Service (LSMS) can employ text messages to remind employees of important concepts, encourage the application of acquired knowledge, and even incorporate elements of gamification into the process (Eikenberry, 2017).

In addition to the aforementioned methods, there are emerging experimental approaches in the field of professional training that are closely linked to the increasing implementation of information technologies (IT) (Garg & Sharma, 2020). For instance, Baashar et al. (2022) examined 23 studies investigating the use of **Augmented Reality (AR)** for training purposes in areas such as anatomy, surgery, and patient simulation. The findings indicated that AR can serve as an effective tool to enhance learning and performance among healthcare professionals in training. AR involves the utilization of advice systems, such as AR glasses, to augment the real-world environment (Bazavan et al., 2021).

These innovative methodologies demonstrate the potential of IT-driven approaches to revolutionize professional training and offer novel ways to improve learning outcomes and performance (Garg & Sharma, 2020).

On the other hand, **Virtual Reality (VR)** technology enables a fully immersive experience where users perceive a simulated world that encompasses their entire field of vision and can interact with it using VR equipment (Bazavan et al., 2021). By overcoming the constraints of space and time, VR has the potential to revolutionize T&D practices, facilitating efficient knowledge acquisition and personal development (Khandelwalaand & Upadhyay, 2021).

2.4. Innovation

According to Zhang et al. (2019), technological innovation and management innovation are two complementary types of innovation. Thus, we aim to build the foundation of our study based on this complementarity.

2.4.1. Technological Innovation

Internal factors, such as employees' age and education, have the potential to influence strategic decisions regarding T&D (O'Connell & Byrne, 2012). Additionally, external factors such as market conditions, market demand, competition, and technological advancements also play a significant role in T&D decision-making (Sung & Choi, 2018).

In relation to this subject, two concepts that merit analysis are Industry 4.0 and Economy 4.0. These contemporary concepts are closely associated with organizational decision-making, aligning with our objective of assisting organizations in their choices by focusing on technological innovation.

The term "Industry 4.0" was first introduced during a press conference at the Hannover Fair in 2011, where the future vision of manufacturing was discussed (Cazeri et al., 2022). Industry 4.0 aims to enable autonomous decision-making among interconnected cyber-physical systems. This is made possible by the extensive flow of data and the utilization of artificial intelligence for processing large datasets and extracting knowledge to facilitate autonomous decision-making (Cellary, 2019). Due to its profound impact on social, political, and economic sectors, Industry 4.0 has gained significant global recognition and has been referred to as the fourth industrial revolution (Collan & Michelsen, 2020).

Economy 4.0 is closely linked to the process of globalization, which presents new opportunities arising from widely accepted technological advancements, trade liberalization, and the convergence of legal regulations and standards (Kraciuk, 2018). Economy 4.0 encompasses not only Industry 4.0 but also extends to the concept of smart factories and the application of intelligent ideas across various industries such as healthcare, energy, mobility, and others. It can be seen as an extension of Industry 4.0 (Cellary, 2019).

In both Industry 4.0 and Economy 4.0, there is a progressive trend towards digitalization, automation, and robotization. These pathways are key to enhancing efficiency and responsiveness to customer needs (Kraciuk, 2018).

Cellary (2019) highlights that Economy 4.0 is a more complex concept compared to Industry 4.0 due to the fact that individuals in this context are not trained on how to interact with autonomous cyber-physical systems, as intelligent factory workers are. This concern underscores the significance of employee T&D.

Hence, in the job market, a dynamic approach is required to better adapt to changing conditions. Organizations play a crucial role in the development of human resources, as emphasized by Esteban-Lloret et al. (2018). In this regard, Manresa et al. (2019) conducted a study focusing on a sample of 162 Spanish companies. Their study specifically examined a particular type of training, namely, Training and Development for Creativity and Innovation (TD4CI). The objective was to investigate the extent to which the adoption of this training approach influences the organization's performance in terms of innovation and finance. The data collected revealed a positive relationship between innovation performance and the organization's innovation in products and services, indicating the introduction of new products and services.

Similarly, Demirkan et al. (2022) focused their study on German SMEs and arrived at similar conclusions. The authors emphasized that innovation in organizations played a crucial role in achieving better outcomes during a crisis, such as the one experienced with Covid-19. Based on the collected data, Demirkan et al. (2022) concluded that there exists a positive relationship between product innovation within organizations and increased investments in training in the context of SMEs.

Addressing the impact of Covid-19, Mikolajczyk (2022) conducted interviews and observed significant changes in how companies in Poland approached the development of their employees' skills in response to the pandemic. Many of the traditional methods were swiftly transferred to online platforms, adapting development strategies to ensure that revenues were not adversely affected. The author noted that only organizations unaffected by the pandemic crisis did not alter their approaches.

In response to the ever-changing landscape, Eesley and Briggs (2019) argue that it is essential to adopt innovative training initiatives. They highlight that innovation enables employees within organizations to generate better and more creative ideas based on their knowledge, distinguishing them from those without access to training. One effective approach is to implement upskilling and/or reskilling programs, which play a vital role in enhancing organizational effectiveness. These types of training contribute to improving company competitiveness by fostering employee loyalty, enhancing job satisfaction, and boosting morale (Wahab et al., 2021).

In an effort to address the literature gap concerning upskilling the workforce in the context of innovation, Antonioli and Della Torre (2016) conducted a study examining two typologies: organizational innovation and technological innovation. Focusing on the effects of innovation on training in SMEs, the authors arrived at the following conclusions: higher investment in internal training is associated with organizational innovation, while there is no significant relationship observed between technological innovation and learning activities. Organizational innovation pertains to novel approaches in corporate organization that extend beyond technology and encompass areas such as human resource management, database administration, responsibility allocation, and external collaborations (Edquist et al., 1998; Damanpour and Aravind, 2012). Technological innovation refers to the implementation of new concepts for goods or services, or the introduction of new components into a company's manufacturing or service operations (Edquist et al., 1998; Damanpour and Evan, 1984).

Technological Innovation has gained significant attention from executives across various firms (Zhang et al., 2019). However, there are divergent views on its definition. For instance, TI plays a vital role in enabling companies to introduce a wide range of new products and services, which are essential for achieving high performance and generating revenues (Camison & Villar-Lopez, 2014).

Camison and Villar-Lopez (2014) highlight the distinction between TI and non-technological innovation, wherein TI encompasses marketing-related improvements and organizational enhancements, while non-technological innovation focuses on advancements in products and processes.

Given the aim of this study to explore the impact of technological innovation on T&D, the following research questions are formulated:

RQ$_1$: How is TI related to the T&D strategies adopted by organizations?

RQ$_{1A}$: How is TI associated to face-to-face training in organizations?

RQ$_{1B}$: How is TI linked to online training in organizations?

On the other hand, Chen (2022) argues that as the job market evolves, so do the training opportunities. Upskilling employees needs to be customizable and flexible, and one effective approach is through training that utilizes Artificial Intelligence (AI). This method can address challenges posed by other strategies, such as traditional training that may not meet the specific needs of employees (Chen, 2022).

Artificial Intelligence can serve as a means to acquire new knowledge and enable innovative T&D strategies. The concept encompasses various definitions (e.g. Poll et al. (2021), Haenlein and Kaplan (2019)). In this study, we adopt the perspective of Kaplan and Haenlein (2019), which views AI as the capacity of computer-based systems to accurately perceive and understand external data, learn from it, and use that knowledge to pursue objectives and complete tasks.

AI can serve as a platform that facilitates the identification of individual learners' specific characteristics, minimizes human bias through intelligent interfaces, and adapts to various contexts. It can also aid in building a knowledge base, identifying training needs, developing training plans, and providing feedback on results. However, AI also presents certain drawbacks, including concerns related to data security, legal issues, costs, potential job displacement, and unfavorable attitudes (Chen, 2022).

Adoption of such methodologies may evoke fear among many individuals, but training employees can foster greater confidence in AI systems (Arslan et al., 2022). For instance, Schuur et al. (2021) underscore the significance of AI for radiologists due to technological advancements in the market. They emphasize the value of training that takes a more practical approach, focusing on real-life work situations. This new approach, centered on practical scenarios, can lead to the development of new soft and hard skills among employees (Schuur et al., 2021).

2.4.2.   Management Innovation

Nonetheless, the advancements extend beyond the mere introduction of new goods and services; they also endeavor to reshape the operational practices of management within organizations (Zhang et al., 2019). Consequently, in addition to TI, it is imperative to acknowledge the significance of Management Innovation.

The concept of MI can be subject to varying definitions. For instance, Damanpour (2014) characterizes MI as the utilization of untested practices and approaches in the administration and management of an organization. On the other hand, Birkinshaw et al. (2008) posit that MI encompasses the creation and implementation of management practices, processes, structures, or techniques that are novel to the job market and aimed at enhancing organizational objectives. These management practices can be described as patterns, procedures, or methodologies pertaining to activities such as skill management, communication, and strategic provisioning, devised by organizational administrators (Montenegro et al., 2022).

Zhang et al. (2019) emphasize the significance of MI as a critical instrument for business growth and achievement. A forward-thinking management system employs various principles and protocols to optimize resource utilization, thereby assisting firms in attaining sustainable competitive advantages. From a perspective centered on people management practices, Montenegro et al. (2022) interpret the concept of MI as the cultivation and engagement of employees in fostering novel ideas.

Due to its impact, MI enables companies to achieve high performance by effectively integrating diverse approaches within the organization. Presently, organizations strive to attain goals encompassing elevated social, environmental, and economic performance (Zhang et al., 2019). The findings presented by Zhang et al. (2019) establish a positive relationship between MI and the sustainability and performance of organizations.

Recognizing that besides TI and MI, there exist other types of innovation such as social innovation, product innovation, and organizational innovation (as previously defined), it is worth noting that MI and TI have been identified as the most crucial factors for the ongoing survival of organizations (Zhang et al., 2019).

Thus, investigating the effects of MI on T&D becomes particularly pertinent in understanding the broader implications for organizational growth and success:

RQ$_2$: How is MI related to the T&D strategies adopted by organizations?

    RQ$_{2A}$: How is MI connected to face-to-face training in organizations?

    RQ$_{2B}$: How is MI associated to online training in organizations?

2.5. Satisfaction of the employees

Following the elucidation of T&D strategy definitions, it becomes crucial to comprehend the factors that can influence the training process. These factors encompass the trainee's motivation, satisfaction, and perception of training usefulness, among others. Understanding these factors is vital for gaining insights into the multifaceted dynamics that impact T&D outcomes and effectiveness.

2.5.1. Trainees' satisfaction

The effectiveness of training becomes evident when trainees are able to apply the acquired knowledge from their training courses to their daily work routines. Eesley and Briggs (2019) highlight two indicators of knowledge mobilization in the workplace: trainee satisfaction with the training and the perceived usefulness of the training. These factors, referred to as affective reactions by Eesley and Briggs (2019), are essential elements to be incorporated into our study. Specifically, we aim to examine worker satisfaction.

Trainee satisfaction refers to the extent to which employees derive enjoyment from the training experience (Tracey et al., 2001).

Trainee satisfaction with the provided training is subject to numerous factors, and there are various reasons why individuals may prefer specific training strategies or methods. For instance, Garg and Sharma (2020) conducted a study examining the factors influencing trainee satisfaction and the intention to continue participating in e-training programs. Their findings indicate that ease of use and course content significantly impact trainee satisfaction, which, in turn, influences their intention to remain engaged in the e-training program. These aspects shed light on the crucial elements that contribute to trainee satisfaction and subsequent program retention.

Trainees' satisfaction is also influenced by their perception of the effectiveness and utility of the training, as well as their evaluation of the trainer's performance (Giangreco et al., 2009). Giangreco et al. (2009) identified a positive correlation between these factors and trainees'

satisfaction. Given the diverse characteristics that can impact trainees' satisfaction, the objective of this study is to comprehend the following aspects:

RQ$_3$: How different T&D strategies can impact the trainee's satisfaction?

3. Methodology

3.1. Investigation method

This study adopted a quantitative research approach. The quantitative method is widely employed in academic research and involves the collection and analysis of numerical data to identify patterns, relationships, and trends. It is based on a deductive approach, where theories and hypotheses are formulated and tested based on empirical evidence (Creswell, 2014)

The quantitative method offers several advantages. Firstly, it allows for the generalization of results to a larger population when it utilizes representative samples. Additionally, it enables the obtainment of objective and measurable results, facilitating statistical analyses and the identification of associations between variables. Moreover, it allows for more efficient and cost-effective data processing and analysis due to automation (Rubin & Babbie, 2016).

Regarding sampling, convenience sampling was employed. Convenience sampling is a type of non-probability sampling where participants are selected based on their availability and accessibility (Maroco, 2014). This approach is frequently adopted in academic studies due to the ease of participant access and data collection convenience (Creswell, 2014).

Convenience sampling offers advantages such as quick and easy participant recruitment. It is particularly useful when time or resource constraints hinder the implementation of more rigorous sampling methods. However, this approach also has its drawbacks. The sample may not be representative of the target population, limiting the generalizability of the results. Additionally, selection bias may occur as participants are chosen based on their availability and interest (Rubin and Babbie, 2016; Neuman, 2014). In order to address these limitations, attempts were made to achieve an adequate sample size for analysis.

Primary data was collected through questionnaires. Primary data refers to information collected directly from specific study participants to address research questions (Neuman, 2014). This approach allows for obtaining specific and up-to-date information regarding the variables of interest. Additionally, it allows for statistical analyses and the obtainment of personalized and direct results (Rubin & Babbie, 2016).

3.2. Data collection procedures

The data collection process, conducted through a questionnaire, took place from May 12th to May 27th, 2023. A total of 413 responses were collected; however, 88 responses did not meet the requirements for the study. Additionally, 11 responses were excluded for not passing the trap question test. Therefore, 314 valid responses remained for data analysis.

Data collection was conducted through online questionnaires using the Google Forms platform. Access links to the questionnaire were distributed through the LinkedIn and Facebook social media platforms, aiming to reach a wide and diverse audience.

Throughout the data collection process, measures were taken to ensure the anonymity of the participants. The information provided by the participants was treated confidentially, and only the researchers responsible for the study had access to the collected data.

The questionnaire was made available in Portuguese to facilitate comprehension and participation among the respondents. Scales were included to measure the variables of the study, which were translated into Portuguese as no previously translated scales were available.

Additionally, attention-check questions were included to verify respondent attentiveness. In case of inconsistency in the questionnaire responses, those particular responses were excluded to ensure the acquisition of more precise and reliable data.

These measures were implemented to ensure the integrity and reliability of the collected data, as well as to promote a secure and confidential research environment.

The questionnaire utilized for the study is available in Annex I.

3.2.1. Questionnaire

The questionnaire comprises a total of twenty-one closed and mandatory questions. Additionally, three scales from different authors were utilized and adapted to align with the objectives of the study.

To assess participant attentiveness, "trap questions" were strategically incorporated throughout the questionnaire. Respondents were queried about their past or planned training activities in 2023, followed by questions regarding the number of hours already completed or planned for the same year. For instance, when asked whether they have received or will

receive training in 2023, respondents could answer "yes". Subsequently, when questioned about how many hours of training they have already received in 2023 or may receive in 2023, if they were to respond with "0 hours", we would infer that it is an unconscious response to the questionnaire.

By employing this approach, data reliability could be verified and confirmed through a sequence of four "trap questions" where all responses were expected to align. Consequently, eleven responses that exhibited inconsistent answers were excluded from the sample.

It should be noted that, contrary to the findings of Liu (2018) suggesting that respondents are more prone to falling for a single trap question rather than multiple ones, this study opted for a sequence of four "trap questions" in which consistency across all responses was expected. However, in line with Liu (2018) recommendation, no specific methods were employed to actively draw attention to the questionnaire, as the effectiveness of such measures in improving participant attentiveness remains unconfirmed.

Measurement instruments

The questionnaire initiates with a series of sociodemographic and professional inquiries aimed at characterizing the study sample. Alongside these questions, three scales were employed to assess the constructs under investigation.

To analyse training, a four-item scale, "Satisfaction with training" ($\alpha = 0.898$), developed by Schmidt (2007), was utilized. This scale was chosen to gain insights into employees' perspectives regarding training within their organizations, particularly in terms of addressing needs, satisfaction with the quantity of training received, and the practical applicability of the training content in the workplace. Furthermore, an additional item was included to supplement the scale, focusing on employees' perceptions of the organization's provision of training. Participants assessed their level of agreement with each item using a 5-point Likert scale, where 1 = "Strongly Disagree"; 2 = "Disagree"; 3 = "Neutral"; 4 = "Agree"; 5 = "Strongly Agree".

To examine TI within respondents' organizations, a nine-item scale ($\alpha = 0.938$) developed by Zhang et al. (2019) was employed. This scale assesses respondents' perceptions of the level of technological innovation prevalent in their respective organizations. Example items include "We utilize cutting-edge technology for new product development" and "We

maintain technological competitiveness." Each item is evaluated on a Likert scale ranging from 1, "Strongly Disagree," to 5, "Strongly Agree."

Lastly, to explore the variable of MI, a six-item scale (α = 0.834), also developed by Zhang et al. (2019), was utilized. This scale aims to gauge the degree of innovation in management practices within respondents' organizations. Participants indicated their level of agreement with each item using a 5-point Likert scale, ranging from 1, "Strongly Disagree," to 5, "Strongly Agree."

The items of each variable are display in table 1.

Table 1 - Variables, items, fonts, and Cronbach alphas

Variable	Item	Sources and cronbach's alpha
Satisfaction	Training meets needs.	(Schmidt, 2007)
	Amount of training is satisfactory.	
	Ability to use training content on job.	0.898
	Training applicability to job.	
	I usually like the training organized in my company.	
Technological innovation	We are able to produce products with novelty features.	(Zhang et al., 2019)
	We use the latest technology for new product development.	
	The speed of new product development is fast enough/competitive.	0.938
	We have enough new products introduced to the market.	
	We have new products which are first-in-market (early market entrants).	
	We are technologically competitive.	
	We use up to date/new technology in the process.	
	We are fast in adopting process with the latest technological innovations.	

	The process, techniques, and technology change rapidly in our company	
Management inonovation	Rules and procedures within our organization are regularly renewed.	(Zhang et al., 2019)
	We regularly make changes to our employees' tasks and functions.	
	Our organization regularly implements new management systems.	0.834
	The policy with regard to compensation has been changed in the last three years.	
	The intra- and inter-departmental communication structure within our organization is regularly restructured.	
	We continuously alter certain elements of the organizational structure.	

In addition, the study also measures various training strategies examined in the literature review, including face-to-face training, online training, coaching, shadowing, job rotation, applications, gamification, videos, augmented reality, and virtual reality.

These strategies are assessed through two distinct approaches: attendance records within the company and the perceived significance of each training strategy within the participants' job responsibilities. The frequency of utilization is evaluated using a 5-point Likert scale, where 1 = "Never"; 2 = "Rarely"; 3 = "Sometimes"; 4 = "Often"; 5 = "Always". This scale measures the extent to which various training strategies are implemented within their respective organizations. Additionally, participants are requested to rate the importance of each training strategy to their work using a 5-point Likert scale, where 1 = "Not at all Important", 2 = "Low importance", 3 = "Moderate"; 4 = "Important", 5 = "Very Important".

Socio-demographic and control variables

Demographic data such as age, gender, nationality, and educational qualifications were collected. The professional profile of the respondents was assessed by inquiring about their professional situation, occupation, and tenure in their current company.

In relation to the employing organization, information was gathered regarding its location (country and district), type (national, multinational, or other), sector of activity, and size.

Furthermore, the source of initiative for T&D within the company was examined, specifically whether it originated from the employee, the company, or both.

In this study, only six factors were included as control variables. These variables, namely age, gender, company size, and the source of initiative for training (whether it originates from the employee, the company, or both), were incorporated as control variables due to their potential influence on respondent questionnaire responses, thereby enhancing the significance of the results.

3.2.2.   Sample characterization

As previously mentioned, 88 responses were disqualified at the initial screening stage as they did not meet the required criteria, rendering them ineligible for inclusion in the study. According to the Portuguese Labor Code, Portuguese organizations are obligated to provide 40 hours of professional training to each employee annually. Specifically, these 88 respondents were found to lack access to professional training in their current employment, which is proved to be a mandatory requirement in Portugal.

Out of the original 325 responses to the questionnaire, all the items were mandatory and thus there were no missing values. However, eleven respondents were excluded from the analysis due to not meeting the necessary requirements related to the inclusion of trap questions, which were implemented to enhance data reliability.

The sample (Table 2) in terms of age range encompasses individuals aged between 20 and 64 years, with an average age of approximately 33 years. The distribution of gender among respondents shows a higher proportion of female participants (81.5%) compared to males (18.5%). In relation to nationality, the majority of participants (98.7%) are Portuguese, while 0.6% represent Brazilian nationality, and 0.3% are of French/Portuguese or Brazilian/Portuguese descent. With respect to educational qualifications, the sample is predominantly composed of individuals holding a licentiate degree (43.6%), followed by those with a master's degree (24.8%), and individuals with Secondary Education (10th to 12th year) qualifications (22.6%). The remaining participants possess educational

qualifications beyond the 2nd cycle (5th to 6th year), with only 1.3% having obtained a PhD degree.

Table 2 - Sociodemographic characterization of the sample

	Participants
Age	Mean - ≈ 33 years
Gender	Feminine – 81.5% Masculine – 18.5%
Nacionality	Portuguese – 98.7% Brazilian – 0.6% Others – 0.6%
Literary Abilities	Below High school – 3.2% High school – 22,6% Graduation – 43.6% Master's degree – 24.8% Doctorate – 1.3% Others – 4.5%
Professional Situation	Employee – 98.7% Self-employed – 1.3%
Seniority in the Organization	Mean – ≈ 6 years

In terms of professional status, the vast majority of participants (98.7%) is employed, while only four out of the 314 valid respondents work as self-employed individuals. Among these self-employed workers, the average tenure in their respective companies is approximately 6 years. Regarding seniority, most of the sample (19.7%) reported having 1 year of experience, while the maximum recorded length of service in the questionnaire was 37 years.

The professional backgrounds of the participants vary significantly, encompassing a range of occupations including consultants, human resources specialists, administrators, nurses, supermarket operators, and other professions.

3.2.3. Characterization of sampled companies

In addition to characterizing the individuals within the sample, questions were also included to gather information about the companies where the participants are employed and their T&D practices.

It was observed that the majority of the companies represented in the sample is located in Portugal (97.8%), while a small percentage of companies are based in Spain (0.6%), the Netherlands (0.6%), Brazil (0.3%), and both Portugal and Spain (0.6%) (see Table 3).

Table 3 - Organization characterization

Company Location (country)	Portugal – 97.8% Spain – 0.6% Netherlands – 0.6% Others – 0.9%
Type of Company	National Company – 58% Multinational company – 39.8% Others – 2.2%
Activity Sector	Primary sector – 2.2% Secondary sector – 20.1% Tertiary sector – 73.2% Others – 4.4%
Dimenson of the Company	1 to 9 workers – 9.2% 10 to 49 workers – 20.7% 50 to 250 workers – 17.8% More than 250 workers – 52.2%

Regarding the geographical distribution of the participants' companies at the district level, there is a notable concentration of companies in Lisbon (94 mentioned), Porto (69 companies), and Braga (57 companies). Additionally, the sample includes participants whose companies are located in districts such as Faro, Azores, Madeira, Madrid, Hilversum, and others.

Regarding the type of companies, 58% of the sample comprises respondents employed in national companies, 39.8% work in multinational companies, and 2.2% are affiliated with other types of organizations. The predominant sector of activity among the questionnaire responses is the tertiary sector, encompassing services and commercial activities (73.2%). This is followed by the secondary sector, representing the industry, with 20.1%, and the primary sector, including agriculture, livestock, and extractive activities, with only 2.2%.

However, there are companies that operate in multiple sectors, accounting for the remaining portion of the sample (4.4%).

Concerning the size of the participants' organizations, companies with over 250 employees are the most prevalent (52.2%). Only 9.2% of the sample comprises companies with fewer than 10 employees, 20.7% represent companies with 10 to 49 employees, and 17.8% correspond to companies with 50 to 250 employees.

3.2.4. Characterization of companies' T&D strategies

The company profile of the respondents was assessed in terms of the prevailing T&D practices. The results revealed that 90.4% of the participants have already received or are scheduled to receive professional training in their current companies in the year 2023. Moreover, it was found that, on average, participants had received 13.67 hours of training until May 2023. Additionally, participants anticipated an average of 32.85 hours of training to be received in 2023, while 82 participants (26.1%) were unable to predict the number of training hours they would undergo in 2023 (see Table 4).

Table 4 - T&D practices characterization

Received or will receive training in 2023	Received or will receive – 9.6% Didn't received and will not receive – 90.4%
Training hours carried out in 2023, until May	Mean – 13.67 hours
Hours of training planned to be carried out in 2023	Mean – 32.85 hours
Type of Training	Technique – 40.5% Behavioral – 9.6% Not yet realized in 2023 – 28.6% Technique and Behavioral – 21.2%
Compared to 2022	Will receive more hours of T&D – 41.7% Will receive the same number of hours of T&D – 44.9% Will receive fewer hours of T&D – 13.4%

Employee Training Initiative	Never – 10.5% Rarely – 16.2% Sometimes – 32.8% Often – 31.8% Always – 8.6%
Firm Training Initiative	Never – 1% Rarely – 12.1% Sometimes – 23.2% Often – 31.8% Always -31.8%
Both (employee and firm) Training Initiative	Never – 10.5% Rarely – 18.2% Sometimes – 34.4% Often – 26.4% Always -10.5%

Concerning the nature of the training received in 2023, it was found that 28.6% of the participants did not undergo any training during 2023 at the time of responding to the questionnaire. However, among those who completed training until May 2023, 40.5% received technical training, 9.6% received behavioral training, and 21.2% received a combination of both technical and behavioral training.

When comparing with the previous year of 2022, the majority of respondents (44.9%) anticipates receiving the same number of T&D hours in 2023. Meanwhile, 41.7% of the sample expects to receive a higher number of T&D hours in 2023, whereas only 42 out of 314 respondents (13.4%) expect to receive a lower number of T&D hours in 2023 compared to 2022.

Lastly, the initiative for training was examined to determine whether it originates from the employee, the company, or both. The findings indicate that, predominantly, the initiative always comes from the company (31.8%), followed by instances where it sometimes comes from the employees (32.8%), and in some cases, from both the company and the employees (34.4%).

3.2.5. Data analysis procedures

The data was processed using *Microsoft Excel* and *IBM SPSS Statistics 29*, a statistical software commonly used for data analysis in research studies.

To analyze the collected data, a factor analysis was performed. **Factor analysis** is a statistical technique used to identify and investigate the underlying structure of a set of observed variables. It aims to identify latent factors that contribute to the correlations among the observed variables, providing insights into the relationships among them (Pestana, 2008). There are two main types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

EFA is employed when there is no prior theory or clear hypotheses about the underlying factor structure. In this case, the goal is to explore the data and identify the latent factors that best explain the observed relationships among the variables (Maroco, 2014). On the other hand, confirmatory factor analysis is conducted when there are pre-existing theories or hypotheses about the factor structure. In this case, the researcher tests a specific theoretical model, comparing it to the observed data. CFA aims to confirm whether the theoretical model fits well with the data and whether the relationships among the variables align with the theoretical expectations (Maroco, 2014)

For the present study, given that the scales employed to assess the variables were translated and adapted exclusively for this research, an **EFA** was performed using SPSS Statistics 29.

In the context of the EFA, the Principal Components Method was utilized for factor extraction. This method aids in data interpretation by transforming an initially interrelated set of variables into a reduced set of uncorrelated variables referred to as principal components. The principal components are derived through linear combinations of the original variable set, thereby reducing complexity in data interpretation (Pestana, 2008).

The Varimax rotation method was applied in conjunction with the Principal Components Method. As an orthogonal rotation method, Varimax produces uncorrelated factors. Its aim is to minimize the number of variables that load heavily on a single factor to which they are strongly associated. By employing the Varimax rotation, the interpretation of the resulting factors becomes more straightforward and facilitates the identification of distinct underlying constructs (Pestana, 2008).

Additionally, as mentioned by Pestana (2008), in order for factor analysis to be feasible, it is necessary for there to be correlations among the variables. If the correlations are weak, it is unlikely that there are common factors underlying the variables. To assess the adequacy of the correlations, two measures can be employed: the Kaiser-Meyer-Olkin (KMO) measure and the Bartlett's Test of Sphericity. These measures help evaluate the quality of the correlations (Pestana, 2008). In this analysis, the scales used in the study were retained, namely satisfaction, technological innovation, and management innovation.

For the variables TI and MI, a rotated component matrix was generated. The rotated component matrix aids in simplifying the complexity of the factor analysis outcomes by grouping variables into more distinct and interpretable factors. This facilitates the comprehension of the relationships between variables and the interpretation of the obtained factors (Maroco, 2014).

In addition, to gauge the internal consistency of the scales, a reliability coefficient, specifically Cronbach's Alpha, was utilized for assessment.

Following the completion of factor analysis, a comprehensive examination of the variables was undertaken involving **descriptive and correlational analyses**. This analytical step holds significant importance as it aids in addressing the research inquiries and comprehending the interconnections between the variables. Through the scrutiny of correlations, we can gauge the relationships between T&D strategies and various scales, such as Satisfaction, TI, and MI, as well as specific sociodemographic and company-related characteristics. Additionally, we conducted a descriptive analysis regarding the frequency of T&D strategies and their importance for employees' work.

For the purpose of this study, SPSS Statistics 29 was employed to produce correlation tables. These tables encompass essential statistical information, including means, standard deviations, and correlations, which are derived from the entire dataset.

As previously mentioned, the questionnaire incorporated T&D strategies, which were evaluated based on two key parameters: their prevalence within respondents' respective companies and their significance in relation to participants' job roles. Consequently, during the correlation analysis, two distinct tables were generated. One set of correlations focuses

on the frequency of training strategies, while the other set pertains to correlations linked to the significance of these strategies within the context of participants' job responsibilities.

Lastly, a linear regression analysis was performed to address the final research question, which focuses on the impact of T&D strategies on employee satisfaction. Linear regression allows us to assess the strength and direction of the relationship between the independent variables (T&D strategies) and the dependent variable (employee satisfaction) (Maroco, 2014). This analysis helps us understand the extent to which training strategies influence employee satisfaction and provides valuable insights for decision-making and practice improvement in organizations.

To utilize the multiple linear regression model, it is imperative to scrutinize a series of assumptions, which will be evaluated in the forthcoming results section. According to Pestana (2008) and Maroco (2014), there are six hypotheses that should be verified before proceeding with the multiple linear regression of a model. They are:

H_1: The presence of a linear relationship in the phenomenon under study.

H_2: The presence of a normal distribution in the study.

H_3: The independence of observations of the dependent variable.

H_4: The verification of homoscedasticity of residuals.

H_5: The absence of outliers.

H_6: The absence of multicollinearity.

4. Results

The analysis of the acquired results followed a quantitative approach and involved the utilization of various statistical tests, including EFA, descriptive and correlation analysis, and multiple linear regression analysis. To execute each of these tests, a set of prerequisites needed to be met. Once the adherence to these prerequisites was confirmed, the outcomes derived from the tests facilitated our ability to draw meaningful inferences concerning the research questions under investigation.

4.1. Identification and Structuring of Relevant Factors in the Study Context

As indicated in the methodology, EFA involves an investigative process of the dataset, aiming to identify the latent factors that provide the most robust elucidation for the observed associations among the variables.

In accordance with Pestana (2008), it is imperative for this analysis that each item within the scales exhibits a normal or at the very least, a symmetrical distribution. Therefore, we conducted assessments to ascertain the normality of the variables under examination.

The data obtained, as presented in Annex II (Table 8, Table 9 and Table 10), indicate that, based on the values of the univariate skewness coefficient (skewness) and the univariate kurtosis coefficient (kurtosis), it can be inferred that the data deviated from a perfectly normal distribution. Acceptable values are considered when $|sk| < 2-3$ and $|ku| < 7-10$ (Maroco, 2014). To supplement the analysis of normality, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were conducted. Based on the data obtained in Annex II (Table 11), it can be concluded that regarding normality, the data significantly deviate from a normal distribution. This is evident from the results of both the Kolmogorov-Smirnov test ($p < 0.001$) and the Shapiro-Wilk test ($p < 0.001$) conducted for all variables. The departure from normality observed in our dataset underscores the need for meticulous deliberation when selecting appropriate statistical tests, exploring potential data transformations, and conducting a nuanced interpretation of results, all of which will be conscientiously incorporated into our analytical framework.

As mentioned in the methodology section, in the context of EFA, following the application of the Principal Components Method and Varimax rotation, it is imperative to assess the

adequacy of correlations through the measurement of the KMO statistic and Bartlett's Test of Sphericity (Pestana, 2008).

The KMO value for the satisfaction variable is 0.782, indicating that the sample has reasonable adequacy for conducting factor analysis. On the other hand, the TI and MI variables exhibit a KMO value of 0.923, suggesting a strong correlation between the variables and indicating a good sample adequacy for factor analysis (Pestana, 2008). The Bartlett test revealed a significance value (Sig.) below 0.01 for all variables (satisfaction, TI and MI), indicating a significant correlation structure among the variables under analysis (Pestana, 2008). Therefore, the values obtained in these two tests confirm that the factorial analysis can proceed.

Satisfaction

When considering the satisfaction variable, it is not feasible to derive a component matrix by extracting a single component. Nevertheless, it is possible to evaluate the reliability level using Cronbach's alpha, which yields a value of 0.898 for this scale. This value indicates a satisfactory internal consistency among the items of the measurement instrument (Pestana, 2008).

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Regarding the TI and MI variables, the rotated component matrix (see Table 5) reveals that the items exhibit a strong association with Component 1, particularly the TI items, with values ranging from 0.670 to 0.852. As for MI, although the values are not as close to 1, they still demonstrate a significant relationship with Component 2, ranging from 0.614 to 0.831.

Table 5 - Rotative Components Matrix of TI and MI

	Component 1	Component 2
inovtec1	0.670	
inovtec2	0.826	
inovtec3	0.811	
inovtec4	0.779	
inovtec5	0.730	
inovtec6	0.852	

inovtec7	0.825	
inovtec8	0.782	
inovtec9	0.710	0.424
inovgest1		0.699
inovgest2		0.654
inovgest3		0.744
inovgest4		0.614
inovgest5		0.831
inovgest6		0.686

Extraction method: Principal Component analysis. Rotation Method: Varimax with Kaiser Normalization.ª a. Rotation converged in 3 iterations.

Regarding the TI and MI variables, the Cronbach's alpha coefficient obtained is 0.938 and 0.834, respectively. These values indicate excellent reliability among the items measuring each respective construct.

Consequently, it can be concluded that all the scales utilized in this study consist of items that measure the same characteristic and exhibit high reliability in measuring the respective constructs (Pestana, 2008).

4.2. The Correlation between T&D Strategies and Technological and Management Innovation

As delineated in the methodology section, the subsequent phase of analysis involves the examination of intercorrelations among the variables. The findings from Table 6, which delineates the correlation between the frequency of T&D strategies and various variables, reveal several noteworthy associations.

To commence, the correlation between literary abilities and age reveals a modest negative relationship ($r = -0.231$**; $p < 0.001$). This implies that younger individuals tend to possess slightly superior literary abilities when contrasted with their older counterparts. Furthermore, a marginal tendency is observed, indicating that females tend to exhibit slightly higher literary abilities than males. Additionally, as the organizational size increases, there is a trend towards higher levels of TI ($r = 0.156$**; $p = 0.006$) and increased MI ($r = 0.152$**; $p = 0.007$).

When the impetus for training originates from the company or jointly from the company and the employee, there is a more robust correlation with trainee satisfaction in comparison

to situations where the impetus solely stems from the employee. Furthermore, with an increase in the frequency of online training, a tendency is observed towards heightened employee initiative towards training.

Turning our attention to research question 1, which seeks to understand the relationship between TI and the T&D strategies adopted by organizations, sub-questions RQ_{1A} and RQ_{1B} focus on face-to-face and online training, respectively. The analysis reveals that the correlation between face-to-face training and TI is feeble or virtually nonexistent ($r = 0.086$), signifying a lack of significant association. In contrast, a meaningful correlation is evident between online training and TI ($r = 0.258**$; $p < 0.001$), indicating that higher frequencies of online training within organizations are associated with elevated levels of TI.

Among the remaining T&D strategies, coaching emerges as particularly noteworthy, exhibiting a substantial correlation with TI ($r = 0.355**$; $p < 0.001$). Additionally, it is worth highlighting the positive and significant correlation between the use of applications and TI ($r = 0.320**$; $p < 0.001$).

Another significant correlation, as observed in Table 7, pertains to the importance of videos as a training strategy for trainees and TI. This correlation implies that employees who ascribe greater significance to the utilization of videos as a training tool are more inclined to attain elevated levels of TI within their respective organizations. In essence, prioritizing the use of videos in training programs can have a positive impact on an organization's technological innovation capabilities.

Returning to research question 2, which investigates the relationship between MI and the adopted T&D strategies, sub-questions RQ_{2A} and RQ_{2B} focus on face-to-face and online training, respectively. The findings closely mirror those of TI. Notably, the relationship between face-to-face training and MI appears fragile ($r = 0.097$), if not negligible, with no substantial correlation evident. In contrast, a notable connection is established between online training and MI ($r = 0.253**$; $p < 0.001$), suggesting that higher frequencies of online training within organizations are positively associated with heightened levels of MI.

Among the remaining T&D strategies, coaching demonstrates a particularly salient correlation with MI ($r = 0.397**$; $p < 0.001$). Furthermore, it is important to emphasize the robust and statistically significant correlation observed between the use of applications and

MI ($r = 0.332**$; $p < 0.001$). Additionally, a positive correlation is evident between job rotation and MI ($r = 0.325**$; $p < 0.001$).

It is worth noting that the revised T&D strategies in this study exhibit a positive and statistically significant correlation with both TI and MI, particularly concerning their frequency of utilization.

Temporarily shifting our focus from the analysis of TI and MI, it becomes evident that online training exerts a substantial and positively significant influence on trainee satisfaction ($r = 0.382**$; $p < 0.001$). Furthermore, coaching demonstrates a particularly robust correlation with trainee satisfaction ($r = 0.443**$; $p < 0.001$).

In summary, coaching demonstrates the highest correlation values, nearing a value of 1, indicative of a particularly strong association (Maroco, 2014).

Examining the analysis presented in Table 7, which considers the importance of T&D strategies for participants' work rather than their frequency of utilization, it is evident that as the perceived importance of online training increases for trainees, their level of satisfaction also tends to rise ($r = 0.224**$; $p < 0.001$). This implies that trainees who regard online training as important are more likely to report higher levels of satisfaction with their training experience.

Regarding additional correlations, it is noteworthy that the remaining variables demonstrate relatively weak or nearly negligible associations; however, these associations remain statistically significant. Notably, there exists a negative correlation between the importance attributed to gamification for the participant's job and their level of satisfaction ($r = -0.015$), suggesting that the degree of importance assigned to gamification does not significantly impact trainee satisfaction levels.

4.3. The Relationship between the Frequency of T&D Strategies and Their Importance to Employees

To determine whether the most frequently employed training strategies in the sampled organizations align with those perceived as most crucial by employees for their job roles, we conducted an analysis of descriptive data pertaining to the variables of frequency and importance. Consequently, it was possible to obtain additional results beyond the answers to the research questions.

From the descriptive examination of the frequency of T&D strategies, it becomes evident that online training stands out as the most utilized strategy, with 48.7% of the sample affirming its frequent implementation within their respective organizations. Following closely is face-to-face training, with 35% of respondents indicating its frequent adoption. In contrast, there is a discernible lower prevalence of utilization among the remaining strategies, particularly with regard to AR and VR training strategies. Specifically, 84.1% of the respondents reported never having undergone AR-based training, while 81.2% of the sample had never experienced VR-based training.

These findings are in concordance with the conclusions drawn concerning the perceived significance of training strategies by employees. Employees attribute a high level of importance to face-to-face training (35.4% of respondents deem it as highly important for their work) and online training (41.7% consider it important). Conversely, employees regard training through AR and VR as inconsequential to their job roles, with 57.6% and 57.3%, respectively, deeming them as not at all important.

Table 6 - Means, Standards Deviations and Correlations with frequency of T&D Strategies

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Age	33,23	7,698																			
2. Gender (a)	,82	,389	,072																		
3. Literary Abilities (b)	5,14	1,127	-,231**	,088																	
4. Company Size (c)	3,13	1,042	-,132*	-0,82	,044																
5. Collaborators Initiative (d)	3,12	1,111	-,128*	-,023	,191*	,064															
6. Company Initiative (e)	3,82	1,044	-,121*	-,053	-,030	,225**	-,075														
7. Initiative Both (f)	3,08	1,133	-,183**	-,067	,136*	,123*	,665**	,245**													
8. Satisfaction (g)	3,5433	1,00451	-,123*	-,161**	-,007	,093	,191**	,386**	,380**	,898											
9. TI (h)	3,1348	1,01829	-,003	-,213**	,091	,156**	,140*	,241**	,339**	,545**	,938										
10. MI (i)	2,9464	,88656	-,113*	-,199**	,078	,152**	,117*	,243**	,364**	,572**	,578**	,834									
11. Face-to-face training (j)	3,32	1,114	,047	-,033	-,087	,005	-0,48	,125*	,050*	,145*	,086	,097									
12. Online training (k)	3,41	1,122	-,108	-,017	,104	,250**	,266**	,179**	,310**	,382**	,258**	,253**	-,263**								
13. Coaching (l)	2,32	1,236	-,115*	-,083	,055	,305**	,152**	,231**	,278**	,443**	,355**	,397**	,021	,293**							
14. Shadowing (m)	2,34	1,358	-,158**	-,085	,010	,305**	,132*	,198**	,210**	,290**	,296**	,256**	,090	,193**	,494**						
15. Job Rotation (n)	2,20	1,187	-,005	-,167**	-,060	,211**	,050	,211**	,166*	,258**	,243**	,325**	,159**	,129*	,354**	,452**					
16. Applications (o)	1,82	1,092	,023	-,174**	,007	,211**	,046	,224**	,161**	,279**	,320*	,332**	,004	,228**	,314**	,295**	,385**				
17. Gamification (p)	1,54	,922	-,076	-,210**	,050	,179**	,069	,131*	,171**	,200**	,274**	,257**	-,028	,160**	,412**	,354**	,273**	,532**			
18. Videos (q)	2,49	1,319	-,110	-,215**	-,018	,293**	,039	,226**	,169**	,235**	,291**	,311**	-,072	,365**	,361**	,334**	,311**	,417**	,440**		
19. AR (r)	1,27	,728	,036	-,184**	-,023	,143*	,047	,116*	,112*	,174**	,230**	,201**	,019	,127*	,241**	,213**	,254**	,425**	,495**	,320**	
20. VR (s)	1,32	,793	,030	-,126*	,010	,184**	,051	,088	,137*	,192**	,234**	,193**	,038	,152**	,285**	,207**	,252**	,442**	,532**	,330**	,876**

Notes: n = 314; ** p < 0,01; * p < 0,05.

(a) Gender: 0 = Masculine; 1 = Feminine; (b) Literary Abilities: 0 = No schooling; 1 = 1st cycle (1st to 4th year); 2 = 2nd cycle (5th to 6th year); 3 = 3rd cycle (7th to 9th year); 4 = Secondary Education (10th to 12th year); 5 = Bachelor's Degree; 6 = Master's Degree; 7 = Doctorate; 8 = Postgraduate; (c) Company Size: 1 = 1 to 9 persons; 2 = 10 to 49 persons; 3 = 50 to 250 persons; 4 = More than 250 persons; (d) Collaborators Initiative: ranging from 1 = Never to 5 = Always; (e) Company Initiative: ranging from 1 = Never to 5 = Always; (f) Initiative Both: ranging from 1 = Never to 5 = Always. Cronbach's alphas are displayed diagonally.

Table 7 - Means, Standards Deviations and Correlations with importance of T&D Strategies

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Age	33,23	7,698																			
2. Gender (a)	,82	,389	,072																		
3. Literary Abilities (b)	5,14	1,127	-,231**	,088																	
4. Company Size (c)	3,13	1,042	-,132*	-0,82	,044																
5. Collaborators Initiative (d)	3,12	1,111	-,128*	-,023	,191*	,064															
6. Company Initiative (e)	3,82	1,044	-,121*	-,053	-,030	,225**	-,075														
7. Initiative Both (f)	3,08	1,133	-,183**	-,067	,136*	,123*	,665**	,245**													
8. Satisfaction (g)	3,5433	1,00451	-,123*	-,161**	-,007	,093	,191**	,386**	,380**	,898											
9. TI (h)	3,1348	1,01829	-,003	-,213**	,091	,156**	,140*	,241**	,339**	,545**	,938										
10. MI (i)	2,9464	,88656	-,113*	-,199**	,078	,152**	,117*	,243**	,364**	,572**	,578**	,834									
11. Imp. of Face-to-face training (j)	3,75	1,226	-,025	-,117*	-,157**	-,032	,153**	-,026	,105	,175**	,087	,160**									
12. Imp. of Online training (k)	3,94	1,028	-,085	,117*	,150**	,099	,249**	,145*	,207*	,224**	,142*	,160**	,087								
13. Imp. of Coaching (l)	3,46	1,337	-,092	-,053	,008	,260**	,106	,175**	,137*	,215**	,196**	,171**	,246**	,205**							
14. Imp. of Shadowing (m)	3,29	1,401	-,096	-,066	-,076	,248**	,062	,207**	,091	,133*	,139*	,053	,208**	,080	,620**						
15. Imp. of Job Rotation (n)	2,97	1,375	-,031	-,063	-,068	,250**	,040	,141*	,065	,026	,093	,104	,184**	,076	,395**	,558**					
16. Imp. of Applications (o)	2,30	1,241	,070	-,056	-,026	,140**	,078	,056	,071	,011	,032	,100	,138*	,131*	,315**	,317**	,411**				
17. Imp. of Gamification (p)	2,03	1,158	-,075	-,108	,016	,087	,062	-,032	,069	-,015	,075	,062	,136*	,055	,339**	,325**	,410**	,645**			
18. Imp. of Videos (q)	2,67	1,293	-,017	-,076	,062	,162**	,056	,069	,091	,068	,212**	,173**	,079	,231**	,329**	,367**	,335**	,470**	,513**		
19. Imp. of AR (r)	1,77	1,086	-0,004	-,077	,018	,088*	,041	-,040	-,008	,032	,110	,078	,128*	,077*	,236**	,260**	,281**	,556**	,631**	,480**	
20. Importance of VR (s)	1,80	1,108	,013	-,064	,007	,089	,053	-,021	,013	,048	,143*	,093	,147**	,082	,234**	,249**	,303**	,537**	,603**	,502**	,958**

Notes: n = 314; ** $p < 0,01$; * $p < 0,05$.

(a) Gender: 0 = Masculine; 1 = Feminine; (b) Literary Abilities: 0 = No schooling; 1 = 1st cycle (1st to 4th year); 2 = 2nd cycle (5th to 6th year); 3 = 3rd cycle (7th to 9th year); 4 = Secondary Education (10th to 12th year); 5 = Bachelor's Degree; 6 = Master's Degree; 7 = Doctorate; 8 = Postgraduate; (c) Company Size: 1 = 1 to 9 persons; 2 = 10 to 49 persons; 3 = 50 to 250 persons; 4 = More than 250 persons; (d) Collaborators Initiative: ranging from 1 = Never to 5 = Always; (e) Company Initiative: ranging from 1 = Never to 5 = Always; (f) Initiative Both: ranging from 1 = Never to 5 = Always. Cronbach's alphas are displayed diagonally.

4.4. Exploring Determinants of Trainee Satisfaction Regarding T&D Strategies

As mentioned in the methodology, there is a set of requirements that must be met to apply multiple linear regression. We will now proceed to assess whether the model and data employed in our study are suitable for multiple linear regression.

To investigate the presence of a linear relationship (H_1), it is essential to examine Graphic 1. By doing so, one can ascertain whether a linear relationship exists between the dependent variable and the independent variables of the model. If no discernible linearity is observed and the points are scattered in a dispersed manner, it becomes possible to infer the absence of a linear relationship between employee satisfaction with T&D and the distinct independent variables that underpin the model.
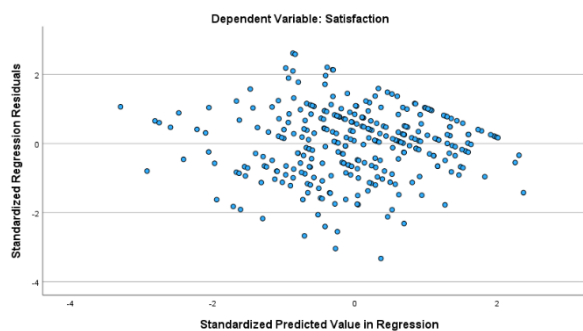
Graphic 1 - Scatter plot

While examining the remaining prerequisites for regression, with a focus on the second hypothesis, the normal distribution of residuals, it becomes necessary to analyze the following histogram (see Graphic 2):
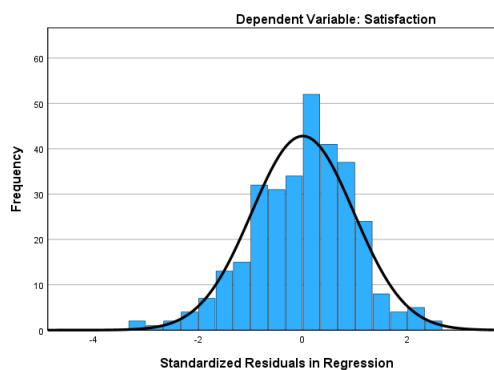
Graphic 2 - Histogram

By means of graphical analysis, it is possible to infer that, despite the residuals not exhibiting a perfect normal distribution, they tend to approach this reality. The normal curve fits appropriately with the values displayed in the graph.
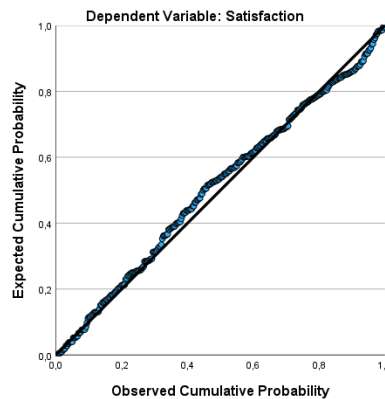
To substantiate the normality of the residuals, it is still viable to examine Graphic 3, from which a similar conclusion can be drawn, the residuals are normally distributed.

Graphic 3 - P-P Graphic

To test the third hypothesis, when examining the Durbin-Watson test, which allows us to infer about the independence of residuals—meaning, the independence between predicted and observed values—it is stated that an acceptable Durbin-Watson value is one that approximates the value of 2 (Maroco, 2014). In the analyzed model, the Durbin-Watson test yielded a value of 2.131, indicating that there is no strong evidence of autocorrelation in the residuals of the regression model; in other words, these residuals are independent.

To verify the fourth prerequisite, the presence of homoscedasticity, Graphic 1 must be revisited. Through its analysis, since the points within it are randomly situated and tightly bounded within a rectangular shape, it can be inferred that homoscedasticity exists in the examined model, satisfying the fourth hypothesis.

To confirm hypothesis 5, the absence of outliers, it is imperative to scrutinize the statistics related to the residuals of the analyzed model. In this case, it can be ascertained that there are no outliers in the model, given that the values of the residuals and predicted errors fall within the stipulated range.

Upon analyzing the correlations among the independent variables, it is possible to investigate and provide an initial impression regarding the presence or absence of multicollinearity (H_6). Multicollinearity refers to an autocorrelation between two independent variables in the model (Maroco, 2014). In this case, we can infer that no correlation value between the independent variables exceeds an absolute value of 0.9 (Pestana, 2008). Therefore, we can conclude that there is no multicollinearity. However, this assumption can be further confirmed using the Tolerance and Variance Inflation Factor (VIF) values. Upon verifying the values of the tests, it is possible to confirm that autocorrelation does not exist in the studied model. To achieve this, the Tolerance test was examined, wherein the values for each independent variable should exceed 0.1, a condition met in the studied model. Furthermore, when VIF values are below 10, multicollinearity is absent (Maroco, 2014), thus validating the hypothesis of no multicollinearity for the multiple linear regression model under scrutiny.

With all prerequisites satisfied, it is feasible to describe the results of the examined multiple linear regression.

Therefore, multiple linear regression was employed to determine whether various training strategies (in-person training, online training, coaching, shadowing, job rotation, applications, gamification, videos, augmented reality, and virtual reality) as well as age, gender, company size, employee's training initiative, company's training initiative and joint training initiative can explain employee satisfaction with T&D practices in their organization.

To facilitate the progression toward multiple linear regression analysis, two distinct models were formulated. In the initial model, exclusively the control variables previously identified were incorporated. In the second model, alongside the control variables, we introduced the frequencies of various training strategies identified within this study.

With regard to the first model, we were able to establish a statistically significant model [$F_{(6,306)}$ = 16.998; $p < 0.001$; $R^2 = 0.250$]. It can be concluded that the control variables explain employee satisfaction with training in the company: Age (β = -0.026; t = -0.504; p = 0.615), Gender (β = -0.126; t = -2.521; p = 0.012), Company Size (β = -0.026; t = -0.515; p = 0.607), Employee's Initiative (β = -0.028; t = 0.399; p = 0.690), Company's Initiative (β = 0.315; t = 5.691; p = < 0.001), and Joint Initiative (β = 0.274; t = 3.782; p = < 0.001).

Concerning the second model, wherein the inclusion of training strategy frequencies was implemented, it was feasible to ascertain a statistically significant model [$F_{(16,296)} = 13.888$; $p < 0.001$; $R^2 = 0.429$]. Age ($\beta = -0.034$; $t = -0.739$; $p = 0.461$), Gender ($\beta = -0.120$; $t = -2.588$; $p = 0.010$), Company Size ($\beta = -0.163$; $t = -3.324$; $p = < 0.001$), Employee's Initiative ($\beta = -0.003$; $t = -0.050$; $p = 0.960$), Company's Initiative ($\beta = 0.225$; $t = 4.436$; $p = < 0.001$), Joint Initiative ($\beta = 0.147$; $t = 2.228$; $p = 0.027$), In-Person Training ($\beta = 0.159$; $t = 3.326$; $p = < 0.001$), Online Training ($\beta = 0.285$; $t = 5.356$; $p = < 0.001$), Coaching ($\beta = 0.284$; $t = 5.084$; $p = < 0.001$), Shadowing ($\beta = 0.045$; $t = 0.807$; $p = 0.420$), Job Rotation ($\beta = 0.011$; $t = 0.197$; $p = 0.844$), Applications ($\beta = 0.093$; $t = 1.629$; $p = 0.104$), Gamification ($\beta = -0.080$; $t = -1.306$; $p = 0.192$), Videos ($\beta = -0.053$; $t = -0.963$; $p = 0.336$), Augmented Reality ($\beta = -0.040$; $t = -0.428$; $p = 0.669$), and Virtual Reality ($\beta = 0.081$; $t = 0.831$; $p = 0.407$) are variables that serve as explanatory factors for employee satisfaction with the organization's T&D practices.

By comparing the R-squared values of the two models it is evident that the second model enhances the explanation of the variance in trainees' satisfaction with the organizations' T&D practices by 17.9%. Specifically, the first model yields an R-squared of 0.250, whereas the second model achieves an R-squared of 0.429. Consequently, it can be deduced that when the control variables are combined with the frequencies of different training strategies, they jointly account for 42.9% of the variation in trainee satisfaction with their organizations' T&D practices.

Drawing from the information gleaned from the ANOVA table during the multiple linear regression analysis, it is possible to reaffirm the previously obtained information, stating that the model adjustment with the distinct independent variables is distinct from the adjustment of the model without predictors. This conclusion is supported by the *p-value* being less than 0.001.

Upon analyzing the coefficients of the second model it can be inferred that the Beta values of the following independent variables significantly differ from zero: company size, company's training initiative, in-person training, online training, and coaching. This signifies that among all the variables within the model, these possess the highest relevance for explaining employee satisfaction with the T&D practices. It can be understood that online training ($\beta = 0.285$; $p = < 0.001$) is the strongest predictor of employee satisfaction, followed

by the coaching training strategy ($\beta = 0.284$; $p = < 0.001$), as well as the company's training initiative ($\beta = -0.225$; $p = < 0.001$). Conversely, the standardized coefficients that exhibit less prediction for employee satisfaction are company size ($\beta = -0.163$; $p = 0.001$) and gender ($\beta = -0.120$; $p = 0.010$), for instance.

Consequently, the following equation represents the multiple linear regression model for the study:

(satisfaction) = 1.247 − 0.004 (age) - 0.310 (gender) - 0.157 (company size) - 0.003 (employee's initiative) + 0.217 (company's initiative) + 0.130 (joint initiative) 0.144 (in-person training) + 0.255 (online training) + 0.230 (coaching) + 0.033 (shadowing) + 0.009 (job rotation) + 0.086 (apps) - 0.087 (gamification) - 0.041 (videos) - 0.056 (augmented reality) + 0.103 (virtual reality)

5. Discussion and conclusion

The initial objectives of the study were twofold: first, to understand the relationship of innovation with T&D strategies, and second, to examine how these strategies could influence learner satisfaction within companies.

The analysis undertaken aimed to address and analyze research questions related to TI and MI concerning various training strategies. Additionally, it explored the relationship between learner satisfaction and T&D strategies.

5.1. Discussion of results

This dissertation has uncovered several noteworthy correlations. Notably, a weak negative correlation was observed between age and literary abilities, suggesting that younger individuals tended to possess slightly stronger literary skills. In terms of gender, females exhibited a slight advantage in literary abilities over males. Additionally, as the size of the company increased, higher levels of TI and MI were evident. Moreover, initiatives originating from the company or jointly initiated by both the company and employees exhibited a stronger correlation with trainee satisfaction compared to those solely initiated by employees. Additionally, increasing frequencies of online training were associated with greater employee engagement in training initiatives. These conclusions have been drawn, recognizing the significance of examining internal factors, such as the age of employees within organizations, which can influence strategic decisions concerning T&D practices, as previously discussed in the literature by O'Connell and Byrne (2012).

To address the relationship between TI and various T&D strategies (Research Question 1), the study reveals that TI is positively related to specific T&D strategies employed by organizations. The analysis indicates that the correlation between face-to-face training and TI is weak or nearly nonexistent, while online training exhibits a significant positive association with TI. Coaching, applications, and the importance of videos for trainees as training strategies also demonstrate significant correlations with TI.

This positive and significant relationship between T&D strategies and TI confirms the findings of previous studies, for example, Eesley and Briggs (2019) emphasize that innovation enhances employees' creativity, distinguishing companies with access to training

from those without. Thus, investing in T&D practices is deemed essential for technological advancement in companies.

In addition, these results serve to substantiate the thesis put forth by Demirkan et al. (2022) regarding the significance of innovation for organizations. The positive relationship between product innovation, linked to technological innovation (Edquist et al., 1998; Damanpour and Evan, 1984), and increased investment in training is reinforced by the positive and significant correlations found with the various T&D strategies examined in this study, notably online training and coaching.

This underscores, as noted by Sung and Choi (2018), that technological advancements play a crucial role in decision-making regarding T&D.

Addressing the second research question, which pertains to how MI is related to T&D strategies, the study finds that face-to-face training appears to have a weak or negligible connection with MI, while online training is positively linked to higher levels of MI. Coaching, applications, and job rotation demonstrate significant and positive correlations with MI, suggesting their importance in enhancing organizational MI.

The conclusions drawn from the correlations among the various T&D strategies align with what Zhang et al. (2019) have discussed, as different approaches lead to improved company performance. Therefore, as observed, the T&D strategies exhibit distinct relationships with MI, but all of them are positive and significant, underscoring their relevance for organizations to consider these strategic decisions.

In summary, the revised T&D strategies in this study are positively and significantly correlated with both TI and MI in terms of frequency of use. Coaching exhibits the strongest correlation, indicating a robust relationship. The results are important and bolster Zhang et al. (2019) conclusion that both TI and MI are critical factors for the continuity and success of organizations.

Furthermore, the perceived significance of online training for trainees is positively associated with their satisfaction levels, while other variables exhibit weak or negligible correlations, yet remain statistically significant. It is worth emphasizing that both online training and coaching exhibit substantial and positive associations with trainee satisfaction. Notably, the importance of gamification does not exert a significant impact on trainee satisfaction.

Likewise, the model scrutinized within the scope of multiple linear regression, which incorporates both control variables and T&D strategies, elucidated 42.9% of the variance in trainee satisfaction with their organizations' T&D practices. This underscores the substantial influence exerted by both control variables and the frequencies of T&D strategies on shaping levels of satisfaction. The coefficients in this model highlighted the importance of specific variables in predicting employee satisfaction. Online training, coaching, and the company's training initiative emerged as the strongest predictors of satisfaction.

This analysis illustrates those various T&D strategies, in conjunction with control variables, exert a significant influence on trainee satisfaction. This finding addresses our third research question and aligns with the existing literature. Online training and coaching, in particular, have a substantial positive influence on satisfaction levels. Additionally, the company's training initiative plays a pivotal role in shaping employee satisfaction with T&D practices.

The importance of online training aligns with the growing trend in organizations to adopt digital learning platforms, which provide flexibility and accessibility for employees (Fake & Dabbagh, 2020). Research has shown that online training can lead to higher levels of engagement and employee commitment due to its convenience and personalized learning experiences (Kimiloglu et al., 2017). The same applies for coaching, Grant and Cavanagh (2016) emphasize the value of one-on-one guidance and mentorship in employee development, helping them reach their potential and, in turn, increasing their satisfaction with the T&D process.

Drawing from Giangreco et al. (2009) study, which reframes trainee satisfaction as influenced by the perspective of training efficiency and usefulness, as well as trainer performance evaluation, our study allows us to infer which T&D strategies have the most impact on trainee satisfaction. Beyond T&D strategies, we can assert in the literature that when the training initiative originates from the organization, trainee satisfaction improves.

This analysis demonstrated that specific training strategies and initiatives play a pivotal role in enhancing employee satisfaction, contributing to a more comprehensive understanding of factors shaping employees' perceptions of training effectiveness within organizations.

5.2. Conclusions

The results lead to the conclusion that among various T&D strategies, strong correlations can be highlighted between TI and online training, coaching, and applications while in-person training exhibits limited representation on TI. Similarly, the correlation with MI is prominent for online training and coaching, also to applications as a training strategy and job rotation. In contrast, face-to-face training demonstrates a weak correlation. Overall, the correlations are positive and significant for both TI and MI. It is noteworthy to highlight that online training and coaching demonstrate considerable and favorable relationships with trainee satisfaction.

This study has revealed that a variety of training strategies play a crucial role in employee satisfaction with T&D practices in their organizations. Specifically, in-person training, online training, and coaching emerged as key predictors of employee satisfaction. This suggests that investing in well-designed and effective training strategies, such as face-to-face training, online training, and coaching, can have a positive and substantial impact on employees' perceptions of T&D practices.

From the results obtained regarding the relationship between the frequency of T&D strategies and their importance to the employee's job, it can be concluded that what is perceived by the employee as most important for their work (in this case, online training, and face-to-face training) coincides with what is most commonly used in the organizations in the sample. Similarly, the strategies that are less utilized in organizations are the ones to which employees attribute less importance in their role, namely AR and VR.

The present study lends significant robustness to the aforementioned conclusion, as multiple linear regression allows us to conclude that online training and coaching carry significant weight when it comes to explaining employee satisfaction with the organization's T&D practices. Simultaneously, correlation analysis allows us to infer a strong relationship between online training and employee satisfaction, as well as between coaching and employee satisfaction.

The results also addressed the influence of contextual factors, such as gender and company size, on employee satisfaction. While company size and gender demonstrated relatively lower impacts compared to other variables, they still contributed to explaining employee

satisfaction. Therefore, it is important for organizations to be aware of these factors when developing training and T&D strategies.

Company-implemented training initiatives also showed a significant relationship with employee satisfaction. The finding that the company's training initiative is positively associated with employee satisfaction underscores the importance of a proactive approach by organizations in fostering employee development. This suggests that companies that prioritize and invest in training programs are more likely to reap benefits in terms of employee satisfaction.

5.3. Theoretical and Practical Contributions to Human Resource Management

The present study offers significant implications for organizations' decision-making processes concerning T&D practices. The results underscore the importance of prioritizing employee satisfaction, highlighting that online training outperforms other training strategies in this regard. Furthermore, it is crucial to recognize that online training, coaching, and the use of applications are associated with higher levels of TI in organizations. Additionally, job rotation emerges as a driver of innovation in management. Thus, it is possible to theorize about T&D practices employed within organizations. From the perspective of an HR manager, for example, if the objective is to enhance employee satisfaction concerning T&D initiatives, one should consider prioritizing online training and coaching, while gradually diminishing the emphasis on face-to-face training in the future. The advantages of online training, as identified in the literature, for instance by Fake and Dabbagh (2020), are found to be highly valued by the study's sample.

Considering Anguelov and Angelova (2022), which underscores the imperative of organizational adaptability in response to the dynamic labor market, this investigation provides valuable guidance for decision-makers in organizations regarding T&D practices that effectively address employee satisfaction. For this reason, the implementation of proactive training initiatives by companies it is important, namely, online training and coaching. Additionally, it reinforces the need to consider contextual factors when developing T&D programs, for example, the greater satisfaction of the employee when the initiative of the training programs comes from the company.

5.4. Study limitations and suggestions for future research

The present study retains limitations that can be addressed in future research endeavors, thereby enhancing, and enriching the exploration of the investigated topic.

Firstly, future studies should aim to employ larger and more culturally diverse samples to provide a more representative depiction of the target population, thus strengthening the accuracy and robustness of the results. Additionally, gaining insight from perspectives within organizations beyond solely that of employees. For example, applying the study to HR managers or team leaders. In the same line, future research would benefit from examining a broader range of T&D strategies and different types of innovation to achieve a more comprehensive understanding of their interrelationships.

Moreover, it is crucial to acknowledge that the measures used in this study relied on self-reported data, introducing the potential for common method bias and social desirability response tendencies. To address these limitations, prospective research endeavors could contemplate the administration of the questionnaire across multiple time intervals and the inclusion of diverse data sources, including objective metrics, which extend beyond mere satisfaction. Such an approach would serve to mitigate potential challenges and augment the overall robustness and credibility of the research outcomes.

Future research would benefit from examining a broader range of T&D strategies and different types of innovation to achieve a more comprehensive understanding of their interrelationships.

Another limitation is the inability to establish causality between T&D and TI, MI, and employee satisfaction. Merely through correlation analysis, it is not possible to infer which variable is the cause and which variable is the effect in the study between T&D and TI, MI, and employee satisfaction. Further theoretical development and testing are required to substantiate the existing causality.

Finally, it would be beneficial to employ a case study approach to assess participants' satisfaction with various types of training received, utilizing the same sample subjected to diverse T&D practices. This approach would provide valuable insights into the topic under investigation.

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7. Appendices

7.1.   Appendix 1 - Questionnaire

The role of innovation in professional Training and Development (T&D)

This questionnaire was carried out as part of a master's dissertation in Economics and Human Resources Management at the Faculty of Economics of Porto.

The main objective of this analysis is to perceive the employees' perspective on the different Training and Development (F&D) strategies, considering technological innovation and innovation in the management of organizations.

The data collected is for academic purposes only, so all information collected will be confidential.

Therefore, we request that you respond to the questionnaire with the utmost seriousness in order to obtain reliable results.

Answering the questionnaire takes about 7 minutes.

We thank you in advance for your cooperation!

Sociodemographic Data

This is an anonymous document, and your details are confidential.

Age: ⎽⎽⎽

Gender:

☐ Feminine

☐ Masculine

Other ☐

Nacionality: ⎽⎽⎽⎽⎽⎽

 Literary qualifications (complete):

☐ No schooling

☐ 1st cycle (1st to 4th year)

☐ 2nd cycle (5th to 6th year)

☐ 3rd cycle (7th to 9th year)

☐ Secondary education (10th to 12th grade)

☐ Graduation

☐ Master's degree

☐ Doctorate

Other ☐

Professional situation:

☐ Worker for others

☐ Self-employed

☐ unemployed

☐ Retired

Profession: _____

Seniority at current company (in years): _____

Characterization of the current company and F&D practices

In this section, we intend to understand how your current company is characterized in terms of the adopted T&D practices.

Country (company location): _____

District (company location): _____

The company represents a:

☐ National organization

☐ Multinational organization

Other ☐

Does the company in which you are employed represent which sector/sectors of activity?

☐ Primary sector (includes agriculture, livestock and extractivism)

☐ Secondary sector (corresponding to industry)

☐ Tertiary sector (services and commercial activities)

What is the size of the company?

☐ 1 to 9 people

☐ 10 to 49 people

☐ 50 to 250 people

☐ More than 250 people

During this year, have you received, or will you receive, Professional Training in your current company?

☐ Yes

☐ No

How many hours of training have you received this year 2023?:_____

How many hours do you plan to work until the end of 2023?:_____

What kind of training did you do?

☐ Technique

☐ Behavioral

☐ I have not yet completed training this year (2023)

Other ☐

Comparing with 2022, it expects to receive in 2023:

☐ Highest number of F&D hours

☐ Equal number of F&D hours

☐ Less number of F&D hours

Whose initiative is it to carry out training in your company?

	Never	Rarely	Sometimes	Often	Always
Of the collaborators					
From the company					
Both					

Training and Development Strategies (T&D)

In this section, questions will be asked regarding different F&D strategies, in order to understand their level of frequency in your company.

For the present study, the following definitions of F&D strategies were adopted:

Coaching - It is a specialized and systematic development process that helps employees and/or teams to achieve specific goals and improve performance in specific areas (for example, leadership, relationships and well-being).

Job Shadowing - Where a new employee is accompanied by a professional expert for a certain period of time to observe and learn from their daily work.

Job rotation - Involves the transfer of employees between various positions and tasks within the same organization.

Gamification - It is an environment that incorporates game features in order to improve the user experience and increase dedication, in order to achieve specific goals.

Augmented Reality - It can be represented by elements or tools, such as Augmented Reality glasses that improve the current or real environment.

Virtual Reality - In Virtual Reality, the user perceives a different world in his field of vision and can only interact with that world through Virtual Reality equipment.

Indicate the extent to which your organization has invested or used the different types of training strategies:

	Never	Rarely	Sometimes	Often	Always
Face-to-face training					
Online training					
Coaching					
Shadowing					
Job rotation					
Apps					

Gamification					
Videos					
Augmented reality					
Virtual reality					

For the different training strategies presented, indicate the level of importance they have for your work.

	Not at all Important	Low Importance	Moderate	Important	Very important
Face-to-face training					
Online training					
Coaching					
Shadowing					
Job rotation					
Apps					
Gamification					
Videos					
Augmented reality					
Virtual reality					

Satisfaction with T&D

In this section, we intend to analyze your level of satisfaction with the F&D practices adopted in your organization.

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

Training meets needs.					
Amount of training is satisfactory.					
Ability to use training content on job.					
Training applicability to job.					
I usually like the training organized in my company.					

Innovation in organizations

In this section, we intend to assess the level of technological innovation and management innovation that exists in your organization.

Select the option that most closely matches your opinion about the existence of the following practices in the organization:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
We are able to produce products with novelty features.					
We use the latest technology for new product development.					
The speed of new product development is fast enough/competitive.					
We have enough new products introduced to the market.					
We have new products which are first-in-market (early market entrants).					

We are technologically competitive.	
We use up to date/new technology in the process.	
We are fast in adopting process with the latest technological innovations.	
The process, techniques, and technology change rapidly in our company	

Select the option that most closely matches your opinion about the existence of the following practices in the organization:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Rules and procedures within our organization are regularly renewed.					
We regularly make changes to our employees' tasks and functions.					
Our organization regularly implements new management systems.					
The policy with regard to compensation has been changed in the last three years.					
The intra- and inter-departmental communication structure within our organization is regularly restructured.					

We continuously alter certain elements of the organizational structure.

Thank you for your cooperation!

7.2. Appendix 2 - Normality

Table 8 - Asymmetry Coefficient (sk) and Flatness Coefficient (ku) of Satisfaction

	satis1	satis2	satis3	satis4	satis5
Skewness	-,404	-,390	-,759	-,949	-,782
Standard skewness error	,138	,138	,138	,138	,138
Kurtosis	-1,009	-1,049	-,324	,229	-,118
Standard kurtosis error	,274	,274	,274	,274	,274

Table 9 - Asymmetry Coefficient (sk) and Flatness Coefficient (ku) of TI

	inovtec1	inovtec2	inovtec3	inovtec4	inovtec5	inovtec6	inovtec7	inovtec8	inovtec9
Skewness	-,614	-,285	-,169	-,385	-,123	-,277	-,381	-,148	,022
Standard skewness error	,138	,138	,138	,138	,138	,138	,138	,138	,138
Kurtosis	-,411	-,998	-,825	-,822	-,897	-1,029	-,852	-1,049	-1,002
Standard kurtosis error	,274	,274	,274	,274	,274	,274	,274	,274	,274

Table 10 - Asymmetry Coefficient (sk) and Flatness Coefficient (ku) of MI

	inovgest1	inovgest2	inovgest3	inovgest4	inovgest5	inovgest6
Skewness	-,228	-,029	,103	-,441	,087	0,44
Standard skewness error	,138	,138	,138	,138	,138	,138
Kurtosis	-,996	-,987	-,934	-,994	-,958	-1,070
Standard kurtosis error	,274	,274	,274	,274	,274	,274

Table 11 - Kolmogorov-Smirnov Test and Shapiro-Wilk Test for Satisfaction, TI, and MI

	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
satis1	,257	<,001	,877	<,001
satis2	,264	<,001	,875	<,001
satis3	,266	<,001	,855	<,001
satis4	,293	<,001	,833	<,001
satis5	,293	<,001	,855	<,001
inovtec1	,245	<,001	,880	<,001
inovtec2	,204	<,001	,898	<,001
inovtec3	,169	<,001	,913	<,001
inovtec4	,220	<,001	,891	<,001
inovtec5	,191	<,001	,905	<,001
inovtec6	,204	<,001	,898	<,001
inovtec7	,206	<,001	,895	<,001
inovtec8	,173	<,001	,904	<,001
inovtec9	,149	<,001	,911	<,001
inovgest1	,232	<,001	,897	<,001
inovgest2	,198	<,001	,901	<,001
inovgest3	,197	<,001	,907	<,001
inovgest4	,255	<,001	,873	<,001
inovgest5	,172	<,001	,910	<,001
inovgest6	,177	<,001	,905	<,001