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HOW DOES TRAINING CONTRIBUTE TO ORGANIZATIONAL INNOVATION? NEW RESEARCH AVENUES

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ABSTRACT

Purpose: In this study the aim is to propose a research agenda about how training activities contribute to organizational innovation results, based on an integrative and systematic review of a scientifically relevant literature portfolio.

Methodology/approach: Based on relevant literature selected after applying *Methodi Ordinatio* structured protocol, a state of knowledge systematic literature review was carried out on studies about the relationship between training activities and organizational innovation. Theoretical and methodological content categories were analyzed comprising articles published in databases indexed on *Portal de Periódicos da CAPES*.

Originality/value: After systematic reviewing relevant literature about the relationship between training effects and organizational innovation, this study proposes new research avenues focusing to address identified state of knowledge research gaps. These new research possibilities can guide advancements on the field by contributing for better phenomenon comprehension.

Findings: The studies analyzed are primarily based on measures focused on the organizational level and predominantly quantitative. The most used data source were perceptual measures compared with econometric data focused on organizational results, and training effects were measured only on a post-fact transversal approach.

Theoretical and methodological contributions: New relevant research avenues based on state of knowledge research gaps are presented, aiding the field to advance. The use of *Methodi Ordinatio* structured protocol contributes to methodologically advance in this kind of research by supporting the selection of relevant bibliographic portfolio.

Keywords: Training. Innovation. Systematic literature review. Organizational innovation.

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COMO TREINAMENTO CONTRIBUI PARA A INOVAÇÃO ORGANIZACIONAL? NOVOS CAMINHOS DE PESQUISA

RESUMO

Objetivo: Neste estudo, o objetivo é propor uma agenda de pesquisa sobre como atividades de treinamento contribuem para os resultados da inovação organizacional, a partir de uma revisão integrativa e sistemática de um portfólio de literatura cientificamente relevante.

Metodologia/abordagem: Com base na literatura relevante selecionada após a aplicação do protocolo *Methodi Ordinatio*, foi realizada uma revisão sistemática da literatura sobre o estado do conhecimento na relação entre atividades de treinamento e inovação organizacional. Foram analisadas categorias de conteúdo teórico-metodológico compreendendo artigos publicados em bases de dados indexadas no Portal de Periódicos da CAPES.

Originalidade/relevância: Após uma revisão sistemática da literatura relevante sobre a relação entre os efeitos do treinamento e a inovação organizacional, são propostos novos caminhos de pesquisa com foco em abordar as lacunas de pesquisa do estado do conhecimento identificadas nesse estudo. Essas novas possibilidades de pesquisa podem orientar os avanços na área, contribuindo para uma melhor compreensão do fenômeno abordado.

Resultados: Os estudos analisados baseiam-se principalmente em medidas focadas no nível organizacional e predominantemente quantitativas. As fontes de dados mais utilizada foram medidas perceptuais comparadas com dados econométricos focados nos resultados organizacionais, e os efeitos do treinamento foram medidos apenas em uma abordagem transversal pós-fato.

Contribuições teóricas/metodológicas: Novos relevantes caminhos de pesquisa com base em lacunas de pesquisa de ponta são apresentados, ajudando o campo a avançar. A utilização do protocolo estruturado *Methodi Ordinatio* contribui para o avanço metodológico neste tipo de pesquisa ao subsidiar a seleção de portfólio bibliográfico cientificamente relevante.

Palavras-chave: Treinamento. Inovação. Revisão sistemática da literatura. Inovação organizacional.

1. INTRODUCTION

The purpose of this study is to propose a research agenda on training contribution to organizational innovation results, based on an integrative and systematic review of a scientifically relevant literature portfolio about the state of knowledge on the topic. Innovation has been considered an important and efficient form of competitive advantage between organizations, which could attracts resources for the development of innovation programs in the most diverse organizations, including those in the public sector, as well as a vast literature that seeks to conceptualize the phenomenon of innovation and its ramifications (Antonioli & Della Torre, 2015; Damanpour, 2020; Damanpour et al., 2009; Djellal & Gallouj, 2018; Gallego et al., 2013; Gallouj, 2002; Gallouj & Weinstein, 1997; Ganter & Hecker, 2013; Mol & Birkinshaw, 2009; Schumpeter, 1997).

Human capital is an important determinant of an organization ability to innovate. Thus, it is possible that any increase in this asset through investment in training could lead to more innovation (Dostie, 2018). Organizational innovation needs human participation on its activities by mobilizing individual skills and using creativity and knowledge to generate and implement new ideas. Considering that cognition and learning processes are closely related to the results of the most diverse types of innovation (Antonioli & Della Torre, 2015; Bauernschuster et al., 2009; Børing, 2017; Dostie, 2018; Gallouj & Weinstein, 1997; Sung & Choi, 2014), it could be assumed that there is a contribution between the effects of formal learning actions on organizational innovation results when training is meant to be an intrinsic part of the innovation process.

Learning and skills development processes can occur and generate results at least at three main levels of analysis (individual, group and organizational), with multifactorial antecedents present in less comprehensive levels of analysis. For example, studies on organizational learning focus on the macro level, but also consider that learning is a process that begins in the individual component of the organization. Based on a literature review about creativity and organizational innovation organized by levels of analysis, Anderson et al. (2014) demonstrate that there is a set of key variables reported to have an effect on creativity and innovation, such as: personality traits, goal orientation, values, thinking styles, self-concept and identity, knowledge and skill, psychological states, motivation, task complexity, work objectives and requirements, leadership and supervision at the individual level; team composition and structure, team processes and climate, team leadership at the group level, and; factors related to management, networks and use of knowledge, structure and strategy, size,

culture and climate, external environment, diffusion of innovation and corporate entrepreneurship at the organizational level.

It is important to highlight that studies related to training-innovation relationship have mainly focused its efforts on analysis at the organizational level (Antonioli & Della Torre, 2015; Børing, 2017; Dostie, 2018; Ganter & Hecker, 2013; Piening & Salge, 2015; Sung & Choi, 2014), using perceptual measures collected from secondary data from national or even continental ones made with managers from different organizations, relating them to objective data at that same level, without making use of important information relevant to the lower levels of aggregation, such as individual learning and transfer of training by workers trained to produce innovations, or organizational climate favorable to innovation at group level of analysis. This implies that there is still much to discover in order to understand how the contribution of training activities to organizational innovation results occurs, particularly on public sector organizations.

2. BIBLIOGRAPHY

2.1 ORGANIZATIONAL INNOVATION AND HUMAN CAPITAL

Following the pioneering theoretical approach of the Austrian economist Schumpeter (1997) on the importance of innovation for economic development, organizational innovation science developed some epistemological and theoretical advances, passing by the characteristics approach present in the seminal article of Gallouj and Weinstein (1997), until the service science perspective of Maglio and Spohrer (2008) which suggests integrative analyzes of innovation in durable goods and services. Some innovation theories, like the chain link model by Kline and Rosenberg (1986) and the innovation systems theory, emphasize that innovation is not a sequential and linear process, but, on the contrary, it concerns a lot of interactions and feedbacks in creation and knowledge use. Additionally, it is understood that innovation is based upon a learning process with multiple inputs and that requires continuous problem solving (Organization for Economic Co-operation and Development/Eurostat [OECD/Eurostat], 2018).

With little exceptions, and for a long time, innovation studies were synonym of studying new products and productive process development. Recently, researchers have increasingly criticized this narrowed notion which focus exclusively in technological innovation, generating interest in non-technological forms of innovation, as organizational or

managerial innovation (Ganter & Hecker, 2013). Innovation process in organizations, for having a strong dynamic and in stages characteristics until a real innovation is achieved, also tends to develop people involved in it because human participation is essential to having an innovation generated and implemented from the ideas generation to the final stages of implementing what was created.

Innovation is a well-accepted driver of economic growth and development, and the key determinant underlying the innovation process is assumed to be human capital. The most common indicators of human capital are the amount and quality of schooling; however, many skills are best learned on the job. Because of the rapidly changing environment of today's world in which human capital derived from formal education (schooling, vocational education) depreciates quickly, learning by doing, in the form of in-firm training, may be an additional way to continue to accumulate leading-edge knowledge (Bauernschuster et al., 2009).

According to Arundel and Huber (2013), innovation in the public sector has often been viewed as an oxymoron, with many scholars assuming that it is rare, due to a lack of incentives and a risk-averse attitude of senior managers in public organizations. Nonetheless, the high innovation rates found on Arundel and Huber (2013) study indicate that Australian public sector managers are capable of innovating in what appears to be difficult conditions, such as a risk-averse environment and a lack of market-mediated financial incentives. Assumptions about the public sector being risk averse and lacking suitable incentives are either misleading or public sector managers can innovate within these constraints.

Considering that creativity and innovation have been increasingly important determinants of success, organizational performance and long-term survival, Anderson et al. (2014) coined an integrative concept between these two parts of the same process, what brings new and intriguing perspectives for the field of organizational studies about innovation, attempting to the fact that organizational innovation has multilevel antecedents and results and it is an emergent phenomenon at the workplace and has a procedural character over time.

2.2 TRAINING ACTIVITIES EFFECTIVENESS AND ORGANIZATIONAL SUCCESS

Training, development and education (TD&E) investment can be seen as an organizational competitive advantage and it should have a direct connection with organizational objectives and goals, as well as being planned and executed with the fundamental objective of avoiding organizations obsolescence and promoting constant innovations, based on recognition of needs imposed by a globalized scenario (Coelho Junior & Borges-Andrade, 2008). TD&E

programs have become essential for survival and organizational competitiveness, being considered effective instruments for new skills learning that are required for structuring an increasingly complex and comprehensive professional profile (Meneses, 2007).

Also, training and skills development are human resource management practices that can contribute for innovation activities results due to their potential to influence an organization ability in taking advantage from its workforce skills and creative potential (OECD/Eurostat, 2018). In modern and competitive organizations, investments in training are necessary due to the growing strategic role of knowledge and human capital in building and sustaining competitive advantages, such as innovation in its most diverse types and applications (Antonioli & Della Torre, 2015).

The importance of human capital and its performance for the success of an organization is highlighted by Dostie (2013), Lenihan et al. (2019), Liu et al. (2020), Ma et al. (2019) and Michaelis and Markham (2017). These studies discuss evidence about the relationships between investment in human capital accumulation through human resources organizational systems and productivity or innovation results enhancement. Assuming that innovation leads to economic growth and development, and that human capital is the key factor in the innovation process, the theory of endogenous growth, which analyzes the effects of human capital on production, emphasizes its effects on the growth of innovative capacity, in the form of new processes and products (Bauernschuster et al., 2009). In a recent and extensive literature review, Bell et al. (2017) point out the important development of research focusing on the benefits of training not only for individuals, but also for the effectiveness of teams and organizations, as emphasized in the study by Aguinis and Kraiger (2009).

To Borges-Andrade and Pilati (2006), the measurement process is one of special importance for training, development and education actions. The activity of assessing something demands the establishment of a judgment on an action or event, and the act of measuring supports that judgment. The TD&E assessment measures have different characteristics depending on type of variables to which they refer. Some of these measures may be suitable for investigating training effects on organizational innovation results due to its multilevel, longitudinal and multivariate characteristics.

Meneses and Abbad (2009) highlighted reasons for the low level of knowledge development about the relationship between training and organizational performance: frequent lack of definition for organizational results indicators that are clearly associated with training programs, and lack of methodological prescriptions. Meneses and Abbad (2009) presented a proposal to develop models for training effectiveness evaluation that are centered on application

of a methodological tool called logical model, which is used by the program evaluation field and could guide the articulation of individual and organizational training objectives.

The focus on more comprehensive analysis level of training interventions results in organizations is not new, as it can be seen on the seminal four levels training evaluation model (Kirkpatrick, 1976), reinforced and complemented by the consequent five levels framework presented on Hamblin (1978). The evaluation model presented by Hamblin (1978) makes references to organizational change and final value as levels of analysis related to organizational performance results with the potential to suffer effects from training programs realization. However, most of evaluative studies focus on effects at the individual level of analysis and regarding effectiveness of training, a dimension that includes measures and indicators at higher levels of analysis, the field has been continually challenged by the difficulty of articulating individual performance objectives and goals with organizational results (Damasceno et al., 2012).

When reviewing literature on the relationship between training and its effects on organizational performance, Thang, Nguyen Ngoc, Quang and Buyens (2010) report that some studies have failed to find evidence about the impacts of this relationship while their review indicated that this relationship can be mediated by the employee's knowledge and attitude, in addition to being moderated by capital investment or organizational strategy. On the other hand, even with the existing criticisms regarding the cost of training practice in organizations and some skepticism about the distal link between training and organizational performance, new evidences of the impacts produced at this level of analysis has been emerging (Kim & Ployhart, 2014; Lacerenza et al., 2017; Sung & Choi, 2014).

Recent publications such as the theoretical-empirical research by Avolio, Avey and Quisenberry (2010) and Kim and Ployhart (2014), the meta-analysis carried out by Lacerenza et al. (2017), the extensive systematic review carried out by Bell et al. (2017) and the review of training transfer by Ford, Baldwin and Prasad (2018) demonstrate positive results from the impact of training programs on organizational performance, including managerial training on leadership, while pointing out paths and avenues for future research in this area.

Avolio et al. (2010) report expected return on investment made in leadership development ranging from negative values up to 200% and suggest that decisions regarding training and leadership development should use an approach like the financial return on capital investment, as the process incurs on costs for an expected benefit, which draws attention to more evidence of the relationship between training and organizational performance. In turn, Kim and Ployhart (2014), when examining data from 359 firms over twelve years on how

organizations can leverage their human resources to improve their performance and competitive advantage, found that the amount of internal investment in training over time was significantly related to its financial profit growth through the impact of this investment on the productivity of its workforce.

Lacerenza et al. (2017) estimated the effectiveness of leadership training in an extensive meta-analysis and found that these training are substantially more effective than previously thought, finding significant effects at all four result levels (reaction, learning , transfer and results) in addition to describing how the power of these effects are affected by fifteen moderators related to their development, delivery and implementation characteristics, suggesting the importance of continuing to study the effects of training even at the broadest level of organizational performance. Bell et al. (2017) call attention to the emergence of the need for more research that is guided by theories, take greater account of trainee and training context roles, examine learning that takes place outside the classroom and, finally, understand training impacts at different levels of analysis, which contributes for addressing the objective of this study.

3. RESEARCH METHODS AND TECHNIQUES

A mixed methodological strategy was chosen to achieve the objective of this study after applying *Methodi Ordinatio* structured protocol (Pagani et al., 2015) to select, rank and systematically read papers that are scientifically relevant to analyze the state of knowledge on the relationship between training activities and organizational innovation, composing a current bibliographic portfolio. *Methodi Ordinatio* is a systematic review method consisting in nine phases, which employs the Index Ordinatio (InOrdinatio) equation to rank papers in a multicriteria way taking into consideration the main factors to be considered in a scientific paper: year of publication, number of citations and impact factor of the journal in which the paper was published. It is also suitable for selecting a scientifically relevant bibliographic portfolio for any desired research.

Since the objective of this article is to propose future research avenues, an integrative systematic review (Badger et al., 2000; Torraco, 2016) was performed on theoretical and methodological approaches present on selected bibliography, aiming to identify research gaps that could support the proposal of new research avenues on the subject. The application of *Methodi Ordinatio* protocol on this research is described step-by-step, as follow:

Phase 1 – *Establishing the intention of research*. This research intention was to analyze the state of knowledge about the contribution of training to organizational innovation and proposing new research possibilities.

Phase 2 – *Preliminary exploratory search of keywords in data bases*. Initially, the keywords combination *innovation training* and *organizational learning* was tested in data bases through *Portal de Periódicos da CAPES* (https://www-periodicos-capes-gov-br.ezl.periodicos.capes.gov.br), with which the researchers usually work and are familiar.

Phase 3 – *Definition and combination of keywords and data bases*. The sample space was defined as all the databases accessible through Coordination of the Improvement of Higher Education Personnel (CAPES) organization, in accordance with its scope and recognition by the Brazilian scientific community. *Portal de Periódicos da CAPES* indexes 116 data bases referring to the Applied Social Sciences knowledge area including *Web of Science, Scopus, SCiELO.ORG, Science Direct, ProQuest, EBSCO, Annual Reviews and SAGE Journals Online*. Through *Portal de Periódicos da CAPES* the researchers have access to a large number of publications with the keywords searched and higher availability of access to the material published with consistency on results.

After analyzing title and keywords used on results obtained at the preliminary exploratory search on phase 1, new keywords were added to the final search. Since organizational innovation is a topic explored into the wider field of innovation and that could be more related to process and service innovation, and training related to innovation is a topic linked to learning and development, the keywords related to the issue of research were selected as: "*organizational learning*", "*learning and development*", "*training*", *"process innovation"*, "*innovation*", and "*innovation in services*". These keywords were divided into two groups, one for training (the first three) and the other for innovation (the last three). Using the Boolean operator "AND" the data bases were searched nine times, performing three combinations of each first group keyword with each one from the second group, individually, as: "*organizational learning*" AND *"process innovation";* "*organizational learning*" AND *"innovation";* "*organizational learning*" AND *"innovation in services";* "*learning and development*" AND *"process innovation";* "*learning and development*" AND *"innovation";* "*learning and development*" AND *"innovation in services";* "*training*" AND *"process innovation";* "*training*" AND *"innovation"; and,* "*training*" AND *"innovation in services"*.

Phase 4 – *Final search in the data bases*. The nine literature searches at *Portal de Periódicos da CAPES* using the keywords combinations defined on phase 3 resulted on more than 100,000 publications listed on four of the nine keywords combination used, with repeated

sources appearing between then. Results could support that all six keywords used were helpful to address the greater fields of knowledge that this research objective is inserted. The keywords "*training*", "learning and development" and "*innovation*" generated the larger amount of return on each search round of its combinations. These amounts showed also that the greater learning and development, innovation and training fields of research have an expressive current scientific production and that this path continued in 2020.

Phase 5 – *Filtering procedures*. Each of the nine searches performed at *Portal de Periódicos da CAPES* showed results on many pages sorted by relevance according to the inclusion and exclusion criteria applied. In order to filter the large preliminary results obtained on phase 4, it was considered only results that matched the following inclusion criteria: complete scientific articles, peer-reviewed in the blind review system, exclusively published in scientific journals, published in English language, and published between 2013 and 2020. Therefore, content and temporality were considered as inclusion criteria since the keywords used were topic related as mentioned before and the chosen time frame comprised the state of knowledge on the topic for the last 8 years (2013-2020) following studies by Anderson *et al.* (2014) and Araújo *et al.* (2015) that reviewed literature until 2013. Filtered results included only studies addressed at organizational contexts that presented research frameworks with antecedents and dimensions of organizational or service innovation or explicitly dealt with the relationship between training effects and innovation results.

The following elimination procedures were applied: repeated papers; papers whose Title, Abstract or Keywords were not related to the subject searched; papers presented in conferences and book chapters; articles that are not focused on organizational contexts; and papers thar did not present any knowledge related to the relationship between training and innovation or organizational innovation concepts, types and dimensions. Altogether, the filtering procedures resulted in a large number of papers eliminated. This resulted in a total of 26 articles left. After performing a preliminary reading on these articles full text (without systematic reviewing them yet), other 7 papers outside the researched time frame were added to the sample by cross-reference due to their seminal, relevance to the subject or literature review nature. The final sample resulted with 33 articles left.

Phase 6 – *Identifying impact factor, year of publication and number of citations*. The sources used to retrieve information needed were Google Scholar for number of citations, Journal Citation Report data base for JCR and Scopus data base for CiteScore (both for last year impact factor). This search result in 28 papers with JCR metrics available and 5 papers that did not presented JCR last year impact factor but had CiteScore metrics available. The two

groups were treated within the same table in the next phase, since no incompatibility was found between the results. The articles were organized in a spreadsheet in the following columns order: paper title, impact factor, number of citations, and year.

Phase 7 – *Ranking the papers using the InOrdinatio*. The InOrdinatio equation (Pagani et al., 2015) was employed with ∝ equal to 10, considering the factor year is relevant for the theme and objective of this research, since that to analyze state of knowledge gaps it is required newer articles (but with lower number of citation) and to analyze theoretical and methodological advances it is required the old seminal ones (higher number of citations). Table 2, at Appendix 1, shows the final articles resulting from application of phases 1 – 7.

Phase 8 – *Finding the full papers*. This phase was partially carried out simultaneously with phase 6, because some articles had full text access available when searching for impact factor, year of publication and number of citations. All papers were found in their full text version.

Phase 9 – *Reading and systematic analysis of the papers.* A systematic reading was performed on all 33 articles, since they resulted with a positive *InOrdinatio* value. An integrative analysis (Torraco, 2016) focused on literature methodological approaches and its results was performed to discover research gaps and proposing future research paths that could support the advancement of organizational innovation research field. The papers content was analyzed considering the following categories: field of enquiry, year of publication, authors' institution and country, research objectives, main theoretical issues, relationship between training and innovation, methodological design, limitations, suggestions for future research and main results.

4. DISCUSSION AND RESULT ANALYSIS

4.1 INTEGRATIVE REVIEW: METHODOLOGICAL APPROACHES AND MAIN RESULTS

Within this research limits, the studies about the contribution on training activities to organizational innovation results presented itself as being fragmented between the fields of enquiry Economics, Management and Psychology, with an emphasis on the second one. Research that is specifically focused on process innovation is also related to Management science, sometimes cited as organizational innovation (Damanpour, 1991), administrative or even managerial innovation. In general, studies from Management science have a main focus

on organizational learning and innovation and its background, with service innovation in the public sector being divided between the first two disciplines (Management and Economics).

Training as a method to stimulate new ideas or creativity is an important method to increase innovation activities. Training can either support innovation or a background to its activities, but it can also do so through training on work practices required by newly introduced products or processes (Børing, 2017). Training encourages innovation results in organizations, as trained workers obtain cutting-edge knowledge in order to understand complex products and production processes and are more likely to achieve technological improvements. The relationship between training and innovation is, in fact, a causal relationship (Bauernschuster et al., 2009). However, the present research showed that this relationship is not yet well explored on relevant literature, with few exceptions among a vast production about innovation, in general. Similar situation is also reported by (Børing, 2017; Dostie, 2018; Naranjo-Valencia et al., 2018).

The Norwegian study presented by Børing (2017) adds that few studies have focused on how training is related to innovation, reinforcing the existence of this research gap and justifying current efforts to scientifically clarify this phenomenon. Most of the studies considered in this review are focused on the macro analysis levels (Dostie, 2013; Sung & Choi, 2014), use only secondary data and come from Economics approach. Sung and Choi (2014) study introduces propositions that explore the mechanism by which investments in training and development affect the performance of organizational innovation and helps to clarify the mediating effect of multilevel learning practices in this relationship. This was the only empirical study on the effect of investments in training and development on learning and innovation at the organizational level based on a longitudinal study with multiple sources of data found on this review.

Sung and Choi (2014) show that financial investment in corporate training significantly increases organizational innovation and emphasize that organizational investments in training and development create a climate for constant learning. González, Miles-Touya and Pazó (2016) present evidence that performing R&D and employee training, simultaneously, significantly increases the probability to innovate. Climate for constant learning facilitates the exchange of knowledge and ideas between employees, which, in turn, promotes the generation of new knowledge and innovations (Børing, 2017).

No specific meta-analysis or integrative literature review focused on the relationship between training effects and organizational innovation results was found with publication year between 2013 and 2020. Using cross-reference search on the state of knowledge relevant

literature reviewed it was found one meta-analysis published by F. Damanpour (1991) focused on the background and moderating effects of Organizational Innovation. Damanpour (1991) used correlations to analyze the power of the relationship between thirteen antecedent variables and innovation: Specialization, Functional differentiation, Professionalism, Formalization, Centralization, Managerial attitude favorable to change, Duration of the manager in the position, Technical knowledge resources, Administrative intensity, Plenty of resources, External communication, Internal communication, and Vertical differentiation, considering the mediating role of Type of innovation, Adoption stage, Type of organization, and Scope of innovation. The variable "professionalism" involves the professional knowledge of employees and can be measured by an index that reflects the degree of professional training of employees.

Aiming to explore which dimensions of innovation effectively moderate the relationship between innovation and its determinants and testing some of the existing innovation theories using aggregated data, the work of F. Damanpour (1991) also aimed to assess the validity of the premise of instability in the results of innovation research and found that this premise is not necessarily valid, that the type of innovation adopted did not prove to be an important mediator of the relationship between organizational innovation and its antecedents. (Damanpour, 1991) also suggests the need for multidimensional studies on a single type of innovation and on several types simultaneously for the field advancement on several issues.

Analyzing the measures most found on the literature portfolio reviewed, most articles make use of scales to collect perceptual data on variables about distinct kinds of innovation results and variables that are direct related to investments in training. These perceptual data are often related to secondary data from organizational indicators or even econometric panels, both with a more objective nature. No relevant variability was found on measures used by the studies found and analyzed in this literature review. Considering that many of these studies are focused only on the macro analysis level, organizational innovation still lacks many advances in detailing factors that preceded successful innovation, which highlights the need for more robust theoretical research models, with inclusion of antecedent and contextual variables of less comprehensive levels that can better explain the aggregate results observed at higher levels.

4.2 RESEARCH GAPS REGARDING TRAINING CONTRIBUTIONS TO ORGANIZATIONAL INNOVATION RESULTS.

According to Neirotti and Paolucci (2013), existing empirical work does not explore various elements of the ways firms invest in training to sustain innovation processes, like how

much and what type of training occurs for this purpose and for whom occurs. Indeed, the articles analyzed in this review have some relevant research gaps, like the ones mentioned in Table 1, which corroborates this assumption until now. It seems that, when it comes to analyze and understand how training activities contribute to organizational innovation results, relevant antecedents, explanatory and contextual variables are missing on research frameworks on the topic, despite existing advancements on more robust research frameworks on training effectiveness evaluation and publication of new theoretical and empirical approaches on innovation science. The deepening and discussion of such aspects by researchers and professionals in the areas of effectiveness of training and organizational innovation may contribute for the development of related new knowledge.

A preliminary search at scientific data bases with the keywords chosen to this study showed that there are many articles published between 2013 and 2020 that could be related to the topic of training-innovation relationship. Nonetheless, when the combo Title, Keywords and Abstract is analyzed, it gets clear that the great majority of this sample do not directly explore questions about if and how training activities contribute to organization innovation results. In some innovation studies, training is embedded on approaches more related to issued like organizational learning and human capital development, when it appears as a considered variable.

Besides training activities, organizational innovation results can be related to several other factors, such as investments in appropriate technology, a R&D program - Research and Development (if necessary) and retention of consultants and several external suppliers, including agreements licensing and partnerships with other firms. Still, relatively few studies examine the relationship and the effects of training with innovation performance at the organizational level, and even less explore which specific characteristics of factors directly related to these training processes affect the aforementioned results, despite the numerous reasons to consider training as one of the components of successful innovation (Dostie, 2018). The impact of training on innovation has been neglected in the literature on human capital and innovation but could be of particular importance for certain kinds of innovation (Bauernschuster et al., 2009).

For content analysis, it was necessary to limit the number of articles, prioritizing studies with greater proximity to the research focus and scientific relevance. After performing a categorization of all 33 studies retrieved for this article approach, an integrative review focused on methodological approaches and research gaps was achieved. The portfolio was first categorized by means of year of publication, authors country, keywords, study type and nature,

objective, innovation theoretical characteristics, training relation to innovation, research design, data collection and analysis procedures, measures and instruments, participants and field of research application, antecedents and dependent variables, moderator and mediator variables, hypothesis statements, results, limitations, field of enquiry and research gaps.

The objectives and results published in these articles shows that just a few numbers of studies aimed to discover details on how training can contribute to organizational innovation, and less on public service domain. Most studies analyzed focused on the existence of a relationship between training activities and innovation results, but always measuring it on a higher organizational level, which leads to gaps on approaching important characteristics of the multidimensional phenomena involved. Table 1 shows methodological design and identified research gaps on seven reviewed articles that are a sample of scientifically relevant empirical studies that show state of knowledge on the topic, ranging from 2013 to 2020. The seven studies presented an *InOrdinatio* result equal or more than 100, representing their relevance according to *Methodi Ordinatio* (Pagani et al., 2015).

Table 1 – Methodological design and identified research gaps on state of knowledge reviewed articles

Source reference	InOrdinatio	Methodological design	Variable measures and research instruments	Research gaps identified
(Sung & Choi, 2014)	358	Statystical analysis of longitudinal and multilevel survey applied on 260 HR managers, 7996 employees, strategy managers and other departments managers, and qualitative content analysis from Korean patent registrations.	Questionnaire with individual perception scale. Documentary analysis of patent registrations from 260 organizations at the Korean intellectual property institution.	All predictors were only reported by HR directors, incurring the risk of common method bias. Some learning processes and efforts to develop employees may take more than 2 years to impact innovative performance. Lack of alternative measures for training and development such as instructional design or specific content. Possibility of overestimating learning practices and abilities due to the use of perceptual measures in managerial assessment. Non-generalizable study, as it was applied only to Korean organizations.
(Dostie, 2018)	144	Longitudinal linear regression analysis with secondary data collected from historical series.	Secondary data from the Canadian Employee and Workplace Survey (1999-2006) about number of employees receiving on-the-job and classroom training; product innovation; process innovation; radical innovation; routine innovation	Single (macro) level of analysis. Training types and characteristics are not considered. Single data source, incurring the risk of common method bias. Use of only self-report data to measure organizational level variables. Non-generalizable study.

(Gonzalez et al., 2013)	118	Statistical analysis of secondary data of 18,923 observations from 3,257 Spanish organizations collected between 2001 and 2011 on a large-scale cross-sectional survey (ESEE panel).	ESEE panel composed by survey about Business Strategies in Spanish companies.	Little information on innovations typology, without distinguishing whether they were radical or incremental innovations, and it may be that worker skills and training are more important than R&D for incremental innovations. Only data from Spain, not generalizable. Single (macro) level of analysis. Use of only self-report data to measure organizational level variables.
(Michaelis & Markham, 2017)	105	Content analysis of primary data collected on a semi structured interview with 30 senior R&D and product development managers from 27 organizations of Global Fortune 1000 list.	One hour-long semi structured interview professionally transcribed into 512 pages and coded into three categories.	Cross-sectional data collection. Single (macro) level of analysis. Single data source, incurring the risk of common method bias. Use of only qualitative data to measure organizational level variables, without triangulation to more objective measures.
(Børing, 2017)	100	Large scale cross-sectional survey secondary data analyzed by correlation paired with sociodemographic data of employees from 5,204 manufacturing and service Norwegian companies.	Questionnaire with individual perception scale part of the European CIS survey, applied in Norway, which measures the extent to which firms introduced process or product innovations during the period 2008-2010.	Cross-sectional data collection. Single (macro) level of analysis. Training types and characteristics are not considered. Single data source, incurring the risk of common method bias. Use of only self-report data to measure organizational level variables. Non-generalizable study, as it was applied only in Norway.

(Manresa et al., 2019)	100	Logit and multinomial regression analysis of secondary data from 162 Spanish organizations collected on international survey.	Data based on the HR Management block of the European Manufacturing Survey (EMS) questionnaire answered by Spanish companies	Cross-sectional data collection. Single data source, incurring the risk of common method bias. Use of only self-report data to measure organizational level variables. A small number of responses restricts the overall findings reliability. Non-generalizable study.
(Jeon, 2020)	101	Descriptive and linear regression analysis of data collected by survey from 321 employees of the social security service of South Korea.	Questionnaire with individual perception scale.	Cross-sectional data collection. Single data source, incurring the risk of common method bias. Only self-report data to measure at organizational level. Non-generalizable study. Research model's inability to include third-party variables that could affect organizational innovation.

Source: By the authors.

Articles with higher values of *InOrdinatio* between the ones with greater similarities to our proposed research objective are briefly addressed in Table 1. An integrated analysis of research gaps presented in Table 1 shows a scenario where there is room for advances regarding adoption of multivariate, multilevel, and longitudinal frameworks considering mixed approaches, in view of the procedural and multidimensional nature of the relationship between the contribution of training effects to organizational innovation results and the evidence of their impacts at more than one organizational level.

The in-depth analysis of the articles sample presented a series of theoretical and methodological gaps that demonstrate a certain convergence of needs for advances in the field, such as:

a) Scarcity of studies about training contribution to organizational innovation, or even on its effects on the level of organizational change and final value.

b) A priority on quantitative analysis without methodological triangulation with qualitative ones, which will allow greater accuracy on findings interpretation.

c) Among the few studies that assess this relationship, the effects are mostly measured only at the levels of organizational change and final value, always post-fact, at the end of the intervention, with a single measure, and without longitudinally monitoring the permanence of the effects found.

d) The measurement and interpretation of effects is based primarily on individual perceptions and results, with a single source of data collection, subject to method bias.

e) There is little evidence of which specific types and characteristics of training are most effective in generating organizational innovation (of any kind) either in in private or in the public sector.

f) Application of measures with low representativeness of explanatory or contextual variables involved in the evaluation of innovation results on higher organizational levels that have training as an antecedent from lower organizational levels.

g) Few references to context variables, whether mediating or moderating, that affect the relationship between training effects and organizational innovation results, in general.

The analysis of these gaps in an integrated way allowed the proposal of new research avenues for understanding how training activities can contribute to organizational innovation results.

4.3 NEW RESEARCH AVENUES PROPOSAL

The relationships between innovation and education, for example, are the source of new epistemological questions related to methodological challenges, as stated by Djellal and Gallouj (2018) in a publication about the fifteen main advances in studies of innovation in services. In this sense, it is expected that positive relationships will be found between antecedent variables related to training effects and their respective consequent variables corresponding to innovation constructs, observing findings that support this assumption (Bauernschuster et al., 2009; Damanpour et al., 2009; Dostie, 2018; Neirotti & Paolucci, 2013; Sung & Choi, 2014).

There is a need for more detailed explanations of why training may be related to innovation. Some studies argue that training can play an important role in the knowledge absorption process. For example, training can facilitate exposure of employees to a variety of knowledge, encourage openness to new ideas that tend to be sources of organizational and technological innovations, and favor the routinization of innovations in production technologies and business processes (Børing, 2017). In the same line, Sung and Choi (2014) point out relevant suggestions for advancing studies of this nature such as the need for independence of data sources, use of alternative measures regarding training variables and longitudinal assessment based on objective learning indicators.

There is also a convergence that studies on the relationship between training effects and innovation results need to evolve with the scope at the individual, team (group) and organization level, as suggested by F. Damanpour (1991), in a multilevel approach, with multiple sources of data and longitudinal approaches, considering the nature of the variables involved. Training processes and innovation programs require time to generate the expected results, are influenced by contextual variables that change over time and are expected to generate aggregate results at more than one level of analysis. This is consistent with the perspective of vertical and horizontal transfer of the results of an organizational innovation program following the multilevel taxonomy by Kozlowski, S. W. J. and Klein, K. J. (2000), and the characteristics, limitations and challenges related to the application of longitudinal studies on phenomena related to the Work and Organizations Psychology as reported by Abbad and Carlotto (2016), and the long neglected need for improving better time perspective on organizational research as discussed by Sonnentag (2012).

Despite the existence of research frameworks and studies on organizational innovation considering the human cognitive and creative components as a fundamental part of innovation processes as well as theorizing about the relationship between learning, skills development and innovation (Anderson et al., 2014; Damanpour, 2020; Dostie, 2018; Gallouj & Weinstein, 1997; Sung & Choi, 2014), there are still some relevant knowledge gaps to be understood on this subject. For example, studies that use mixed methods combined with multilevel longitudinal approaches and different data source triangulation are not easily found on literature about the relationship between training and organizational innovation.

If both training and innovation are organizational processes affected by multiple variables and also have a multifaceted character as it can be seen in studies such as Arthur et al. (2003), Bell et al. (2017), Børing (2017), Damanpour (1991), it should be expected that its relationship is quite complex and that time is a preponderant factor for the expected training and innovation results to be developed and disseminated among groups and provoke lasting results at all analysis levels. Then, the aggregation of results obtained from application of more robust research frameworks and methods could bring the necessary evolution of knowledge on this matter.

5. FINAL CONSIDERATIONS

The objective of this research was to propose a research agenda about the contribution of training to the results of organizational innovation. This goal was successfully accomplished. Therefore, it was applied *Methodi Ordinatio* structured protocol (Pagani et al., 2015) to systematic review a scientifically relevant literature portfolio from state of the knowledge on the topic and an integrative literature review (Torraco, 2016) was performed to identify the main research gaps.

Results showed that there is a need to advance in this field of knowledge with the development and application of new multilevel and longitudinal research frameworks of mixed nature and that take into consideration the multidimensional and procedural characteristics of both training and innovation phenomena in organizations in an integrated way. The integrated analysis of identified literature gaps reinforced what Børing (2017), Dostie (2013), and Naranjo-Valencia et al. (2018) reported, that the relationship training-innovation is not yet well explored.

As a contribution of this research, it is suggested that training activities and innovation in organizations are phenomena with similar procedural, multilevel and multifactorial nature that could be more integrated in theoretical approaches built to understand how training can contribute to organizational innovation results when the first is antecedent to the latter. Therefore, it is believed that with this perspective, research in the area can expand the theoretical scope of explanation.

With regard to methodological advances, this research encourages the production of systematic literature review papers using the *Methodi Ordinatio* protocol as a method capable of supporting the selection of a bibliographic portfolio through the use of variables of recognized scientific relevance, facilitating this stage of a review work at the same time that it strengthens the decision-making process of inclusion and exclusion of bibliographic material through the use of quantitative criteria.

Regarding this article limitations, even though the present research has chosen scientific articles from journals as *corpus*, works such as conference articles were not considered. In addition, having privileged the scientifically relevant literature to draw the state of the knowledge using *Methodi Ordinatio* and restricting it to studies published in English language and blinded reviewed journals may have excluded research published in other languages or in journals not much cited yet.

It is expected that the findings here unveiled will contribute to the creation of new research lines and agendas on the subject, derived from the gaps pointed out. Furthermore, researchers interested in developing future studies on the relationship of training and innovation can use the findings to guide the construction and application of new research frameworks, for example. Finally, the results engendered here can inspire innovation managers to empirically develop and test innovation programs with training activities as an inseparable and antecedent part, to increase the effectiveness in the implementation of new services, processes or products in the public and private sectors.

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APPENDIX 1

Table 2 – Final papers on organizational, service, process innovation and training after application of *Methodi Ordinatio'* phase 8

Ranking number	Articles on organizational, service, process innovation and training (Authors, year, title and journal)	Impact Factor	Year	Citations	InOrdinatio (phase 8)
1	Damanpour, F., 1991. Organizational Innovation: a meta-analysis of effects of determinants and moderators. *Academy of Management Journal*	7.571	1991	10711	10521
2	Barras, R., 1986. Towards a theory of innovation in services. *Research Policy*	5.351	1986	1811	1571
3	Damanpour, F., Walker, R. M., Avellaneda, C. N., 2009. Combinative Effects of Innovation Types and Organizational Performance: A Longitudinal Study of Service Organizations. *Journal of Management Studies*	4.888	2009	1473	1463
4	Mol, M. J., Birkinshaw, J., 2009. The sources of management innovation: When firms introduce new management practices. *Journal of Business Research*	4.874	2009	932	922
5	Gallouj, F.; Weinstein, O. 1997 Innovation in services. *Research Policy*	5.351	1997	1050	920
6	Gallouj, F., Savona, M., 2009. Innovation in services: a review of the debate and a research agenda. *Journal of Evolutionary Economics*	1.433	2009	804	794
7	Djellal, F., Gallouj, F., Miles, I., 2013. Two decades of research on innovation in services: Which place for public services? *Structural Change and Economic Dynamics*	2.023	2013	335	365
8	Sung, S. Y., Choi, J. N., 2014. Do organizations spend wisely on employees? Effects of training and development investments on learning and innovation in organizations: TRAINING AND DEVELOPMENT INVESTMENT AND INNOVATION. *Journal of Organizational Behavior*	5.026	2014	318	358
9	Bloch, C., Bugge, M. M., 2013. Public sector innovation — From theory to measurement. *Structural Change and Economic Dynamics*	2.023	2013	319	349
10	Piening, E. P., Salge, T. O., 2015. Understanding the Antecedents, Contingencies, and Performance Implications of Process Innovation: A Dynamic Capabilities Perspective. *Journal of Product Innovation Management*	5.000	2015	240	290

11	Walker, R. M., 2014. Internal and External Antecedents of Process Innovation: A review and extension. *Public Management Review*	4.221	2014	233	273
12	Ganter, A., Hecker, A., 2013. Deciphering antecedents of organizational innovation. Journal of Business Research	4.874	2013	168	198
13	Arundel, A., Huber, D., 2013. From too little to too much innovation? Issues in measuring innovation in the public sector. *Structural Change and Economic Dynamics*	2.023	2013	120	150
14	Dostie, B., 2018. The impact of training on innovation. *ILR Review*	3.025	2018	64	144
15	Morrar, R. Innovation in Services: A Literature Review. *Technology Innovation Management Review*	0	2014	84	124
16	Ma, L., Zhai, X., Zhong, W., Zhang, Z. 2019. Deploying human capital for innovation: A study of multi-country manufacturing firms, *International Journal of Production Economics*	5.134	2019	32	122
17	Sartori, R., Costantini, A., Ceschi, A., Tommasi, F. 2018. How Do You Manage Change in Organizations? Training, Development, Innovation, and Their Relationships. *Frontiers in Psychology*	2.067	2018	40	120
18	González, X., Miles-Touya, D., Pazó, C., 2016. R&D, worker training and innovation: firm-level evidence. *Industry and Innovation*	3.351	2015	68	118
19	Michaelis, T. L., & Markham, S. K., 2017. Innovation Training: Making Innovation a Core Competency. *Research-Technology Management*	2.449	2017	35	105
20	Susanty, A., Yuningsih, Y., Anggadwita, G., 2019. Knowledge management practices and innovation performance: A study at Indonesian Government apparatus research and training center. *Journal of Science and Technology Policy Management*	3.300	2019	13	103
21	Gonzalez, R., Llopis, J., Gasco, J., 2013. Innovation in public services: The case of Spanish local government. *Journal of Business Research*	4.874	2013	71	101
22	Jeon S.Y., 2020. The effect of information system utilization and education and training on organizational innovation in public social welfare officers: Focused on the moderating effect of organizational trust. *Asian Social Work and Policy Review*	0.480	2020	1	101

23	Manresa, A., Bikfalvi, A., Simon, A. 2019. The impact of training and development practices on innovation and financial performance. *Industrial and Commercial Training*	2.400	2019	10	100
24	Børing, P., 2017. The relationship between training and innovation activities in enterprises. *International Journal of Training and Development*	2.400	2017	30	100
25	Lafuente, E., Solano, A., Leiva, J. and Mora-Esquivel, R., 2019. Determinants of innovation performance: Exploring the role of organisational learning capability in knowledge-intensive business services (KIBS) firms. *Academia Revista Latinoamericana de Administración*	0.739	2019	9	99
26	Antonioli, D., Della Torre, E., 2015. Innovation adoption and training activities in SMEs. T*he International Journal of Human Resource Management*	3.040	2015	42	92
27	Naranjo-Valencia, J. C., Naranjo-Herrera, C. G., Serna-Gómez, H. M., Calderón-Hernández, G., 2018. The relationship between training and innovation in companies. *International Journal of Innovation Management*	2.700	2018	10	90
28	Profiroiu, A., Profiroiu, C., Pacesila, M., Mihalcea, O., 2019. Is Training a Precondition for Enhancing Innovation Capacity? Current Perception of Employment Agencies' Civil Servants in Romania. *Transylvanian Review Of Administrative Sciences*	0.603	2019	0	90
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Source: By the authors.