administrative sciences

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Leadership Styles and Innovation Management: What Is the Role of Human Capital?

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Abstract: Leadership styles and human capital are important drivers of innovation processes. The way the leader interacts with the organization members can pre-empt or leverage innovation processes as leaders influence, empower and motivate other individuals in the achievement of their goals. Human capital is an important driver of innovation and competitiveness, as it will shape the uniqueness of the company as well as the process to obtain skills, capabilities, knowledge and expertise. As such, the main objectives of the paper are to analyze the impact of leadership styles on the innovation process and also to address the moderation effect of the human capital on the previous relation. Four leadership styles—autocratic, transactional, democratic, and transformational—were considered to measure their impacts on the innovation process, considering the alternative types of innovations. The 2018 Community Innovation Survey (CIS) database was used, encompassing Portuguese data, covering the 2016–2018 period, with a sample of 13702 firms. In regard to the empirical part, first, an exploratory analysis was run to better understand the connection between the leadership styles and the innovative strategies followed by an econometric estimation encompassing 28 logit models to disentangle the specific impacts of each leader on each innovation type. Evidence proves that autocratic and transactional leadership styles have a negative impact on innovation and transformational and democratic leadership impact innovation positively. Furthermore, human capital was found to moderate the relationship between leadership styles and the innovation process; i.e., under the same leadership style, the presence of additional skills leverages innovative propensity. The paper brings relevant insights for both managers and policymakers, highlighting that innovation will be accelerated if firms implement more participatory (democratic and transformational) leadership styles and also if they invest in competences to promote knowledge internalization and share. All in all, participatory leadership combined with the internal skills is proved to be an efficient combination for innovation to take place; as such, policy instruments must promote the coexistence of these two factors.

Keywords: leadership styles; human capital; innovation; logit; Portugal

Citation: Costa, Joana, Mariana Pádua, and António Carrizo Moreira. 2023. Leadership Styles and Innovation Management: What Is the Role of Human Capital? *Administrative Sciences* 13: 47. https://doi.org/10.3390/admsci13020047

Received: 30 November 2022
Revised: 1 February 2023
Accepted: 2 February 2023
Published: 7 February 2023

1. Introduction

Innovation plays a crucial role in organizations being a major driver of companies' growth and long-term survival (Waite 2014). Organizations are increasingly drawing upon innovation to answer the fast-technological development (Jia et al. 2018; Waite 2014). One of Schumpeter's definitions of innovation relies on the "creative destruction", proposing that large firms have a greater incentive to invest in product innovation (Swedberg 1995).

Innovation can be defined as new products, novel ideas, radical change, and creativity (Waite 2014). It can also be defined as the generation and implementation of new ideas and structures related to marketing innovation, product innovation, service innovation, process innovation, and even organizational innovation to bring value to the customer and employees (Alblooshi et al. 2020; Jia et al. 2018).

Leadership is a topic attracting the attention of academics over decades, being defined as the interaction and relationship established with one's followers that influences, motivates or empowers other individuals in the achievement of certain goals (Łukowski 2017; Reed et al. 2019). Although there is no universal definition for leadership, as it varies widely depending on the context in which it is analyzed, leaders act as agents of change providing vision and supporting followers to achieve their goals (Judge et al. 2002). Leadership is a process of obtaining shared goals through individuals; this process is characterized by the interactive leader–followers influence and by the context in which it takes place (Bass and Bass 2008; Bass and Avolio 1994). It can also involve mentoring and coaching (Jia et al. 2018). Leaders help organizations through their creativity and innovation, ensuring results, being result-driven and innovative, and encouraging, motivating, and inspiring employees (Waite 2014).

The style used by the leader empowers organizational innovation once leaders influence employees, supporting innovation processes (Łukowski 2017). The term transactional leadership was introduced by Weber (1947); it is centered on the companies' behavior and based on reward exchange (Barbuto 1977). Later, transformational leadership was introduced by Burns (1978), encapsulating a leadership style related to employees' motivation (Łukowski 2017; Waite 2014). By analyzing the leadership styles—such as autocratic, transactional, democratic, and transformational leadership—it can be concluded which styles promote innovation the most and affect human capital growth. Hence, areas of study must integrate leadership development with human capital and leadership's impact on companies (Eckardt et al. 2021). Furthermore, companies have the dilemma of understanding which leadership style is best associated with an organization (Abdullahi et al. 2020). In addition, different leadership styles lead to different stages of innovation types (Łukowski 2017).

Different leadership styles can present with an impact on innovation (Eckardt et al. 2021; Jia et al. 2018). Based on different leadership styles, Barnová et al. (2022) conclude that different leadership styles—supportive, directive, engaged, frustrated and intimate—affect the quality of interpersonal relationships and the outcomes. The openness of the leader has important consequences for innovation, creativity and knowledge sharing (Khassawneh et al. 2022). Job performance was positively influenced by the servant leadership style, even with passive, control-oriented employees (Qiang et al. 2023).

There are alternative leadership styles (Bush 2003) involving different behaviors and outcomes: transformational leadership in which the leader is focused on the process of influencing the outcomes; participative leadership, in which leaders involve stakeholders' participation in the decision-making process; transactional leadership, in which leaders seek to ensure benefits for both the leader and other stakeholders; contingent leadership, in which leaders are prepared to use alternative approaches to the particular context or situations they face; moral leadership, in which leaders seek to introduce values, beliefs and ethics; and instructional leadership, in which leaders try to set directions of influence targeting learning and improving over time. Other types of leadership styles were put forward based on the behavior of the leader, e.g., autocratic, transactional, democratic, and transformational styles (Alblooshi et al. 2020), which are dependent on the organizational culture, task environment and organization's human resources.

The main challenge for an organization is to ensure how to manage innovation. That is why it is important to have leaders who guide followers to achieve innovative performance and gain sustained success (Jia et al. 2018). On the same line of thought, leadership can make a difference in an organization's performance once leaders impact product innovation. Employees play an essential role in innovation: for instance, transformational

leadership can induce a higher level of organizational innovation quality (Chen et al. 2014). Top managers who focus on innovation tend to provide methodologies to motivate, inspire, and empower employees (Alblooshi et al. 2020). In addition, leaders influence organizations, as they can impact culture, strategy, structure, and systems. Moreover, these leaders support followers in establishing open communication standards and learning methodologies needed to innovate, so the importance of leadership for innovation comes from its leaders (Chen et al. 2014). The context plays an important role in the relationship between the leaders and subordinates, with higher levels of institutional complexity making participative styles problematic (Khassawneh and Elrehail 2022). Finally, it is concluded that leadership is one of the main contributors to innovation (Łukowski 2017). Furthermore, the impact of leadership on firms' innovation performance is still unexplored, which is critical for firms' competitiveness and effectiveness. As such, an empirical analysis of leadership styles and the consequences on the different roles of innovation role still needs further development (Brillo and Boonstra 2018; Jia et al. 2018).

In order to compete successfully, companies need distinctive resources (Barney 2001). Knowledge is the most important competitive asset companies possess (Grant 1996), which is part of the company's human capital (Grant 1996). As it is unique, difficult to imitate and hard to transfer, firms' internal knowledge plays an important role in creating strategic value (Aman-Ullah et al. 2022). Moreover, as tacit knowledge is difficult to imitate, it normally gives companies a competitive advantage (Lane and Lubatkin 1998). Moreover, as both the level of education, related to articulable knowledge, and learning, related to the way individuals internalize and share knowledge within the company, influence human capital, it is possible to claim that most of the companies' knowledge resides in the human capital the firm possesses. This human capital depends on the companies' employees, skills, capabilities, knowledge and expertise (Mubarik et al. 2020), which influences companies' performance (Chen et al. 2020; Gupta et al. 2020; Kurdi et al. 2020).

It is clear that innovation is key for companies to succeed in the market and to outcompete their rivals, which depends on the companies' leadership styles (Khassawneh et al. 2022; Qiang et al. 2023) and human capital (Mubarik et al. 2020). As such, this article aims at understanding the conduct of these three variables. For that, the following research questions are addressed: (1) Do leadership styles affect innovation processes? (2) Do the types of innovation influence the innovation processes? (3) Is the effect of leadership on innovation affected by human capital? With this analysis, the aim is to understand: (1) the relationship between the variables, i.e., leadership styles and human capital as antecedents of innovation processes; and (2) the moderator effect of human capital on the relationship between leadership styles and innovation processes. Based on moderator analysis (Aguinis et al. 2017; Frazier et al. 2004), it is expected that the moderator variable (human capital) influences the effect of leadership styles and innovation processes, as the higher the human capital of the company, i.e., employees, skills, capabilities, knowledge and expertise (Mubarik et al. 2020), the higher the influence is expected on the relationship between leadership styles and innovation processes.

The introduction of human capital is important for the analysis of the moderation effect, as being an essential resource for organizations, it impacts the competitiveness of organizations once employees collect, internalize, and share knowledge. As such, human capital can be considered a source of competitive advantage impacting innovation (Fakhri et al. 2020; Moore et al. 2020; Van de Vliert 2006). It is clear that based on the resource-based view (RBV) of the firm (Barney 2001), employees' knowledge, skills, competencies and capabilities reside on human capital, and the firm's innovative behavior is reflected in how firms develop, introduce and market their new products and services and master their innovative organizational processes to achieve a competitive advantage (Grant 1996).

This study contributes to the prior literature by providing an overview of how leadership styles, innovation, and human capital behave as a tripod. Several studies consider leadership and innovation, but none so far answer the question: How does leadership affect innovation, considering human capital? In this sense, this study stands out as it addresses

the three variables to verify the moderator effect of human capital (Abdullahi et al. 2020; Echebiri and Amundsen 2021; Waite 2014).

The study is based in Portugal and uses the Community Innovation Survey (CIS) 2018. According to the European Innovation Scoreboard 2021, Portugal recently moved from a Strong Innovator in 2020 to a Moderate Innovator in 2021. This fact is justified by the poor performance in regard to the indicators using innovation survey data, reduced government support for R&D, ICT specialists, and job-to-job mobility of HRST and environment-related technologies. However, Portugal stands out in digitalization and the use of information technologies and foreign doctorate students (Hollanders et al. 2022).

The present article is structured as follows: after this introduction, Section 2 presents the literature review, focusing on the main variables. First, we show leadership styles by exploring four main leadership groups—autocratic, transactional, democratic, and transformational—then human capital and innovation such as marketing, process, product, service, and organizational innovation; and ultimately, leadership human capital and innovation. Secondly, the database analysis and exploratory analysis are introduced in Section 3. Then, Section 4 establishes the econometric estimations and results. Section 5 presents the concluding remarks.

2. Literature Review

2.1. Leadership

Leadership plays an important role in organizations being defined as the process of influencing someone or a group of individuals to achieve a particular goal (Alblooshi et al. 2020; Waite 2014), which may target innovation. Leaders can encourage an organization's innovation, performance, and strategy as they have the capacity to set common goals within the company and affect innovation's capacity through values and behaviors (Jia et al. 2018; Waite 2014). Leadership is increasingly important as the global business environment is more competitive (Gil et al. 2018).

There is no universal definition of leadership once there are several leadership styles—e.g., autocratic, transactional, democratic, and transformational—that depend on how leaders behave (Alblooshi et al. 2020). Leadership is considered one of the main contributors to innovation despite its different styles (Brillo and Boonstra 2018; Gil et al. 2018). Similarly, human capital encompasses both individual and group knowledge of employees being essential in establishing organizational innovation (Moore et al. 2020). Likewise, human capital includes tacit knowledge, skills, and individual attributes (Donate and Guadamillas 2011; Moore et al. 2020).

Leadership and management support are fundamental for employee performance when dealing with innovation strategy (Chen et al. 2014; Pasamar et al. 2019). Depending on the leadership styles companies adopt, innovation performance levels may change widely (Khan et al. 2020). However, despite the different leadership styles, it is not reliable to defend that one style is better than the others, as innovation depends on multiple contextual and organizational variables. Moreover, every leadership style presents important contributions, as different companies may require different leadership styles (Pasamar et al. 2019).

Extant literature offers at least 21 alternative leadership styles; however, the existing styles are not precisely connected to the organizational innovation strategies (Alblooshi et al. 2020). Moreover, there are two major streams of connection, pointing toward a direct or indirect impact (Alblooshi et al. 2020). In this paper, we decided to analyze the four main leadership styles, which differ from each other in terms of the allowance for participation of the staff, and explain their contribution to the implementation of innovation strategies as they present an essential role in promoting this mindset (Pasamar et al. 2019).

2.1.1. Autocratic Leadership

Autocratic leadership was first introduced by Lewin (1935) and can be used from an inclusive perspective, focusing on investing in human capital, balancing the team, and exclusively concentrating on 'producing numbers' (Moore et al. 2020; Wagner 1995).

Similarly, this style can be very effective when the leader has high emotional intelligence and can be effective during stressful periods and when decisions must be resolved quickly (Abdullahi et al. 2020). Whether it is a high-tech company or a more traditional one, autocracy is vital to maintain deadlines and responsibilities. For this reason, they can support innovation processes (Schaeffer 2002). In addition, autocratic leaders play an important role during stressful periods (Brillo and Boonstra 2018).

This leader is present in companies characterized by typical masculine cultures and hierarchical structures, high power distance, and collectivism. Thus, it is related to external environment orientation and small firms in their initial period (Abdullahi et al. 2020; Moore et al. 2020). Autocratic leaders retain all the power and control by forcing their subordinates to work according to their rules. On the other hand, these leaders clarify processes and give clear directions. However, autocratic leaders do not normally allow their subordinates to have their techniques because they tend not to trust their followers' capabilities (Abdullahi et al. 2020).

One of their main characteristics is being very controlling, not considering their followers' opinions, and being very assertive in terms of work directions (Dyczkowska and Dyczkowski 2018; Peker et al. 2018). Regarding creativity and innovation, these leaders are less creative and restricted to communication, affecting employees' satisfaction and leading to low motivation patterns (Beerbohm 2015). Sometimes, this can lead to high absenteeism standards and employee turnover (Abdullahi et al. 2020).

In contrast, autocratic leaders present a positive approach when imprisoning workers with high knowledge levels and stifling long-term innovation processes (Wagner 1995). In organizations with this leadership style, the strict hierarchic structure dominates (Peker et al. 2018). However, in certain contexts, leaders should be autocratic (Beerbohm 2015). Autocratic leadership is essential within organizations that demand error-free outcomes and manufacturing industries (Brillo and Boonstra 2018). This style is famous among military, political leaders, sports coaches, and some industrial CEOs. The authoritarian style is important when employees need training quickly, such as in fast-food companies. Moreover, this leader can be seen in the music industry, specifically in big orchestras (Peker et al. 2018). Thus, this leader plays an important role in many industries and ensures high-efficiency standards in the results presented. However, it may not motivate followers, and dropout rates may be higher, causing a lack of focus on innovation processes (Dyczkowska and Dyczkowski 2018). Based on these characteristics, the following hypothesis was proposed:

Hypothesis 1a. *Autocratic leadership has a negative impact on innovation processes.*

2.1.2. Transactional Leadership

Transactional leadership was first described by Weber (1947) when the author was studying transformational leadership (Barbuto 1977). Transactional leadership is characterized by how leaders can benefit from employees based on the way followers comply with their leaders in an exchange of rewards (Alblooshi et al. 2020). This leadership style ensues when an individual takes the initiative to interact with others to acquire something valued in exchange (Noruzy et al. 2013). These values are essential to the exchange process, such as integrity, responsibility, and reciprocity. Moreover, these values are based on the followers' needs and are associated with their job performance (Fakhri et al. 2020; Pasamar et al. 2019). Rewards and management consist of two indicators: management with active or passive exception; i.e., the characteristics of the leaders can be analyzed by contingent reward, exception management, and *laissez-faire* (Fakhri et al. 2020). Therefore, the transactional leader focuses on leader-follower trades in benefits, rewards, incentives, and self-interest (Donate and Guadamillas 2011). If the subordinate does not achieve the goal, this results in punishment (Abdullahi et al. 2020).

Transactional leadership can be a barrier to innovation and does not contribute to organizational learning (Jia et al. 2018; Naqshbandi and Tabche 2018). In addition, this

leadership style is focused on the context, and it is based on micromanagement or classic management once they are afraid to try new methods (Łukowski 2017). These leaders seek to maintain control to avoid risks in projects or daily tasks (Jia et al. 2018). The relationship between the leader and the subordinate results in a sense of obligation; this happens because subordinates must show high-quality outcomes and effort through leaders' deliberative actions (Echebiri and Amundsen 2021).

Regarding human capital, they are more likely to foster specialized human capital by focusing on individual responsibilities instead of teamwork (Jia et al. 2018; Pasamar et al. 2019). Likewise, these leaders prefer to invest in existing talent rather than outsourcing, since it is important to take advantage of existing resources (Jia et al. 2018). As such, transactional leadership is expected to trigger less innovation performance once creativity is limited, since goals are already set (Alblooshi et al. 2020). However, it is important when companies want to achieve short-term goals promptly and works nicely in large organizations (Brillo and Boonstra 2018).

Hypothesis 1b. *Transactional leadership has a negative impact on innovation processes.*

2.1.3. Democratic Leadership

Democratic leadership or participative leadership became popular in the late 20th century, and experiments can be found in the Hawthorne works (Levitt and List 2011). This leadership style is based on centralized decision making shared by all the followers (Beerbohm 2015). The difference in this style is that it can allow participation, and it is present in democratic governments. This leader is typical in organizations with low power distance between leaders and followers, high on femininity and individualism, and low on uncertain avoidance (Abdullahi et al. 2020). Participation is at the heart of this leadership style, which is unique vis-à-vis other leaders (Caillier 2020).

In start-ups and technology-based companies, this leadership style is conducive. It is recommended for innovative organizations or projects that require cooperation and co-creation between various teams in the organizations (Dyczkowska and Dyczkowski 2018). Motivation is another characteristic that defines democratic leaders and leads to positive organizational performance. In this style, leaders trust and encourage their followers by implementing and sharing their ideas (Beerbohm 2015). They demonstrate developmental behaviors and give followers the ownership to choose their work methodologies (Peker et al. 2018). Democratic leadership is a normative practice (Caillier 2020).

In democratic leadership, ideas play an essential role and are considered valuable regardless of the author and can be noticed in universities (Peker et al. 2018). However, democrats can present disadvantages as they can be slow in the processes, do not work on larger organizations or companies, and lead to stiffness in decision-making processes (Beerbohm 2015). Based on the above-referred premises, the following hypothesis is posed:

Hypothesis 1c. *Democratic leadership is positively related to innovation processes.*

2.1.4. Transformational Leadership

This style was first introduced by Burns (1978) and later developed when studying political leaders and explored by Bass (1985), who explained more in depth the psychological mechanisms between transformational and transactional leadership based on the Multifactor leadership questionnaire (Łukowski 2017).

Transformational leadership has shown increasing interest as it generates and facilitates creativity and organizational innovation (Wipulanusat et al. 2017). Transformational leadership is the most researched leadership style on innovation (Łukowski 2017). Furthermore, this style can be analyzed considering four sub-concepts: individualized influence, inspirational motivation, intellectual stimulation, and individualized consideration. These four sub-concepts justify how these leaders affect innovation; for instance, they can communicate to followers the importance of achieving specific goals and ensuring they feel

intrinsically motivated to work harder to achieve them increasing their performance (Ryu and Shim 2020).

These leaders can be found in companies that have flexible work environments and innovative workplaces, and they promote teamwork by focusing on collective interests and goals (Alblooshi et al. 2020). In addition, this style is more innovation-oriented compared to transactional leadership once transformational leaders engage and connect employees to the organization's mission (Pasamar et al. 2019). In addition, they seek to try new methodologies to solve problems in different ways and to get the most out of their employees, which is one of the reasons they are known as the champions of driving innovation (Aga et al. 2016; Alblooshi et al. 2020; Pasamar et al. 2019). Companies benefit from innovation when their employees have learning skills, as these leaders focus on stimulating learning, so they positively affect learning cultures (Aga et al. 2016; Gil et al. 2018).

This leadership style tends to induce innovation at a high level by establishing simple common goals and by inspiring and encouraging employees, providing vision, and gaining trust and confidence (Pasamar et al. 2019). Consequently, with these practices, leaders can empower followers and generate an appropriate climate for innovation, creating better outcomes and achieving competitive advantages (Jia et al. 2018; Pasamar et al. 2019; Wipulanusat et al. 2017). They encourage employees to think outside the box and beyond expectations; the motivation they transmit is so charismatic that followers tend to become passionate about their jobs (Alblooshi et al. 2020). One of the main attentions of transformational leaders is the ownership they give to employees by exploring multiple alternatives to solve problems from different angles. They are both good communicators and risk-tolerant, impacting how the team generates and creates ideas, new products, services, or even technologies (Abdullahi et al. 2020; Mariz-Pérez et al. 2012; Pasamar et al. 2019).

This leadership style is crucial for innovation, since it focuses on mentoring and coaching that generate intellectual stimulation and charismatic influence to help followers become more efficient without judging them (Chen et al. 2014; Pasamar et al. 2019). When the mentoring is high-skilled and experienced, transformational leadership tends to be effective (Abdullahi et al. 2020). Nevertheless, leaders must support followers by training them and sharing resources to innovate (Alblooshi et al. 2020). These leaders stimulate exploration learning and monitoring motivation by asking employees for systematic feedback (Pasamar et al. 2019). However, this leadership is more than motivation or compliance; it involves subordinates' beliefs, needs, and values (Noruzy et al. 2013). The relationship in this style is based on employees' long-term and positive relationships centered on trust and confidence (Abdullahi et al. 2020; Gil et al. 2018).

Transformational leadership impacts both incremental and radical innovation, affects the way followers develop other innovation capabilities, and influences organizational learning that boosts innovation (Pasamar et al. 2019). Transformational leadership style influences project success both directly and indirectly (Aga et al. 2016). As such, the following hypothesis is put forward:

Hypothesis 1d. *Transformational leadership is positively related to innovation processes.*

2.2. Human Capital and Innovation

There are still conflicts about how human capital can affect firms' innovation capacity and the relationship between both (Mariz-Pérez et al. 2012). On the other hand, human capital is at the core of innovation activities (Zhuang and Ren 2013). Human capital can be defined as tacit knowledge and communication skills that can be transformed into important resources for companies (Grant 1996; Moore et al. 2020; Ryu and Shim 2020). Although investing in innovation is important, human capital plays an essential role in stimulating innovation (Moore et al. 2020). Furthermore, after analyzing the assessment and development of different human capital models, it is possible to conclude that human capital drives innovation (Aman-Ullah et al. 2022; Lane and Lubatkin 1998; Mariz-Pérez et al. 2012). Likewise, human capital represents an important source of creativity and innovation (Gil et al. 2018).

Human capital can be considered an important antecedent enabling an organization's competitiveness since human capital can be characterized by determinant skills, talent, and know-how (Chen et al. 2020; Mubarik et al. 2020). Based on the RBV, human capital is composed of employees' knowledge, skills, competencies and capabilities that drive the firm's innovative behavior (Barney 2001) and supports the firm's competitive advantage (Aman-Ullah et al. 2022; Grant 1996; Mubarik et al. 2020). Moreover, the more qualified the human capital is, the higher the likelihood of generating innovation (Mariz-Pérez et al. 2012). In this way, human capital influences innovation through its qualification, competencies, attitudes, aptitudes, intellectual agility, good workforce, and talent retention (Kesting et al. 2015; Mariz-Pérez et al. 2012). In addition, knowledge is the most critical competence that companies have and resides in human capital (Brillo and Boonstra 2018; Gil et al. 2018). In short, investing in human capital is crucial to transform the potential for innovation in a more productive way (Zhuang and Ren 2013).

Hypothesis 2. *Human capital is positively related to the company's propensity to develop innovation.*

2.3. Leadership Styles, Human Capital, and Innovation

As employees generate and drive creativity in organizations, their perception of leadership is essential for organizations' processes (Alblooshi et al. 2020). Regarding human capital, technological advances are associated with improving strategic processes (Waite 2014). Proper managerial human capital practices support employees' capabilities and enable the improvement of employee performance (Collins and Clark 2003). The way leaders behave with their followers has an impact on them. This behavior can be represented by attitudes such as providing autonomy, rewards, and behaving informally with subordinates, which may affect relationships, team spirit, and union with other members of the organization. Individual consideration can also be necessary for employees to feel like part of the company (Eckardt et al. 2021).

The leadership style impacts the intellectual growth of human capital. Research reveals it is important to integrate leadership development with human capital as it has an impact on organizations (Khan et al. 2020; Sun et al. 2020). Moreover, the leader's behavior influences human capital, which may be visible in employees' effort and dedication with consequences for the quality of the results firms obtain. In this line of thought, it is crucial that leaders motivate employees to ensure their success (Abdullahi et al. 2020). Leaders also contribute to career planning, which can be carried out through daily training and orientation (Jia et al. 2018). In this manner, the entire intellectual part of human capital influences innovation in the way employees are mentored and motivated to use their ideas and creativity (Van de Vliert 2006).

Leadership is context-based, since the relationship between the leader and the followers depends on the way the leaders transmit their mission and support and interact with the followers (Bass and Bass 2008; Bass and Avolio 1994; Judge et al. 2002). Both innovation and creativity rely heavily on the leader's support and direction so that change happens (Barnová et al. 2022). Moreover, interpersonal relationships and the degree of openness plays a crucial role in the success of innovation, creativity and knowledge sharing (Khassawneh et al. 2022).

Companies need to be innovative in order to achieve competitive advantages. For that, employees need to be mentored to internalize new knowledge. Human capital has a synergetic effect on innovation outputs as long as leaders are capable of transforming the firms' internal resources (Sun et al. 2020). Moreover, if employees feel the respect and compassion of their leaders, they are willing to work harder and dedicate more effort to work; consequently, employees will be more satisfied (Khan et al. 2020). Leadership is important as it plays a guiding role, since human capital needs to be targeted and inspired to overcome organizational and contextual challenges (Fakhri et al. 2020).

Although several studies have been carried out relating leadership and innovation, studies dealing with leadership, human capital, and innovation are in high demand. More-

over, no matter how much the leader seeks to innovate, innovation cannot be implemented without proper human resources (Collins and Clark 2003; Van de Vliert 2006). It is known that different leadership styles affect innovation and performance differently (Barnová et al. 2022; Eckardt et al. 2021; Jia et al. 2018; Qiang et al. 2023), as supportive and intimate leaders behave differently than directive and frustrated leaders, as the outcomes are dependent on the influence of their interpersonal relationships. Furthermore, it is expected that firms with higher levels of knowledge sharing, creativity and innovation-led organizational practices have leadership styles conducive to better innovative outcomes. Conversely, poor human resource involvement and close-minded leaders will generate poor innovative performances. As such, it is possible to claim that there is an interplay between human capital and leadership style toward the innovation outcomes. As such, based on moderator analysis (Aguinis et al. 2017; Frazier et al. 2004), it is expected that the higher (lower) the level of human capital, the better (worse) the relationship between leadership styles and human capital.

Hypothesis 3. *Human capital positively moderates the relationship between leadership style and innovation processes.*

In order to better illustrate all the connections between the variables described so far, Figure 1 depicts the conceptual model, linking the different perspectives on the connection between the leadership style and the innovation strategy along with the effect of the human capital in the organization. The analysis appraises the direct role of human capital in the innovation strategy and also the moderation effect of this resource on the impact of the leadership style in innovation.

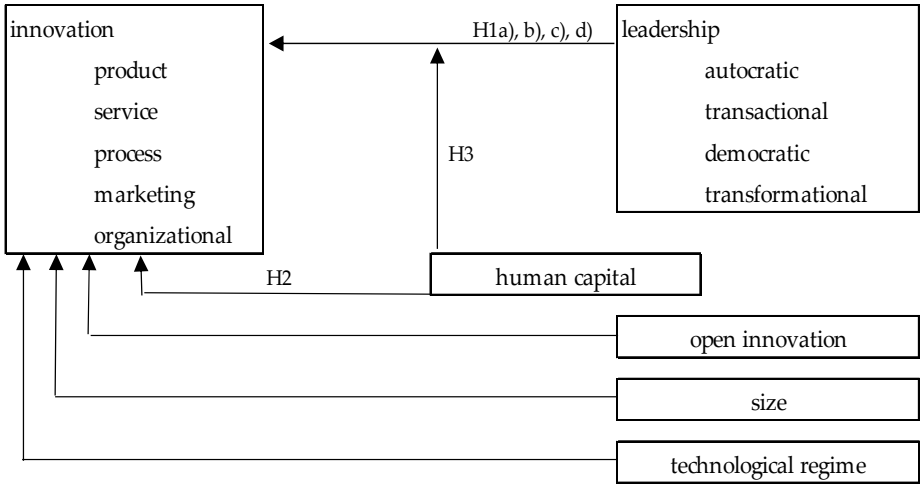

Figure 1. Conceptual model and hypotheses in test.

3. Materials and Methods

To measure how leadership styles, innovation, and human capital are intertwined, 28 logit models were run. First, a descriptive statistic will be made including all the variables under study, which is followed by correlations and estimations.

The models are divided into two groups. In the first group, the role of leadership in types of innovation is analyzed. Second, new variables will be created by multiplying human capital (empud) with the leadership styles, which seeks to address the moderation effect of human capital with leadership styles. In doing so, empirical evidence will be gathered to discuss the impact of these three variables along with reliance on open innovation, size, public funds, technical regime, public funds, channels, and cooperation with universities and clients.

3.1. Database Description

The empirical analysis relies on the Community Innovation Survey (CIS) 2018 from Portugal, encompassing the 2016–2018 biennial. This survey is run under the supervision of Statistics Portugal, following the procedures defined by Eurostat. The database includes 13,702 firms operating in Portugal with heterogeneous structural characteristics and innovative profiles. This CIS is the most comprehensive concerning innovation-related topics providing enlarged evidence for the relevant variables under scrutiny. All information regarding the methodological procedures can be found in: Direcção-Geral de Estatísticas da Educação e Ciência; Instituto Nacional de Estatística—Inquérito Comunitário à Inovação: 2016–2018. Lisbon: INE, 2020. Available at <https://www.ine.pt/xurl/pub/452685463>. (Accessed on 15 March 2022). ISSN 2184-7983. ISBN 978-989-25-0558-9.

3.2. Variables in Use

According to CIS, Table 1 addresses a description and measurement scale of each variable in use. Some variables are basic mathematical conversions; others correspond to the CIS original scale.

Concerning technological regimes, firms were divided into four categories according to technological intensities (Bogliacino and Pianta 2016). Size corresponds to firm size, in terms of the number of employees (small, medium, and large), which is measured using the European Commission definition and CIS methodology. Leadership was divided into four leadership styles (autocratic, transactional, democratic, transformational) depending on the scale responses. Human capital was divided into intensities, following CIS methodology. In addition, innovation was divided into types to know: product, process, marketing, service and organizational. The variable scale is listed in Table 1.

Table 1. Description of variables.

Abbreviation	Variable Name	Description	Measurement
gen_innov (1)	General Innovation	Implemented innovation	Binary
mkt_innov (2)	Marketing Innovation	Implemented marketing innovation	Binary
prod_innov (3)	Product Innovation	Implemented product innovation	Binary
serv_innov (4)	Service Innovation	Implemented service innovation	Binary
proc_innov (5)	Process Innovation	Implemented process innovation	Binary
org_innov (6)	Organization Innovation	Implemented organizational innovation	Binary
in_innov (7)	Indoor Innovation	Implemented innovation indoors (organizational innovation and/or process innovation)	Binary
out_innov (8)	Outdoor Innovation	Implemented innovation outdoors (marketing and/or product innovation and/or service innovation)	Binary
empud (9)	Human Capital	Human Capital Intensity	0 to 6 (0 = 0%"; 1 = "≥1% to <5%"; 2 = "≥5% to <10%"; 3 = "≥10% to <25%"; 4 ="≥25% to <50%"; 5 = "≥50% to <75%"; 6 = "≥75% to 100%")
gen_lead (10)	Leadership Styles	Having practiced autocratic leadership, transactional leadership, democratic or transformational leadership	1 to 4 (1 = autocratic leadership; 2 = transactional; 3 = democratic leadership; 4 = transformational leadership)
autocra_lead (11)	Autocratic Leadership	Having autocratic leadership	Binary

Table 1. *Cont.*

Abbreviation	Variable Name	Description	Measurement
trans_lead (12)	Transactional Leadership	Having transactional leadership	Binary
democ_lead (13)	Democratic Leadership	Having democratic leadership	Binary
transf_lead (14)	Transformational Leadership	Having transformational leadership	Binary
open_innov (15)	Open Innovation	Using open innovation	Binary
size (16)	Firm Size	Nr. of employees	1 to 3 (1 = small; 2 = medium; 3 = large)
funds (17)	Funds	Beneficiary of funds	Binary
tech_reg (18)	Knowledge Intensity	Technological regime of the firm according to the Bogliacino and Pianta (2016).	1 to 4 (1 = supplier dominated; 2 = scale intensive; 3 = specialized supplier; 4 = science based)
channels (19)	Channels	Used of channels to obtain knowledge	1 to 8
client_coop (20)	Client Cooperation	Relying upon clients as partners of innovation cooperation	Binary
uni_coop (21)	University Cooperation	Relying upon universities as partners of innovation cooperation	Binary

3.3. Exploratory Analysis

Table 2 shows information regarding the three main variables used in the framework: leadership, innovation, and human capital. Leadership takes the form of styles that will characterize an organization.

Transformational leadership styles are more likely to occur in firms implementing innovation (55.71%), implementing OI strategies (9.37%), with highly-skilled human capital (16.4%), and tend to receive more funds (22.7%).

The higher the human capital intensity of the firms, the higher the likelihood of firms carrying out innovation, open innovation, and having transformational leaders. On the contrary, the lower the human capital intensity, the higher the likelihood of firms having an autocratic leader. Larger firms, *vis-à-vis* small and medium-sized firms, are more innovative regardless of the type of innovation—general, OI indoor, or outdoor. Finally, when analyzing the knowledge intensity of the firm, science-based firms tend to be more innovative, in terms of indoor (47.5%) and outdoor (46.8%) innovation, and they have the highest percentage of transformational leadership styles (33%) and the lowest percentage of autocratic leadership styles (8%). Firms in the supplier-dominated sector tend to be the least innovative, with the highest percentage of transformational leaders and the highest percentage of autocratic leaders. All these results are in line with the literature that defends that transformational leaders motivate employees, and the workforce that fosters innovation is characterized by highly skilled individuals who are trained and mentored by their leaders (Alblooshi et al. 2020; Eckardt et al. 2021; Pasamar et al. 2019).

As presented in Table 3, 89.69% of the firms show some generic leadership style, with democratic leadership representing 36% of the responses and autocratic leadership representing 19%. In terms of innovation, less than half of the respondents carry out innovation (35.69%), highlighting organizational innovation (29.2%) and marketing innovation with only 16.4%.

Table 2. Summary of exploratory analysis.

Leadership Styles	N	Firms Implementing Innovation		Firms Implementing OI		Funds		Science Based Firms Dimension		High-Skilled Human Capital		Firms Implementing Both OI and General Innovation		Firms that Implementing Both OI and General Innovation Used Funds	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Autocratic leadership	2579	378	14.66	21	0.81	270	10.47	62	2.40	105	4.07	20	5.01	10	1.49
Transactional leadership	3330	1009	30.30	81	2.43	565	16.97	146	4.38	219	6.58	75	6.88	43	2.60
Democratic leadership	5017	1957	39.01	253	5.04	950	18.94	302	6.02	419	8.35	233	10.54	137	4.34
Transformational leadership	2775	1546	55.71	260	9.37	631	22.74	252	9.08	454	16.36	251	13.90	128	5.25
Total	13701	4890	-	615	-	2416	-	762	-	1197	-	579	-	318	-

EMPUD	N	Firms Implementing Innovation		Firms Implementing OI		Transformational Leadership		Autocratic Leadership	
		N	%	N	%	N	%	N	%
0%	2013	295	14.65	8	0.40	195	9.69	726	36.07
1% to <5%	3923	1143	29.14	61	1.55	566	14.43	890	22.69
>=5% a <10%	1757	687	39.10	78	4.44	336	19.12	266	15.14
>=10% a <25%	2207	1011	45.81	163	7.39	507	22.97	282	12.78
>=25% a <50%	1463	648	44.29	111	7.59	381	26.04	177	12.10
>=50% a <75%	1141	511	44.79	79	6.92	336	29.45	133	11.66
>=75% a 100%	1197	595	49.71	115	9.61	454	37.93	105	8.77
Total	13701	4890	-	615	-	2775	-	2579	-

Firm Size	N	Firms Implementing Innovation		Firms Implementing OI		Science-Based Firms		Firms Implementing Indoor Innovation		Firms Implementing Outdoor Innovation	
		N	%	N	%	N	%	N	%	N	%
Small	9451	2889	30.57	202	2.14	500	5.29	2561	27.10	2419	25.60
Medium	3509	1591	45.34	286	8.15	192	5.47	1460	41.61	1351	38.50
Large	741	410	55.33	127	17.14	70	9.45	377	50.88	373	50.34
Total	13701	4890	-	615	-	762	-	4398	-	4143	-

Knowledge Intensity	N	Firms Implementing Indoor Innovation		Firms Implementing Outdoors Innovation		Transformational Leadership		Autocratic Leadership	
		N	%	N	%	N	%	N	%
Supplier Dominated	7933	2396	30.20	2263	28.53	1454	18.33	1607	20.26
Scale Intensive	2699	834	30.90	812	30.09	519	19.23	533	19.75
Specialized Supplier	2307	806	34.94	711	30.82	550	23.84	377	16.34
Science based	762	362	47.51	357	46.85	252	33.07	62	8.14
Total	13701	4398	-	4143	-	2775	-	2579	-

Table 3. Proportion of firms according to the different innovation types and leadership styles.

	All Sample
Variables	**n. obs = 13,702**
gen_innov	35.69%
mkt_innov	16.40%
prod_innov	21.25%
serv_innov	20.52%
proc_innov	24.40%
org_innov	29.16%
empud	28.63%
gen_lead	89.69%
autocra_lead	18.82%
transc_lead	24.30%
democ_lead	36.62%
transf_lead	20.25%

Table 4 shows the descriptive statistics and the correlations of all variables in the study. It is possible to conclude that transactional and autocratic leadership are negatively correlated with all the independent variables, which means that those two leadership styles hinder innovative propensity in all innovation types. On the other hand, transformational leadership is the leadership style more favorable to trigger innovation in general, and OI in particular, which is aligned with the literature that defends that transformational leaders worry about employees and focus on culture and process improvements (Khan et al. 2020).

Human capital (empud) positively correlates with transformational leadership as well as the technological regime (knowledge intensity). It is possible to conclude that to take full advantage of the human capital in high-tech companies, transformational leadership styles are mandatory *vis-à-vis* other leadership styles.

Finally, it is possible to highlight that funds are positively correlated with all types of innovation, which means that funds are likely to incentive innovative actions. Finally, innovation and transformational leadership style are positively related to universities' cooperation, which supports the contention that knowledge exchange between universities and industry fosters innovation.

Table 4. Descriptive Statistics and Correlations.

	Min	Max	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
(1) gen_innov	0	1	0.36	0.479	1																				
(2) mkt_innov	0	1	0.16	0.370	0.595 **	1																			
(3) prod_innov	0	1	0.21	0.409	0.697 **	0.487 **	1																		
(4) serv_innov	0	1	0.21	0.404	0.682 **	0.488 **	0.633 **	1																	
(5) proc_innov	0	1	0.24	0.430	0.763 **	0.584 **	0.584 **	0.582 **	1																
(6) org_innov	0	1	0.29	0.455	0.861 **	0.634 **	0.559 **	0.594 **	0.735 **	1															
(7) in_innov	0	1	0.32	0.467	0.923 **	0.628 **	0.609 **	0.622 **	0.826 **	0.933 **	1														
(8) out_innov	0	1	0.30	0.459	0.884 **	0.673 **	0.789 **	0.772 **	0.715 **	0.737 **	0.790 **	1													
(9) empud	0	6	2.39	1.859	0.210 **	0.169 **	0.113 **	0.214 **	0.152 **	0.203 **	0.199 **	0.212 **	1												
(10) gen_lead	1	4	2.58	1.012	0.274 **	0.227 **	0.207 **	0.246 **	0.265 **	0.283 **	0.283 **	0.261 **	0.256 **	1											
(11) autocra_lead	0	1	0.19	0.391	−0.211 **	−0.161 **	−0.157 **	−0.169 **	−0.188 **	−0.208 **	−0.213 **	−0.197 **	−0.191 **	−0.753 **	1										
(12) trans_lead	0	1	0.24	0.429	−0.064 **	−0.065 **	−0.044 **	−0.073 **	−0.078 **	−0.078 **	−0.071 **	−0.062 **	−0.068 **	−0.326 **	−0.273 **	1									
(13) demo_lead	0	1	0.37	0.482	0.053 **	0.032 **	0.026 **	0.026 **	0.041 **	0.049 **	0.052 **	0.040 **	0.049 **	0.313 **	−0.366 **	−0.431 **	1								
(14) transf_lead	0	1	0.20	0.402	0.211 **	0.188 **	0.169 **	0.212 **	0.218 **	0.226 **	0.221 **	0.210 **	0.200 **	0.705 **	−0.243 **	−0.286 **	−0.383 **	1							
(15) open_innov	0	1	0.04	0.207	0.265 **	0.224 **	0.265 **	0.228 **	0.244 **	0.246 **	0.262 **	0.274 **	0.145 **	0.137 **	−0.085 **	−0.056 **	0.020 *	0.119 **	1						
(16) size	1	3	1.36	0.583	0.165 **	0.115 **	0.136 **	0.113 **	0.148 **	0.152 **	0.164 **	0.160 **	0.156 **	0.150 **	−0.106 **	−0.050 **	0.033 **	0.117 **	0.191 **	1					
(17) funds	0	1	0.18	0.381	0.229 **	0.160 **	0.210 **	0.165 **	0.209 **	0.200 **	0.223 **	0.225 **	0.133 **	0.101 **	−0.066 **	−0.010	0.026 **	0.068 **	0.209 **	0.122 **	1				
(18) tech_reg	1	4	1.70	0.938	0.072 **	0.027 **	0.009	0.095 **	0.056 **	0.075 **	0.075 **	0.068 **	0.372 **	0.102 **	−0.091 **	−0.042 **	0.021 *	0.083 **	0.089 **	00.016	0.019 *	1			
(19) channels	0	8	2.31	2.098	0.385 **	0.342 **	0.323 **	0.337 **	0.354 **	0.376 **	0.383 **	0.393 **	0.360 **	0.366 **	−0.292 **	−0.075 **	0.075 **	0.274 **	0.252 **	0.227 **	0.241 **	0.114 **	1		
(20) client_coop	0	1	0.04	0.189	0.224 **	0.184 **	0.217 **	0.220 **	0.233 **	0.225 **	0.230 **	0.238 **	0.131 **	0.135 **	−0.081 **	−0.056 **	0.012	0.123 **	0.297 **	0.115 **	0.202 **	0.085 **	0.226 **	1	
(21) uni_coop	0	1	0.05	0.208	0.239 **	0.170 **	0.209 **	0.203 **	0.235 **	0.228 **	0.243 **	0.239 **	0.175 **	0.138 **	−0.086 **	−0.055 **	0.016	0.122 **	0.385 **	0.176 **	0.283 **	0.105 **	0.269 **	0.472 **	1

Notes: ** Correlation is significant at the 0.01 level (two-tailed). * Correlation is significant at the 0.05 level (two-tailed).

4. Econometric Analysis

4.1. Econometric Estimations

The following econometric analysis aims to empirically validate the hypotheses theoretically constructed by running fourteen logit models. In this vein, the dependent variables describe the innovative strategy, using innovation in general or each innovation type (as seen in variable description). The leadership styles, human capital intensity and other controls are included in the different models as independent variables.

Table 5 presents the 14 econometric models. Models 1 to 4 validate how the four leadership styles impact general innovation. Models 5 to 14 analyze the five types of innovation with two leadership styles, in detail: models 5 to 6 analyze the impact on marketing innovation, models 7 and 8 analyze the impact on product innovation; models 9 and 10 analyze the impact on service innovation; models 11 and 12 analyze the impact on process innovation, and models 13 and 14 analyze the impact on organizational innovation. Complementarily, in Table 6 (models 15 to 28), the goal is to perceive the moderating effect of human capital; to estimate the moderation effect, an interaction term was included multiplying human capital by each of the four leadership styles, appraising its effect with the five innovation types.

4.2. Results and Discussion

Models 1 to 4 show how important open innovation and size are for explaining the implementation of general innovation activities. Moreover, it also shows that the knowledge intensity of the different technological regimes is not statistically significant to explain general innovation activities and that the leadership styles influence differently the implementation of innovation activities with transactional leadership and autocratic leadership affecting negatively the implementation of general innovation. However, while the democratic leadership style influences positively general innovation, transformational leadership has no statistical influence on general innovation.

When analyzing the different types of innovation, it is possible to conclude that the knowledge intensity of technological regimes is important in explaining marketing and product innovation, while service, process, and organizational innovation hold the same behavior found for general innovation. Furthermore, transactional leadership negatively influences the five types—marketing, product innovation, service, process, and organizational—of innovation, whereas transformational leadership has a strong influence on all of them.

The results clearly indicate that leadership styles, though important, for implementing innovation vary widely and that there is no specific leadership style for all situations and organizations, which is in line with previous work (Kesting et al. 2015; Samad 2012). Moreover, transformational leaders play an important role in driving innovation outwardly—through marketing, product, and service innovation—but perform equally well when leveraging existing resources and improving processes while reducing costs—through process and organizational innovation, confirming previous studies (Kesting et al. 2015; Samad 2012).

The knowledge intensity of the technological regime presents different effects across five models explaining the five types of innovation (model 5 to model 14), showing that the technological regime is relevant only for explaining marketing and product innovation but not for service, process, and organizational innovation. As such, it is possible to claim that firms from specialized and science-based industries need special attention to marketing and product-based innovation activities, as innovative companies exist within every sector.

Table 5. Econometric Estimations.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
	General Innovation				Mkt_innov		Prod_Innov		Serv_innov		Proc_innov		Org_innov	
empud	0.171 ***	0.198 ***	0.199 ***	0.173 ***	0.196 ***	0.224 ***	0.089 ***	0.115 ***	0.2103 ***	0.239 ***	0.109 ***	0.141 ***	0.170 ***	0.199 ***
autocra_lead	−1.136 ***	-	-	-	-	-	-	-	-	-	-	-	-	-
trans_lead	-	−0.197 ***	-	-	-	−0.322 ***	-	−0.148 ***	-	−0.328 ***	-	−0.346 ***	-	−0.305 ***
democ_lead	-	-	0.178 ***	-	-	-	-	-	-	-	-	-	-	-
transf_lead	-	-	-	0.813 ***	0.825 ***	-	0.722 ***	-	0.870 ***	-	0.925 ***	-	0.909 ***	-
open_innov	3.079 ***	3.13 ***	3.142 ***	3.094 ***	1.57 ***	1.628 ***	2.074 ***	2.120 ***	1.590 ***	1.642 ***	1.859 ***	1.899 ***	2.037 ***	2.077 ***
size	0.334 ***	0.368 ***	0.369 ***	0.337 ***	0.211 ***	0.248 ***	0.290 ***	0.322 ***	0.175 ***	0.214 ***	0.320 ***	0.355 ***	0.302 ***	0.336 ***
tech_reg	−0.027	−0.028	−0.037	−0.031	−0.150 ***	−0.144 ***	−0.131 ***	−0.126 ***	0.019	0.021	−0.020	−0.017	−0.019	−0.016
Constant	−1.366 ***	−1.603 ***	−1.722 ***	−1.713 ***	−2.516 ***	−2.37 ***	2.022 ***	−1.938 ***	−2.513 ***	−2.360 ***	−2.152 ***	−1.989 ***	−2.012 ***	−1.868 ***

Notes: *** Coefficient is significant at the 0.01 level (two-tailed).

Table 6. Econometric Estimations of Moderation Effects.

Variables	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28
	General Innovation			Mkt_innov			Prod_Innov		Serv_innov		Proc_innov		Org_innov	
autocrat_lead*empud	−0.241 ***													
trans_lead*empud		−0.002				−0.023		−0.009		−0.026		−0.062 ***		−0.025
democ_lead*empud			0.093 ***											
transf_lead*empud				0.238 ***	0.236 ***		0.166 ***		0.248 ***		0.230 ***		0.252 ***	
open_innov	3.242 ***	3.26 ***	3.246 ***	3.172 ***	1.657 ***	1.777 ***	2.121 ***	2.208 ***	1.681 ***	1.796 ***	1.911 ***	2.010 ***	2.115 ***	2.213 ***
Size	0.442 ***	0.448 ***	0.432 ***	0.398 ***	0.272 ***	0.331 ***	0.330 ***	0.371 ***	0.240 ***	0.302 ***	0.363 ***	0.417 ***	0.361 ***	0.417 ***
tech_reg	0.126 ***	0.119 ***	0.092 ***	0.051 **	−0.063 **	0.026	−0.096 ***	−0.039 *	0.118 ***	0.202 ***	0.015	0.097 ***	0.057 ***	0.136 ***
Constant	−1.460 ***	−1.521 ***	−1.542 ***	−1.492 ***	−2.218 ***	−2.254 ***	−1.867 ***	−1.896 ***	−2.203 ***	−2.233 ***	−1.948 ***	−1.966 ***	−1.772 ***	−1.797 ***

Notes: *** Coefficient is significant at the 0.01 level (two-tailed); ** significant at the 0.05 level (two-tailed); * significant at the 0.01 level (two-tailed).

Leadership matters as autocratic and transactional leadership delay innovation, confirming the work of Łukowski (2017), and transformational leaders support marketing, product, service, process, and organizational innovation, which has consequences for new products, brands, marketing, and customer service, in line with previous work (Abdullahi et al. 2020; Khan et al. 2020).

Lastly, human capital plays a crucial role in impacting positively innovation, which is validated in the first 14 models, and consequently on firms sustaining their competitive advantages (Moore et al. 2020). As such, empirical results demonstrate that human capital is an accelerator of innovation regardless of the types of leadership styles or the knowledge intensity of their technological regime. This is in line with the RBV of the firm, as the more knowledge sharing, competencies and capabilities firms possess, the better the innovation outcomes.

When analyzing Table 6, it is possible to evidence the importance of the moderating effect of human capital on the relationship between the leadership styles and the several types of innovation. As such, the higher the human capital, the higher the effect of transformational leadership on innovation, which is shown in models 18, 19, 21, 23, 25, and 27. This indicates that higher results for general innovation, and for the five types of innovation—product, process, marketing, service, and organizational—are going to be achieved for increasing values of human capital, indicating the key role of human capital for firms' competitiveness. Moreover, model 15 also expresses the negative impact of autocratic leadership styles on general innovation, indicating that despite the higher level of human capital, autocratic leadership styles can have negative repercussions on general innovation outcomes. Furthermore, the moderating effect of human capital on the relationship between transactional leadership and the various forms of innovation analyzed are close to zero, indicating a negligible influence. As such, the message is simple: although human capital is important the leadership style is crucial, as the results obtained by transactional leaders are not similar to those obtained by transformational leaders. This means that transactional leaders use employees as a means to achieve goals, whereas transformational leaders are more tuned to involving the stakeholders, i.e., the lack of proper involvement and motivation of human capital jeopardizes innovation within firms, which is in line with some previous studies (Khan et al. 2020; Łukowski 2017). When comparing the different sets of models, there is a general trait: the presence of a skilled labor force does enhance the probability of performing innovation, with particular emphasis on service and marketing innovation. When combining these skills with transformational leaders, the result is enhanced, meaning that the transformational leader leverages the innovative impact of the human capital. Conversely, the autocratic leader generates a negative impact on the innovative propensity, which is minimized when the firms do have skilled workers. The transformational leader is the one that leverages the innovative strategy the most, exploring the competencies of the human capital. Democratic styles have more neglectable effects while transactional leaders do not make a difference in this domain. These estimations prove that leaders and workers are an important binomial, being able to multiply the innovative propensity when having aligned mindsets.

5. Conclusions

The purpose of the present article was to address the relationship of the tripod leadership style, human capital, and innovation, and also to further address if human capital mediates the relationship between leadership style and innovation. To this end, econometric models were implemented using the CIS database. Empirical evidence proves that leadership styles play an important role in influencing the implementation of innovation strategies across firms. Notwithstanding, on one hand, the leader can work as an enhancer of the innovative activity, and, on the other hand, it may constitute a hindering factor to innovation. While autocratic and transactional leaders tend to negatively influence the implementation of innovation strategies, disregarding the innovation style, democratic and

transformational leaders are innovation boosters, the transformational leader having the strongest influence on the implementation of general innovation.

When analyzing the five types—marketing, product innovation, service, process, and organizational—of innovation, the transformative leadership style influences positively the five types of innovation, whereas the opposite occurs for the autocratic leadership style. Moreover, human capital also influences positively the implementation of innovation across firms and the five types of innovation: marketing, product, service, process, and organizational.

The results highlight that, in general, transformational leaders have a strong impact on the way innovation is dealt with and internalized within the organization, influencing the creative process that leads to different innovation outcomes. On the contrary, it is possible to assert that autocratic leaders hinder creativity within the organization, jeopardizing the outcomes for the five types of innovation. If innovation plays a vital role in firms' competitiveness, a good transformational leadership style is mandatory for making innovation happen. It is also clear that an autocratic leader jeopardizes innovation and, consequently, firms' competitiveness.

The estimation has four moments, and the first (encompassing models 1 to 4) proved that steadily, the human capital intensity rises the innovation odds. Moreover, the establishment of collaborations with external players, firm size, and technological intensity do leverage the innovative propensity. The second moment (Models 5 to 14) addresses the importance of transactional and transformational leaders for each innovation type. In the same vein, the transactional leader does jeopardize the overall innovation propensity, independent of the innovation type. Conversely, the transformational leader, through the motivational and empowered environment developed with the staff within the organizations, does enhance the innovative propensity in all innovation types.

The human capital tested the moderation effect of the leadership style in multiple dimensions in the general innovation performance (models 15 to 18): the moderation is negative in the case of the autocratic-led organizations, not significant in transactional contexts and positive when democratic and transformational leaders are in play. These findings deserve further attention from managers, practitioners, and policymakers, as they further reinforce the positive effects of the collaborative and empowered relationship with employees which raises the innovative propensity. These positive environments are cradles for the innovation processes, which will generate advantages for organizations.

In the final set of models run (models 19 to 28), the same procedure was implemented for each innovation type and for both the transactional and the transformational leaders. Again, the results prove that the transactional leader is incapable of establishing a connection with the firm human capital, being the moderation effect statistically insignificant, evidencing an opportunity for interaction being wasted. Transformational leaders, due to their charisma and the ability to empower the human capital, present a positive and significant impact on the innovation odds in all five types of innovation: marketing, product, service, process, and organizational.

The vast empirical evidence collected across the 28 models run proves that leadership can make the difference in regard to the innovation strategy, and some firms may be doomed to fail due to the wrong leadership strategy. Policymakers cannot ignore this influence on innovative strategies, as the innovative mindset is key to economic growth as well as an important driver of dynamic and competitive ecosystems.

The promotion of consistent Innovation strategies in organizations needs to consider leadership tutorial programs within organizations so that collaboration can flourish. Moreover, this paper proves that the leader may influence the organization in different layers, and the interaction with the skilled labor force (human capital) also plays an important role. The promotion of sustained innovative strategies needs to consider the development of solid and empowered relations with the entire staff and in particular with the most skilled. This trust link will empower staff members, promoting critical sense, intrapreneurship, and virtuous innovation cycles emerging from the inside the firms, which could fully exploit

the absorptive capacity and the development of internal sources of innovation. These findings raise the possibility of developing a tripod strategy for successful innovative strategies investing in prepared leaders who respect, value, and consider their skilled collaborators generating an internal innovation culture, which will be key for underpinning firms' resilience and thus generating competitive advantages.

Future studies could explore how leadership styles influence innovation performance in different types of knowledge intensity, per company size, scrutinizing positive and negative types of leadership styles since the literature still tends to explore the positive impacts, always pointing to transformational leadership. Our empirical analysis had the CIS database, which covered 13,702 companies in Portugal. As such, the limitation of this study is that it is not generalizable to other European economies. As a result, we propose that future studies could explore other economic realities, broadening the breadth and scope of the results to other types of leadership styles and countries.

In terms of practitioners and public policy recommendations, companies should focus on human capital. Moreover, leadership courses need to be provided to managers and directors so that companies can fully profit from the understanding of leadership and adapt more properly to contextual characteristics. In this way, public policy support for innovation could enhance the qualification of employees and managers and improve innovative behavior and standards.

Author Contributions: Conceptualization, J.C., M.P. and A.C.M.; methodology, J.C., M.P. and A.C.M.; formal analysis, J.C., M.P. and A.C.M.; investigation, M.P.; writing—original draft preparation, M.P.; writing—review and editing, J.C., M.P. and A.C.M.; supervision, J.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Nor applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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