INNOVATION AND HUMAN RESOURCES PRACTICES IN COMPANIES OF SOUTHERN BRAZIL

PRÁTICAS DE INOVAÇÃO E RECURSOS HUMANOS EM EMPRESAS DO SUL DO BRASIL

Vanessa Faedo Serafin[1]
Eliana Andrea Severo[2]
Julio Cesar Ferro de Guimarães[2]
Claudio Rotta[3]
Deivis Cassiano Philereno[4]

1 Faculdade Meridional (IMED). Passo Fundo, Rio Grande do Sul, Brazil.
2 Federal University of Pernambuco (UFPE). Recife, Pernambuco, Brazil.
3 Centro Universitário Cenecista de Osório (UNICNEC). Osório, Rio Grande do Sul, Brazil.
4 Faculdade Cenecista de Osório (FACOS). Osório, Rio Grande do Sul, Brazil.

ABSTRACT

Purpose: The purpose of the study is to analyze the relationships between process innovation, human resources practices and the competitive advantage of organizations, through seven research hypotheses.

Design/methodology/approach: The methodology used is a descriptive, quantitative study applied to 207 human resources professionals from companies in the south of Brazil, analyzed by the modeling of structural equations.

Findings: The hypotheses predicted that process innovation and human resources practices would be positively related to competitive advantage, as well as process innovation would be positively correlated with human resources practices. The results confirmed the direct relationships supported by the hypotheses.

Practical implications: Regarding the managerial contributions, the present study brought important information to direct the strategic actions of the companies, integrating process innovation and human resources practices to generate competitive advantage, having human resources management as an important vector for the company strategy, guiding individuals towards the companies' objectives.

Originality/value: The originality of the study consists in the construction of a theoretical framework on the relationships between process innovation, human resources practices and the competitive advantage of organizations, which can be used by other researches and thus advance in the Theory of Administration.

Keywords: Process innovation; Human resource practices; Competitive advantage; Brazil.

RESUMO

Finalidade: O objetivo do estudo é analisar as relações entre inovação de processos, práticas de recursos humanos e vantagem competitiva das organizações, por meio de sete hipóteses de pesquisa.

Desenho/metodologia/abordagem: A metodologia utilizada é um estudo descritivo, quantitativo, aplicado a 207 profissionais de recursos humanos de empresas do sul do Brasil, analisados pela modelagem de equações estruturais.

Constatações: As hipóteses previam que a inovação de processos e as práticas de recursos humanos estariam positivamente relacionadas à vantagem competitiva, assim como a inovação de processos estaria positivamente correlacionada às práticas de recursos humanos. Os resultados confirmaram as relações diretas suportadas pelas hipóteses.

Implicações práticas: No que se refere às contribuições gerenciais, o presente estudo trouxe informações importantes para direcionar as ações estratégicas das empresas, integrando a inovação de processos e as práticas de recursos humanos para gerar vantagem competitiva, tendo a gestão de recursos humanos como um vetor importante para a estratégia da empresa, orientando os gestores para os objetivos das empresas.

Originalidade/valor: A originalidade do estudo consiste na construção de um *framework* teórico sobre as relações entre inovação de processos, práticas de recursos humanos e vantagem competitiva das organizações, que pode ser utilizado por outras pesquisas e, assim, avançar na Teoria da Administração.

Palavras-chave: Inovação de processos; Práticas de recursos humanos; Vantagem competitiva; Brasil.

1 INTRODUCTION

In order to increase their market share, companies have sought new alternatives through innovation, both in the scope of their products, in their management or in their processes. Process innovation, specifically, presents itself as a factor of competitive advantage (CA) from the correct identification, analysis, understanding and manipulation of the variables that permeate this dynamic context, in order to add value to the company and its stakeholders.

However, the direct relationship between process innovation and the company's profitability is open to challenge. In fact, this direct relationship depends on the context in which the organization is inserted (Teece, 1986; Ocde, 2005; Laursen & Salter, 2006; Zhou, Hong, & Liu, 2013; Haneda & Ito, 2018).

It is toward of this premise that the present study delineates its problems, particularly in the Human Resources sector of the organization, defining the question for this research: what are the relations between Process Innovation (PSI), Human Resource Practices (HRP) and Competitive Advantage (CA) in companies in southern Brazil?

This is important to know, since the importance of the role of the HR sector of a company that develops process innovation in its organizational practices is not totally conclusive. In fact, Pintec studies investigating innovative organizations with 10 or more employees, indicate that between 2012 and 2014, Brazil had 132,529 innovative companies covering the sectors of industry and services. In Rio Grande do Sul, a Brazilian Southern State, this figure is 12,255 (Ibge, 2016), with 53% developing product and/or process innovation, 43% developing organizational and/or marketing innovations, while the remaining 4% presenting incomplete or unfinished projects. Still according to Pintec (2014), and considering the companies of the Brazilian Southern State, most of the process innovations represent innovations for the company and not for the national market. Also, for the reality of Rio Grande do Sul, most of these innovations represent an incremental and not radical degree of novelty. Interestingly, the same Pintec survey makes no mention of Human Resource Practices.

Understanding process innovation as an improvement or modification of a value-adding process (Schumpeter, 1934; Rouvinen, 2002; Oecd, 2005; Hullova, Trott, & Don Simms, 2016) it is

possible to comprehend the fundamental role of the HR sector in process innovation, since this area is responsible for the practices related to the recruitment, selection, training, remuneration and database referring to individuals (De Cieri, Cox, & Fenwick, 2007; Mitchell, Obeidat, & Bray, 2013; Shaw, Park, & Kim, 2013; Nolan & Garavan, 2016). It is the experience of the professionals of this sector that supports the leaders in the management of the people, in order to implant new productive processes or to make new products that can result in competitive advantage to the organizations.

Therefore, the HR sector is fundamental to an organization (Brewster, Brookes, & Gollan, 2013; Beltrán-Martín & Roca-Puig, 2013; Kaufman, 2015). Accordingly, De Guimarães, Severo, Dorion, Coallier, & Olea (2016) argue that this sector allows an organization differentiates itself from its competitors, presenting characteristics of rare, inimitable, valuable and strategically irreplaceable resources with the potential to create value for the customer and gain competitive advantage for the organization. In this sense, the authors point out that HR results depend on the human competence and abilities that trigger the emergence of unique capabilities.

In this sense, the purpose of the study is to analyze the relationships between Process Innovation, Human Resources Practices and the Competitive Advantage of organizations, for this purpose, the research hypotheses were developed, which are supported by the consulted literature and were tested using the Modeling of Structural Equations. The survey was applied to 207 human resources professionals from companies in the south of Brazil.

2 RESEARCH HYPOTHESES

To study the research hypotheses and the development of the themes, the study searched for relevant bibliographical sources on the subject. For the exploration of current articles relevant to the theme chosen, the study also sought the Scopus database, since it is the largest database of articles and citations of scientific peer-reviewed literature.

The search for articles in the Scopus database was carried out considering Journals in the Science & Humanities area of knowledge and took place in two phases: the first phase took place on January 13, 2022, using the Keywords "Process Innovation" as a filter and separately the Keywords "Competitive Advantage". The second phase, which took place on January 14, 2022, was used as a filter for the Keywords "Human Resources Practices". In this case, the number of citations of the article was used as a key selection criterion, regardless of the publication date.

The study, then, analyzed 50 most cited articles on HRP, PSI and CA, totaling 150 papers. The abstracts of those articles were extracted to compose the theoretical body of this study, selecting 12 articles related to HRP, 9 articles related to PSI, and 18 articles related to CA. This new cut was based on the criteria already established and in view that the abstracts analyzed were related to the theme of the present study.

These selected articles are presented in Tables 1, 2 and 3, relating the Processes Innovation, Human Resources Practices and Competitive Advantage.

Table 1 – Most cited articles on PSI

Authors/ano of publication	Journal	Number of Citations	Object of study
Teece (1986)	Research Policy	5459	Explaining why innovative companies often fail to achieve significant economic returns, while customers, imitators, and other industry participants benefit.
Leonard-Barton (1992)	Strategic Management Journal	3743	Examining the nature of a company's basic capabilities, focusing on its interaction with new product and process development projects.
Laursen & Salter (2006)	Strategic Management Journal	3340	Investigating the relationship of search strategy to innovative performance.
Van De Ven (1986)	Management Science	2044	Discussing the basic problems of defining innovation and suggesting how they fit into a general framework to guide the longitudinal study of innovation management.
Utterback & Abernathy (1975)	Omega	2036	Reporting results of empirical tests between the innovation pattern of a company and its characteristics of the stage of development, production process and chosen basis of competition.
Abernathy & Clark (1985)	Research Policy	1478	Developing a framework to analyze the competitive implications of innovation.
Garcia & Calantone (2002)	Journal of Product Innovation Management	1935	Demonstrating the importance of considering marketing and technology perspectives, as well as a macro and micro level perspective when identifying innovations.
Klepper (1996)	American Economic Review	1337	Summarizing regularities on how entry, exit, market structure and innovation vary from the birth of technologically progressive industries to maturity.
Cooke et al. (1997)	Research Policy	1293	Exploring the case of Regional Innovation Systems, recognizing the great contribution of research on them.

Source: The authors (2022).

Table 2 – Most cited articles on HRP

Authors/ano of publication	Journal	Number of Citations	Object of study
Black & Lynch (2001)	Review of Economics and Statistics	599	Examining the impact of labor practices, information technology and human capital investments on productivity.
Gooderham et al. (1999)	Administrative Science Quarterly	417	Examining the predictions of the institutional and rational perspectives on the adoption of organizational practices in European companies.
Ones & Viswesvaran (1996)	Journal of Organizational Behavior	373	Discussing the dilemma of bandwidth fidelity in personality measurement for staff selection purposes
Meyer & Smith (2000)	Canadian Journal of Administrative Sciences	345	Analyzing the mechanisms involved in the relationships between human resource management practices and employee commitment.
Cooper & Cartwright (1994)	Human Relations	250	Analyzing a wide range of human resources issues and relating them to the financial health and profitability of the organization.
Kooij, Jansen, Dikkers, & Lange (2010)	Journal of Organizational Behavior	230	Examining how high-commitment HR practices are perceived by employees, and the age differences.
Jehn & Bezrukova (2004)	Journal of Organizational Behavior	187	Exploring how the context of an organizational work-group affects the relationship between group diversity and multiple performance results.
Tsaur & Lin (2004)	Tourism Management	162	To empirically explore the relationship between Human Resource Management practices, service behavior and the quality of services in tourist hotels.
Aycan, Kanungo, & Sinha (1999)	Journal of Cross-Cultural Psychology	159	Testing how the socio-cultural environment affects the internal work culture and influences the Human Resources Management practices.
Ramamoorthy & Carroll (1998)	Human Relations	154	Examining the relationships of potential job seekers and their reactions to alternative Human Resource Management practices.
Schuler (1989)	Human Relations	124	To analyzed the integration of competitive strategy structures and human resources management practices, using the reasoning of employee function behaviors and cost and market conditions
Martinsons & Chong (1999)	Human Relations	101	Investigating the human factors and HR management issues associated with IT assimilation.

Source: The authors (2022).

Table 3 – Most cited articles on CA

Authors/ano of publication	Journal	Number of Citations	Object of study
Barney (1991)	Journal of Management	2660	Examining the relationship between resources and sustained competitive advantage.
Teece, Pisano, & Shuen (1997)	Strategic Management Journal	15531	Knowing the dynamic capabilities that can generate wealth for private companies that operate in environments of rapid technological changes.
Eisenhardt & Martin (2000)	Strategic Management Journal	5660	Describing dynamic capabilities as a lever of competitive advantage.
Zahra & George (2002)	Academy of Management Review	5600	Identifying key dimensions of absorptive capacity, based on dynamic capabilities, as a potential competitive advantage.
Grant (1996)	Organization Science	3404	Developing a theory of knowledge-based organizational capacity to establish competitive advantage.
Gulati, Nohria, & Zaheer (2000)	Strategic Management Journal	2443	Presenting the role of inter-firm networks for strategic and competitive advantage issues.
Argote & Ingram (2000)	Organizational Behavior and Human Decision Processes	2281	Discussing the foundations of knowledge transfer in organizations as the basis for competitive advantage.
Hurley & Hult (1998)	Journal of Marketing	2256	Addressing how organizations develop competitive advantage through organizational learning.
Dyer & Nobeoka (2000)	Strategic Management Journal	2212	Examining the mode of knowledge sharing in the Toyota network that creates competitive advantage.
Nonaka, Toyama, & Konno (2000)	Long Range Planning	2167	Understanding the dynamic process in which an organization creates, maintains, and exploits knowledge to gain competitive advantage.
Lepak & Snell (1999)	Academy of Management Review	1604	Studying the relationships between modes of employment, employment relations, human resource configurations and competitive advantage criteria.
Oliver (1997)	Strategic Management Journal	1604	Suggesting that the context and the resource selection process have an important influence on the heterogeneity of the companies and the sustainable competitive advantage.
Calantone et al. (2002)	Industrial Marketing Management	1509	Outline learning orientation components that impact on competitive advantage.
Zahra, Sapienza, & Davidsson (2006)	Journal of Management Studies	1436	Provide a definition of dynamic capabilities, separating them from substantive capabilities, as well as their antecedents and consequences.
Lee and Choi (2003)	Journal of Management Information Systems	1332	Developing a research model that interconnects knowledge management factors, contributing to competitive advantage.
Baker & Sinkula (1999)	Journal of the Academy of Marketing Science	1108	Demonstrating that a company's learning orientation is likely to indirectly affect organizational performance.
Osterloh & Frey (2000)	Organization Science	1093	Identifying what types of motivation are needed to generate and transfer tacit knowledge, as opposed to explicit knowledge, considering the interference on competitive advantage.
Barney & Wright (1998)	Human Resource Management	1031	Examining the role that HR plays in developing a sustainable competitive advantage.

Source: The authors (2022).

2.1 Process innovation and competitive advantage

In order to point out the advantages of PSI, the Oslo Manual (2005) states that an organization's competitive advantage can be achieved from a cost advantage over its competitors, which will reflect at lower prices than those practiced in the market (Nonaka et al., 2000; Calantone, Cavusgil, & Zhao, 2002; Brem, Nylund, & Schuster, 2016). Accordingly, a firm's competitive advantage is defined by Barney (1991) and Barney & Wright (1998) as the firm´s ability to use internal resources to implement a strategy that is not being implemented simultaneously by its competitors, because of the difficulty they have in copy or simulate such resources.

Regarding the difficulties and importance of PSI, it is also key to consider that organizational characteristics imply a greater or lesser degree of ease in a company to innovate. In fact, Utterback & Abernathy (1975) relate the pattern of innovation within a company to some of its characteristics as, for example, the stage of development of its production process and its chosen basis of competition. In the same vein, Abernathy & Clark (1985) emphasize the relationship of innovation with established production and marketing systems. For the authors, innovation is strongly linked to different evolutionary patterns and managerial environments, underlining the role of the process of industrial maturity and of the incremental change in the formation of competition. In the studies by De Guimarães et al. (2020), process innovation is an antecedent of the generation of competitive advantage of organizations.

Klepper (1996), on the other hand, relates the capacity of a company to innovate with its size, from the difficulty that the company has in appropriating the returns of innovation as it grows. Specifically, the author points out that increasing effort to process innovation are often worsened with the amplified rate of diversity of product innovation. The Oslo Manual (Oecd, 2005) also emphasizes that business size (based on the number of employees) is a variable that must be taken into account in identifying its innovative potential.

Relating innovation to local, regional, and global arrangements, Cooke, Uranga, & Etxebarria (1997) recognize the importance of evolutionary economics, financial capacity, institutionalized learning, and productive culture for systemic innovation. That is, taking the peculiarities of the regions under consideration, the authors advocate the strengthening of regional capacities to promote systemic learning and interactive innovation.

Therefore, based on the above and on several studies, PSI is a source of CA for organizations (Schumpeter, 1934; Teece, 1986; Laursen & Salter, 2006; Brem et al., 2016; Taalbi, 2017). Coherently, Hypothesis 1 stands out.

H1: Process Innovation positively influences Competitive Advantage.

2.2 Human resources practices and competitive advantage

In a study investigating the explicit or implicit HR policies focused at the management of individuals to achieve organizational goals, Wright et al. (1994) suggest that HRP are strategically important to the company because they are directly related to company performance. To that end, the resources and competencies of organizations must be discovered and developed as specificities that generate a competitive advantage to the given company as opposed to the dominant alternative of another industrial organization (Lepak & Snell, 1999). Oliver (1997), in this sense, argues that both resource capital and institutional capital are indispensable for sustainable competitive advantage.

The learning process, which is one of the responsibilities of the HR sector, is an important dynamic capacity that positively implies the competitive advantage of the company (Grant, 1996; Hurley & Hult, 1998; Baker & Sinkula, 1999; Argote & Ingram, 2000; Dyer & Nobeoka, 2000; Nonaka

et al., 2000; Osterloh & Frey, 2000; Calantone et al., 2002). In fact, Lee & Choi (2003) argue that knowledge is crucial for sustaining competitive advantage, which is why companies are beginning to prioritize organizational knowledge management. For Gooderham. Nordhaug, & Ringdal (1999) there are distinctions between efficient HRP and practices aimed at promoting the goals of employees and employers, regardless of the size of the company.

Investments in the process of innovation and in the enhancement of HRP give several advantages to the companies. According to Meyer & Smith (2000), the relations between employee evaluation practices and their affective and normative commitment were largely mediated by the perception of organizational support and procedural justice. Thus, the authors conclude that although HRP may be valuable tools in establishing and maintaining employee engagement, their effects are neither direct nor unconditional.

Kooij et al. (2010), whose study investigated the relationship between HRP and the individual's work, present similar results. In terms of productivity, Martinsons and Chong (1999), in turn, have identified that proactive and supportive HR functions are associated with the most satisfied user, the smoothest organizational changes, and the highest productivity. The relationship between HRP and productivity was also addressed in a study by Black and Lynch (2001), which outlined that unionized establishments that adopted HRP in promoting joint decision-making, combined with incentive-based compensation, have higher productivity than non-unionized ones. On the other hand, the same study pointed out that even the unionized companies, having more traditional management relations, have lower productivity. Tsaur & Lin (2004), in turn, indicated that HR practices present a direct relationship in customer perceptions regarding quality of service and an indirect relationship through employee behavior.

Going beyond the benefit of HRP in the development of various aspects of the organization (environmental, employee commitment, quality of services, productivity and competitive advantage), several researches have been trying to understand the particularities of each subsystem of the organization department of HR (One & Viswesvaran, 1996; Ramamoorthy & Carroll, 1998). In fact, according to Cooper & Cartwright (1994), financially healthy organizations are probably those who succeed in maintaining and retaining a workforce characterized by good physical, psychological and mental health of employees. In the same direction, based on values such as rarity, low imitability and organization, Barney & Wright (1998) argued that HR functions are strategic in achieving and sustaining a sustainable competitive advantage.

Consequently, from the descriptions of HRP (Barney & Wright, 1998; Ramamoorthy & Carroll, 1998; Gooderham et al., 1999; Meyer & Smith, 2000; Kaufman, 2015), it is observed the specificities related to the CA of organizations (Osterloh & Frey, 2000; Zahra & George, 2002; Pérez-López, Montes-Peón, & Vázquez-Ordaz, 2005; De Guimarães et al., 2016). Considering such statements, one can therefore state Hypothesis 2.

H2: Human Resources Practices positively influence the Competitive Advantage.

2.3 Process innovation and human resources practices

According to Teece (1986), some innovative firms often fail to achieve significant economic returns in their PSI, while customers, imitators, and other industry participants benefit from them. Specifically, in a study by Leonard-Barton (1992) it was pointed out that these difficulties of process innovation stems from the basic capabilities of a company deeply rooted in values interfering with its interaction with new product and process development projects.

According to Squio & Hoffmann (2021), in public sector innovation, the main barriers are related to bureaucracy dysfunctions, receptivity of political agents and audit professionals to receive

and take into account proposals from society, time and resources needed, leadership style, lack of citizens' motivation and evaluation model. However, in the private sector of Serra Gaúcha, Dutra, Pavinato, Carrer, Camargo, & Olea (2021) point out that in most companies there are procedures in the processes, the focus of innovation is especially on products and directed to the market.

As Del Corso, Petraski, Silva, & Taffarel (2014) and Nieves & Quintana (2016) highlighted, in order to sustain their CA, companies need to develop innovative strategies such as those related to HRP. These authors consider that innovative HR processes and practices present themselves as strategic resources that are decisive for obtaining a competitive differential vis-à-vis competitors.

For Dos Santos, Gaspar, Rodrigues, & Baldissarelli (2019), the different generations converge in thinking and perceptions about HRP policies and practices. Just as Severo & De Guimarães (2022) emphasize that generations perceive the importance of innovations for regional development. In this context, technological advances and changes in the organization of work and human resources policies are integrated measures that complement each other to influence participation and increase productivity, characterized by increased competitiveness and competition between organizations (Dos Santos, Araújo, & Gitahy, 2016).

In this context, HRP may be correlated with PSI developed in organizations. Therefore, Hypothesis H3 is presented.

H 3: Process Innovation is positively correlated with Human Resources Practices.

2.4 Moderator effect

In this research, it was considered that some variables may have a moderating effect on the relationship between HRP, PSI and CA, meaning that a variable can affect the direction or the intensity of the relationship between a predictive variable (independent) and a dependent variable (Baron & Kenny, 1986). It was considered, therefore, the possibility that the activity sector (Industry) and company size exert a moderating effect between the relations of the constructs. From the studies of Avermaete, Viane, Morgan, Pitts, Crawford & Mahon (2004), Triguero, Córcoles, & Cuerva (2013) and De Guimarães et al. (2016), it was identified the occurrence of a different behavior among the respondents, especially in the innovation construct, when the companies present different sizes. De Guimarães, Severo, & Vieira (2017) and De Guimarães Severo, & De Vasconcelos (2018) also identified that the Activity Sector interferes in the relationship between innovation-related constructs and other managerial practices between them and HRP. Regarding the sector of activity of the companies, these may be classified as Industrial Manufacturing, Commerce and Services, which are presented in Hypotheses H4a and H4b.

Sebrae criteria (2013) were used to determine the size of the company according to the number of employees, classifying the organizations as micro (up to 19 employees), small (from 20 to 99 employees), the average (from 100 to 499 employees) and large (500 or more employees). In this sense, companies were divided into two groups in terms of size: (i) Micro and Small Enterprise (MSE); ii) Medium and Large Enterprise (MLE). In this scenario, the study presents Hypotheses H5a and H5b.

H4a: The activity sector moderates the relationship between Process Innovation and Competitive Advantage;

H4b: The activity sector moderates the relationship between Human Resources Practices and Competitive Advantage;

H5a: The size company moderates the relationship between Process Innovation and Competitive Advantage;

H5b: The size company moderates the relationship between Human Resources Practices and Competitive Advantage.

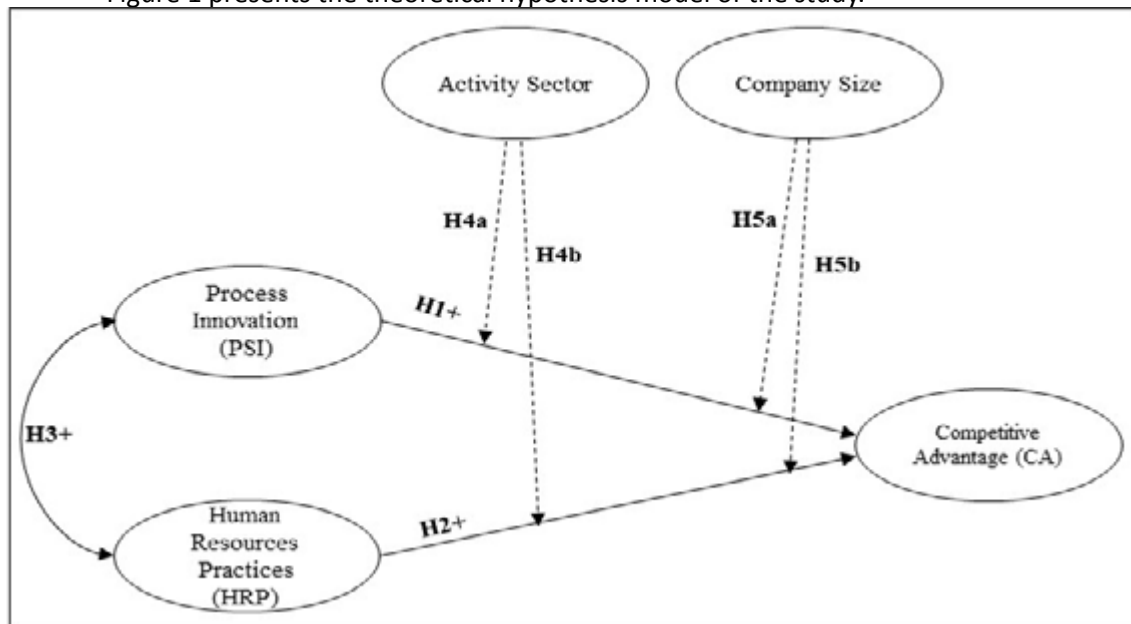Figure 1 presents the theoretical hypothesis model of the study.

Figure 1 – Theoretical model

3 METHOD

The present study is a quantitative research of descriptive character, through a survey applied in Human Resource professionals of companies from various sectors of economic activity (Manufacturing Industrial, Commerce, Services) of the State of Rio Grande do Sul (RS), Brazil. These professionals were surveyed in the databases of the Brazilian Association of Human Resources of the Rio Grande do Sul, the Union of Machinery Industries and Agricultural Implements of Rio Grande do Sul and the Brazilian Association of Machinery and Equipment Industry, totaling the population for approximately 1800 professionals.

The sample was defined according to the availability of the people who were invited to respond to the questionnaire. For the determination of the minimum sample size, the rule of using at least 10 respondents for each observable variable (Hair Jr., Black, Bardin, & Anderson, 2010) and at least 200 respondents (Kline, 2011) was respected.

The primary data collection was done electronically, by sending the search link generated by the Google docs platform, and made available by e-mail to the participants. This procedure occurred between June and July of 2017. A pre-test was performed with 20 questionnaires to verify the understanding of the questions; later these questionnaires were included in the final sample.

A structured questionnaire was used to carry out this research (Table 4). PSI has been adapted from the Oecd (2005) and De Guimarães, Severo, Campos, El-Aouar, & Azevedo (2020). Those that approach the HRP were adapted from the research made by Freitas Filho Campos, & Souza (2015). The issues of CA, on its turn, were adapted from the studies of Paladino (2007) and De Guimarães et al. (2016). For the selection of the statements that make up the questionnaire (Table 4), two experts in innovation and human resources were sent the original versions and adaptations of the questionnaire for the specific research topics, with the purpose that the experts validated and adjusted the affirmative. In this way, it was possible to reduce the number of questions and maintain the quality of the measurement model (questionnaire). The questionnaire was composed of an interval Likert scale, in a degree of agreement or disagreement of five points, where point 1 represents total disagreement and point 5 represents total agreement.

Table 4 – Observable and latent variables - Varimax Rotation

Variáveis Observáveis	Carga Fatorial	Comunalidade
Process Innovation (PSI)		
PSI1) In the company where I work the process innovations have increased the capacity of production and/or the provision of services.	0.784	0.646
PSI2) In the company where I work the process innovations have increased the flexibility of the production and/or of the provision of services	0.747	0.605
PSI3) In the company where I work the process innovations have reduced the costs of production and/or of services rendered.	0.692	0.499
SIP4) In the company where I work the process innovations have improved the quality of the product and/or of the services provided.	0.740	0.584
PSI5) In the company where I work the process innovations have allowed to control aspects related to health and to safety of the worker.	0.571	0.421
PSI6) Process innovations have improved Human Resources Practices.	0.633	0.656
PSI7) Human Resources management has improved its performance after the implementation of process innovations in the sector.	0.563	0.631
Mean 3.942; Standard Deviation 0.934; Cronbach's alpha 0.861; KMO 0.844; Composite Reliability 0.911		
Human Resources Practices (HRP)		
HRP8) In the company where I work the Human Resources Practices contribute to the dissemination of the culture of innovation.	0.661	0.606
HRP9) In the company where I work the Human Resources Practices encourage a climate favorable to the generation and to the development of new ideas.	0.758	0.726
HRP10) The Human Resources management promotes events that stimulate the integration among employees of different areas, encouraging the contact and the building of relationships.	0.723	0.539
HRP11) Human resources management develops innovation competence within the company I work.	0.777	0.740
HRP12) The company where I work disseminates a culture of recognition to innovation.	0.702	0.553
HRP13) The company where I work seeks to share experiences with other companies to develop new skills and abilities related to innovation.	0.653	0.519
Mean 3.711; Standard Deviation 1.067; Cronbach's alpha 0.866; KMO 0.851; Composite Reliability 0.862		
Competitive Advantage (CA)		
CA14) In the company where I work the success rate of new products and/or services is much better compared to competitors.	0.792	0.653
CA15) The company's revenue from new products and/or services is much better compared to its competitors.	0.869	0.787
CA16) The company's profitability with new products and/or services is much better compared to its competitors.	0.875	0.799
CA17) The company where I work has the superior return on investment compared to its competitors.	0.779	0.646
CA18) The company where I work has lower operating costs compared to its competitors.	0.538	0.438
CA19) The Human Resources Management has contributed positively to the company´s overall performance.	0,610	0.679
CA20) The Process Innovation has contributed to improving the overall performance of the company.	0.563	0.668
Mean 3.619; Standard Deviation 0.890; Cronbach's alpha 0.894; KMO 0.880; Composite Reliability 0.928		
Adequacy Measure by Kaiser, Meyer and Olkin (KMO)	0.908	
Bartlett's sphericity tests	2420.338	
Level of significance	0.000	

Note: Significance level $p < 0.001$. Source: The authors (2017).

For the analysis of the data, the procedures adopted were the descriptive statistics used to describe the sample, data behavior and also the Structural Equation Modeling (SEM), a multivariate technique used to test the validity of theoretical models that define causal and hypothetical relationships between variables. In such analysis, Statistical Package for Social Scienses (SPSS®), Version 21 for Windows®, as well as the software AMOS®, Version 21, coupled with SPSS® were used.

In order to operationalize the SEM methodology, the study adopted the steps suggested by Byrne (2010), Hair Jr. et al. (2010) and Kline (2011), who consider the need to define the theoretical model with significance level $p<0.001$ (causal relations). The authors suggest that such methodology helps to define the type of input matrix, to estimate the theoretical model, to evaluate the structural model and to adjust the model if necessary.

The data were refined according to the following steps: i) removing the missing values cases when they are more than 10%; ii) excluding the cases that present answers in a single alternative of the 5-point Likert scale; iii) removing the cases of extreme scores, with analysis of univariate and multivariate outliers, following the recommendations of Kline (2011) and Hair Jr. et al. (2010), in which the Z scores were calculated, identifying cases with higher values to [3,3] for each variable; iv) identifying cases of kurtosis through the Mardia Coefficient (Mardia, 1971; Bentler, 1990) and cases of Pearson's asymmetry; v) evaluating normality from the Kolmogorov-Smirnov and Shapiro-Wilk tests (Shapiro & Wilk, 1965; Öztuna, Elhan, & Tuccar, 2006). Initially, 207 questionnaires answered by Human Resources professionals were collected. However, 2 cases were excluded, since a single alternative response occurred, with the final sample remaining with 205 valid cases.

Before SEM, the Varimax rotation Exploratory Factor Analysis (EFA) technique was applied following the parameters proposed by Hair Jr. et al. (2010), Kline (2011) and Fornell & Larcher (1981): i) verifying the combination of observable variables among each other, in the formation of constructs; ii) verifying the Factorial Loads of each variable (≥0.5); iii) verifying the percentage of explanation of the variance of the set of constructs (> 60%); iv) verifying Communality (≥0.5); v) investigating Simple Reliability through Cronbach's alpha (> 0.7); vi) verifying Bartlett's sphericity tests (significant $p< 0.001$); (vi) investigating Kaiser, Meyer and Olkin (KMO) (>0.7).

In addition, the study performed the analysis of Average Variance Extracted (AVE), which explains the total variance of each observable variable, used to evaluate the construct reliability (Fornell & Larcher, 1981; Marôco, 2010). With AVE it is possible to evaluate the Convergent Validity (CV) (>0.5) and Discriminant Validity (DV), which is expected to be lower than CV.

In the process of evaluation of the structural model the study used the hypothesis tests (variance and covariance), analyzing the Unstandardized Estimates (UE) and Standardized Estimates (SE) parameters. The intensity of the relationships between the constructs was measured by using the Standardized Estimate (SE) index, as proposed by the studies by De Guimarães et al. (2016) De Guimarães, Severo, Jabbour, , de Sousa Jabbour, & Rosa (2021) and Severo, De Guimarães, & Dorion (2018), who advocate that the minimum significance level $p<0.05$, and SE values: i) less than 3.0 is low intensity; ii) values between 0.3 and 0.5 moderate intensity; iii) values greater than 0.5 high intensity.

In order to evaluate the moderating effect of the economic activity sector and the size of the companies, the Chi-square (X2) differences between the groups were measured using the SE indexes as well as the multi-group analysis recommended by Byrne (2010).

In the SEM process, in verifying the adjustment of the measurement model, it was evaluated how well the specified model reproduces the covariance matrix, that is, the similarity between the estimated and observed covariance matrices (Hair Jr. et al., 2010). The following indexes were used as adjustment parameters as suggested by the literature (Hair Jr. et al., 2010; Marôco, 2010; Kline, 2011):

Chi-square value (x^2) of the estimated model divided by degrees of freedom (≤ 5);

Goodness of Fit Index (GFI) (≥ 0.90): The possible range for the quality of GFI is between 0 and 1, with higher values indicating better fit;

Adjusted Goodness of Fit Index (AGFI) (≥0,90);

Normed Fit Index (NFI) (≥ 0.90): The NFI is one of the indexes of incremental adjustment. A model with perfect fit corresponds to an NFI = 1.0;

Root Mean Squared Error of Approximation (RMSEA): values between 0.05 and 0.08 are expected, and zero is perfect fit;

Root Mean Square Residual (RMR): the RMR evaluates whether the sample variances and covariance differ from their estimates. It should range between -4.0 and 4.0 (Hair Jr et al., 2010). The smaller the RMR, the better the model will be considered;

Expected cross-validation index (ECVI): it represents an approximation of the adjustment that the model can achieve with another sample of the same size, serving as a comparison between rival models. Low values for ECVI expressed the model with the best quality of fit, that is, the smaller the ECVI, the better.

4 RESULTS

The average age of the components of the sample is 37 years old. Around 42.9% of those Human Resources professionals have more than ten years in the area. Also, the study pointed out that 69% is female, 19.5% has undergraduate degree and 54.1% graduate degree. It is noteworthy that 89% of respondents have management positions and 68% work in companies with more than 100 employees. As for the companies in the sample, 11% are from the commerce sector, 33% service and 56% are from the manufacturing industry.

In order to verify the viability of the SEM, the EFA was initially applied, resulting in a matrix of three factors, with a 61.97% explanation for data variability, a value considered superior to the minimum recommended by Hair Jr. et al. (2010) which is 60%. It should be noted that Cronbach's alpha of each construct and data set was above the recommended value (>0.7), which confers the simple reliability of the data. With the Varimax rotation in the EFA, it was possible to observe how the variables gather into three factors (Table 1), all of which resulted in a factorial load above 0.5, a parameter recommended by the literature (Hair Jr. et al., 2010). In this analysis, the KMO test (0.908) and Bartlett's Sphericity Test were also performed, both with significant results (p <0.001), conferring viability to EFA for the application of SEM in the empirical data (Hair Jr. et al., 2010).

In order to verify the portion of the variance that an observable variable shares with all other considered variables, the study observed the commonality of the variables of the survey (Table 4), excluding the variable whose value was below 0.5 (Hair Jr. et al., 2010). Three variables presented commonalities below 0.5 (PSI3=0.449, PSI5=0.421, CA18=0.438). However, it was decided to keep them in the model due to the importance of them to theoretically explain the factor.

It was also observed that no variable had a commonality above 0.8, which reveals multicollinearity among the indicators. Still in relation to Table 1, the results of Composite Reliability show values higher than 0.7, demonstrating the feasibility of the data of the constructs and of the set of the data collected (Marôco, 2010).

The verification of the multicollinearity among the observed variables was performed using the Pearson correlation coefficient, whose values of r> 0.90 indicate probable redundancy between items (Hair Jr. et al., 2010). As no correlation above 0.8 was observed, the possibility of multicollinearity was ruled out.
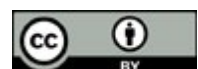
Table 5 presents the Average Variance Extracted (AVE), which evaluates the construct as the total variance of each observable variable. Of the three constructs analyzed, Process Innovation and Competitive Advantage presented a recommended stroke (≥ 0.5) for Convergent Validity (CV) (Fornell & Larcher, 1981). The results of AVE indicate that there may be other observable variables that have not been researched that can contribute statistically to the formation of the Process Innovation and of the Competitive Advantage constructs, since they present values close to the minimum limit of Stroke. Discriminant Validity (DV), in turn, reflects the association between two variables and presented lower indices than the AVE, except for the correlation between the Process Innovation (PSI) and Human Resources Practices (HRP) construct. The others presented values lower than those obtained with the calculation of the AVE, showing suitability.

Table 5 – Average Variance Extracted (AVE)

	PSI	HRP	CV
Process Innovation (PSI)	0.597[a]		
Human Resources Practices (HRP)	0.745[b]	0.757[a]	
Competitive Advantage (CA)	0.487[b]	0.563[b]	0.687a

Note: [a] Convergent Validity (CV). [b] Discriminant Validity (DV).

Figure 2 shows the structural model represented by the straight arrows that link the exogenous constructs PSI and HRP and the endogenous construct CA, indicating the path or cause relationship between two variables. Figure 2 also shows a curved arrow linking two constructs PSI and HRP, representing a correlation.
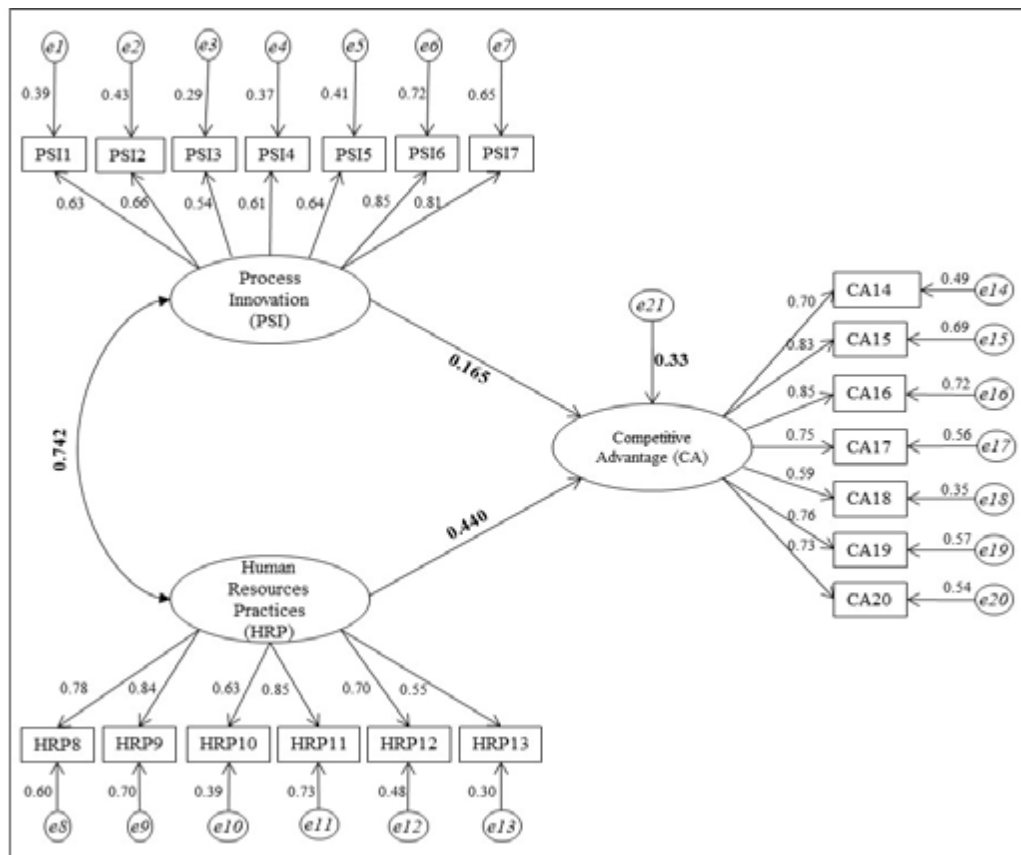

Figure 2 – Integrated theoretical model

The initial results of the hypotheses raised in this research and exposed in Table 6 indicate that the hypotheses and the dependence relations between the constructs (correlation and covariance) were confirmed, since all relations were positive and significant.

Table 6 – Hypothesis test of the theoretical model

Hypothesis	Constructs			Standardized Estimates (SE)	Unstandardized Estimates (UE)	Standard Deviation	Critical Ratio	*p*
H1	Process Innovation (PSI)	-->	Competitive Advantage (CA)	0.165	0.173	0.119	1.448	0.148[a]
H2	Human Resources Practices (HRP)	-->	Competitive Advantage (CA)	0.440	0.385	0.11	3.5	***
H3	Process Innovation (PSI)	<-->	Human Resources Practices (HRP)	0.742	0.257	0.049	5.251	***

Note: [a] not significant for UE. *** Significance level p<0.001 for EU.

The relationships between the constructs were confirmed (Table 6): i) Process Innovation (PSI) and Competitive Advantage (CA) (Hypothesis 1), with values of the Standardized Estimates (SE=0.165) stablishes a low relation between the two constructs. H1 could be considered as an unconfirmed hypothesis, if only the values of Unstandardized Estimates (UE=0.173) were taken into account, as this is not significant where the value of "p" is greater than 0.05. Therefore, in this case, the intensity criterion of the Standardized Estimates (SE) index was used, based on studies by De Guimarães et al. (2016; 2021) and Severo et al. (2018); ii) Human Resources Practices (HRP) and Competitive Advantage (CA) (Hypothesis 2), with values of SE=0.440, expresses a moderate influence of HRP on CA; ii) Process Innovation (PSI) and Human Resources Practices (HRP) (Hypothesis 3), with SE=0.742, shows a high correlation between PSI and HRP, demonstrating that these factors are potentially more effective when used in combination

From the Integrated Model (Figure 2), the analysis of absolute fit measurements was performed. This model indicates how much it reproduces the covariance matrix between the indicators, that is, the similarity between the estimated and observed covariance matrices, based on the indices suggested by Tanaka (1993), Hair Jr. et al. (2010), Marôco (2010) and Kline (2011).

In the analysis of the indexes, the Chi-square value was 2,437,141, while the degrees of freedom were 1002, at a probability level of p<0.001. Analyzing these indices separately, it is considered that the model is appropriate as the indexes suggest that the covariance matrices estimated and observed do not present much difference (Hair Jr. et al., 2010).

Dividing the chi-square by degrees of freedom yields 2.4, a value accepted by the literature, which recommends that this index be less than 5 (Tanaka, 1993). Although the Chi-square test is fundamental, it is not recommended that it be the sole indicator of SEM adjustment (Hair Jr. et al., 2010), and other adjustment measures should therefore be observed.

Regarding the absolute adjustment indexes, the GFI=0.720 was below the recommended value. On the other hand, the RMSEA= 0.048, demonstrates that the model is adequate. The RMR= 0.109 was within range acceptable. The NFI presented value of 0.713, while CFI presented a value of 0.805.

In addition to verifying the direct relations between the constructs, this research proposed to verify the possible influence of non-metrics variables (Activity Sector and Company Size), tested as moderating variables between the relations established in this study, composing the hypotheses H4a, H4b, H5a and H5b. About the moderator effect of Activity Sector (Manufacturing Industrial, Commerce, Services), the Chi-square Difference test (x^2) was performed (Table 7), identifying a significant difference (p<0.001) in the relationship between the constructs. In the PSI->CA relationship, Industrial Manufacturing presented the highest influence intensity (SE=0.416), while in the HRP->CA relationship, Commerce is the group with the highest intensity (SE=1.902).

Table 7 – Hypothesis tests multigrupos – Activity Sector (manufacturing industrial, commerce and services)

Hypothesis				Industrial Manufacturing	Commerce	Service	Chi-square (X^2) Difference
				SE[a]	SE[a]	SE[a]	p
H4a	PSI	-->	CA	0.416	-1.315	-0.232	***
H4b	HRP	-->	CA	0.280	1.902	0.698	***

Note: [a] Standardized Estimates (SE). ***Significance level p<0.001.

About the moderator effect of Company Size, there was a significant difference (p<0.001) in x^2 between the MSEs and MLEs (Table 8). It was also verified that there were different intensities in the relations evidenced by the SE calculations between the constructs, emphasizing that the PSI->CA ratio is more intense in the MLEs with SE=0.210, while the PSI->CA ratio is more intense (SE=0.474) in smaller firms (MSEs).

Table 8 – Hypothesis tests multigrupos – Company size

Hypothesis				Micro and Small Enterprises (MSEs)	Medium and Large Enterprise (MLEs)	Chi-square (X^2) Difference
				SE[a]	SE[a]	p
H5a	PSI	-->	CA	0.093	0.210	***
H5b	HRP	-->	CA	0.474	0.396	***

Note: [a] Standardized Estimates (SE). ***Significance level p<0.001.

5 DISCUSSION

This study found significant evidence for the hypotheses analyzed. Hypothesis H1 predicted that PSI would positively influence CA. This hypothesis was tested using the SEM technique, and through the Standardized Estimates (SE=0.165) it was possible to determine that there is a positive, even a low, relationship of the independent variable PSI on the dependent variable CA. In academic terms, this result is in line with previous research findings, which show a positive relationship between PSI and CA (De Guimarães et al., 2017), in the sense that companies can obtain CA when they develop innovation. However, it was expected that the intensity of the relationship would be greater, indicating that the companies surveyed could invest more in the development of processes and that could create competitive differentials to generate CA. The H1 results show that there is room for the companies surveyed to collect market information and optimize the use of resources to generate dynamic capabilities, and thereby increase organizational competitiveness.

The H2 hypothesis, in turn, that HRP positively influences CA, establishes a moderate relationship between the two constructs (SE=0.440). It is noted that in the companies surveyed HRPs

have a stronger influence on CA than PSI. These highlight an important link between Human Resource Practices and Competitive Advantage, corroborating with the findings of Black & Lynch (2001) and Tsaur & Lin (2004) research. Accordingly, the adoption of these practices by HR professionals influences the CA, as the intangible capital, represented by companies' workers, interacts with other resources dynamically in order to optimize the generation of CA (Del Corso et al., 2014; De Guimarães et al., 2016).

Regarding the correlation between PSI and HRP, expressed in hypothesis H3, the results confirm the existence of a high correlation between the two constructs (SE=0.742). This correlation indicates that when the company uses HRP in an innovative way, the company develops innovative strategies in process, supporting the findings of Del Corso et al. (2014). In this sense, from a theoretical perspective, this result reinforces the understanding that constant investments in PSI and in HR promotes CA in companies (Martinsons et al., 2000; Black & Lynch, 2001; Lin, 2004; Kooij et al., 2010; Freitas Filho et al., 2015). In addition, it is only possible to innovate in processes if people are stimulated and if the company offers a propitious environment. In this regard, HRPs offer greater chances of success. In fact, Freitas Filho et al. (2006), stresses the importance of HR management for the PSI, as HRPs are strongly related to engagement and employee commitment (Kooij et al., 2010).

Another point to highlight is the importance of the individual and group contribution to promote the company's competitiveness, which requires a more systemic and informed articulation between HRP and innovation. This articulation takes place through HR management tools that foster the creative process and the innovative capacity of the workers.

In addition to the main relationships established and illustrated in the Theoretical Model (Figure 1), this study also tested the moderating effect of the Activity Sector and Company Size among the constructs. The hypotheses H4a and H4b, which deals with the moderating effect of Activity Sector on the relation of PSI->CA and HRP->CA, were proven (Table 7). That shows that the Activity Sector, indeed, influences the relations between the constructs. It should be noted that Industrial Manufacturing presents greater intensity in the PSI->CA ratio. This is because manufacturing companies have teams specialized in PSI, with process improvements directly interfering in reducing operating costs and increasing quality, generating CA.

The high intensity results among the Commerce and Services groups in the relationship between HRP->CA indicate that this type of company can effectively manage Human Resources in order to obtain Competitive Advantage, which can be explained by the close relationship between company and consumers of products and services. The moderating effect of Company Size on PSI->CA and HRP->CA relationships was also observed. The hypotheses H5a and H5b were confirmed (Table 9), supporting the studies of Avermaete et al. (2004), Triguero et al. (2013) and De Guimarães et al. (2016). It should be noted that larger companies (MLEs) have more complex and specialized structures, which justifies the high intensity results in the PSI-> CA ratio.

This does not mean that MLEs are more innovative, but that the organizational structure allows for greater conversion of PSI into competitive and CA differentials. The results also indicate that in the HRP->CA relationship the MSEs are more intense, due to the fact that with smaller groups of workers, HRP impacts are more significant in generating CA.

Based on the results of the research, it is possible to infer that Process Innovation and Human Resources Practices contribute to obtaining Competitive Advantage. In this context, Table 9 presents a summary of the hypotheses tested in this study.

Table 9 – Research hypotheses

Hypothesis	Description	Confirmation
H1	PSI positively influences CA	Confirmed
H2	HRP positively influence the CA	Confirmed
H3	PSI is positively correlated with HRP	Confirmed
H4a	The activity sector moderates the relationship between PSI and CA	Confirmed
H4b	The activity sector moderates the relationship between HRP and CA	Confirmed
H5a	The size company moderates the relationship between PSI and CA	Confirmed
H5b	The size company moderates the relationship between HRP and CA	Confirmed

6 CONCLUSIONS

The results indicate that PSI positively influences CA, even at low intensity. The PSI developed by the companies implies significant changes in its procedures, when searching for excellence and improvements. Therefore, PSI offers CA to the companies as PSI provides ways to the companies outperform their competitors, through improvements in their processes and gains in efficiency in their services.

Regarding the companies' HRP, the research findings show that they strongly influence CA. In fact, those practices enable people to generate ideas, work collectively in order to enhance individual capacities, transforming resources in dynamic capabilities. In addition, HRP provide an environment that encourages innovation and the worker's improvement.

The strong correlation between HRP and PSI brings important academic contributions to organizational studies. In that sense, the research found evidence that companies using HRP have highly innovative processes and higher CA in relation to companies that do not systematically use HRP and PSI.

The hypothesis tests of the moderating effect of the Activity Sector and Company Size showed that Commerce and Services companies as well as Micro and Small Enterprises still have room to invest in methods and in organizational structure to broaden the results of PSI influence on CA.

An important contribution of this study to academic research is the construction of an analysis model, based on the validation of a theoretical model (Figure 1) and on the statistical validation of the scales and constructs (Figure 2), which make possible the creation of a framework for future research.

Regarding the managerial contributions, the present study brought important information to direct the strategic actions of the companies, integrating PSI and HRP to generate CA, having human resources management as an important vector for the company strategy, guiding individuals towards the companies' objectives.

Among the limitations of the research, the study highlights the possibility of the existence of the Halo effect, which can occur with the use of the Likert scale (in levels). This effect is associated with the possibility of response biases arising from the wrong generalization effect. Such biases, arising from responses emitted by a single respondent or from the influence of social desire, may reduce or increase the relationships between the constructs and the observable variables (Bagozzi & Yi, 1991; Podsakoff, Mackenzie, Lee, & Podsakoff, 2003; De Guimarães et al., 2018).

It is suggested for future research to identify other variables that may interact with the researched model. In addition, another important factor is the identification of Human Resources Practices and which of these practices contribute to innovation and Competitive Advantage.

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AUTHORS

1. Vanessa Faedo Serafin
Faculdade Meridional (IMED). Passo Fundo, Rio Grande do Sul, Brazil.
Master Degree in Business Administration from the Faculdade Meridional (IMED) in Passo Fundo. She has experience in the area of Business Administration, with emphasis in human resource practices and innovation. Professor at the Faculdade Meridional (IMED), Post-Graduate Program in Administration.
E-mail: vanessaf.serafin@gmail.com
ORCID: http://orcid.org/0000-0001-5367-6176

2. Eliana Andrea Severo
Federal University of Pernambuco (UFPE). Recife, Pernambuco, Brazil.
Post-doctoral degree from the University of Caxias do Sul (UCS), Doctor in Business Administration at the Pontificia University Católica of Rio Grande do Sul (PUC-RS) and University of Caxias do Sul (UCS), Brazil. She has experience in the area of Business Administration, with emphasis in environmental management, innovation and entrepreneurship. Professor at Federal University of Pernambuco (UFPE), Center for Applied Social Sciences, (CCSA), Department of Administrative Sciences (DCA).
E-mail: elianasevero2@hotmail.com

ORCID: http://orcid.org/0000-0002-5970-4032
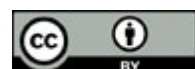
3. Julio Cesar Ferro de Guimarães

Federal University of Pernambuco (UFPE), Recife, Pernambuco, Brazil.

Post-doctoral degree from the University of Caxias do Sul (UCS), Doctor in Business Administration at the Pontifícia University Católica of Rio Grande do Sul (PUC-RS) and University of Caxias do Sul (UCS), Brazil. He has experience in the area of Business Administration, emphasis in management of innovation, business competitiveness and Cleaner Production. Professor at Federal University of Pernambuco (UFPE), Center for Applied Social Sciences, (CCSA), Department of Administrative Sciences (DCA).

E-mail: juliocfguimaraes@yahoo.com.br

ORCID: http://orcid.org/0000-0003-3718-6075

4. Claudio Rotta

Centro Universitário Cenecista de Osório (UNICNEC). Osório, Rio Grande do Sul, Brazil.

Doctor in Business Administration at the University Vale do Rio dos Sinos (UNISINOS) in São Leopoldo and Master Degree in Economics from the University Federal of Rio Grande do Sul (UFRGS). He has experience in the area of Business Administration, emphasis in management of innovation and human resource practices. Professor at the Escola Superior de Propaganda e Marketing (ESPM-SUL).

E-mail: claudio.rottabr@gmail.com

ORCID: http://orcid.org/0000-0002-6738-9896

5. Deivis Cassiano Philereno

Faculdade Cenecista de Osório (FACOS). Osório, Rio Grande do Sul, Brazil.

Doctor in Regional Development at the University Universidade de Santa Cruz do Sul (UNISC) in Santa Cruz do Sul and Master Degree in Economics at Pontifícia Universidade Católica do Rio Grande do Sul (PUC/RS). He has experience in the area of Business Administration, emphasis in management of innovation and regional development. Professor at the Faculdade Cenecista de Osório (FACOS).

E-mail: deivisphilereno@hotmail.com

ORCID: http://orcid.org/0000-0002-3621-9405

Contribution of authors

Contribution	[Author 1]	[Author 2]	[Author 3]	[Author 4]	[Author 5]
1. Definition of research problem	√	√	√		
2. Development of hypotheses or research questions (empirical studies)	√	√	√		
3. Development of theoretical propositions (theoretical work)	√	√			
4. Theoretical foundation / Literature review	√	√			
5. Definition of methodological procedures			√	√	√
6. Data collection	√				
7. Statistical analysis	√	√	√		
8. Analysis and interpretation of data	√	√	√		
9. Critical revision of the manuscript		√	√	√	√
10. Manuscript writing		√	√	√	
11. Other (please specify)					