Universidade de Brasília

Faculdade de Economia, Administração, Contabilidade e Gestão de Políticas Públicas

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Training Contribution to Organizational Innovation

Tese de Doutorado em Administração

Sérgio Ricardo de Castro Gonçalves

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Programa de Pós-Graduação em Administração

Training Contribution to Organizational Innovation

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Brasília/DF, 25 de fevereiro de 2022

“The progress of science depends on new techniques, new discoveries and new ideas, perhaps in that order.”

Sydney Brenner, in

Life sentences: detective rummage investigates, 2002

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A conclusão de uma tese de doutorado representa, acima de sua contribuição científica ao mundo, um ponto representativo em uma longa jornada de desenvolvimento educacional e, certamente, humano, com reflexos no desenvolvimento profissional do recém-doutor e incontáveis agradecimentos a serem feitos. O nascimento de uma tese requer muito trabalho de pesquisa, planejamento, estudo, criação, teste(s), divulgação e defesa, o que não se consegue sozinho.

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ABSTRACT

This main goal of this thesis is to analyze the contribution of training activities to organizational innovation. This thesis is structured in four sequential studies presented as interdependent articles. Study 1 aims to propose a research agenda about how training contribute to organizational innovation, based on an integrative and systematic literature review. New research avenues based on state of knowledge research gaps are presented. Study 2 aims to propose a theoretical methodological framework about training contribution to organizational innovation. It is proposed a conceptual model and a theoretical methodological framework. Study 3 aims to describe an organizational innovation program to evaluate how much its training component has design and delivery characteristics favorable to innovation related transfer of learning. Effects indicators, program components and established relationships were identified. Training component design and delivery characteristics prepared training participants to effectively improve processes. Study 4 aimed to report development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale. Descriptive, reliability, exploratory, and confirmatory factorial analysis were conducted to obtain a one-factor empirical structure constructed to assess the degree of training contribution to the development of organizational innovation individual skills in public sector. TCOIPS presented validity evidence and can be used to identify the development of organizational innovation-related skills and understand the contribution of training to innovation results. This thesis evaluates organizational innovation outcomes in an innovative way and advances literature as it proposes the use of TCOIPS scale to assess the contribution of training to innovation through the development of specific individual skills.

Keywords: organizational innovation, process innovation, training effectiveness, instructional design quality assessment, antecedents of innovation.

RESUMO

O objetivo desta tese é analisar a contribuição das atividades de treinamento para a inovação organizacional. A tese está estruturada em quatro estudos sequenciais apresentados como artigos interdependentes. O Estudo 1 objetiva propor uma agenda de pesquisa sobre como os treinamentos contribuem para a inovação organizacional com base em lacunas do estado do conhecimento. O Estudo 2 propõe um *framework* teórico-metodológico sobre a contribuição de treinamento para inovação organizacional. Propõe-se um modelo conceitual e um referencial teórico-metodológico. O Estudo 3 objetiva descrever um programa de inovação organizacional para avaliar o quanto seu componente de treinamento tem características de desenho e entrega favoráveis à transferência de aprendizagem relacionada à inovação. Foram identificados indicadores de efeitos, componentes do programa e relações estabelecidas. As características do desenho e entrega do treinamento prepararam os treinandos para melhorar efetivamente os processos. O Estudo 4 objetiva relatar o desenvolvimento, evidências de validade psicométrica e discriminante, e confiabilidade da escala *Training Contribution to Organizational Innovation in Public Sector* (TCOIPS). Análises fatoriais descritivas, de confiabilidade, exploratórias e confirmatórias foram realizadas para obter uma estrutura empírica unifatorial construída para avaliar o grau de contribuição do treinamento para o desenvolvimento de habilidades individuais de inovação organizacional. A TCOIPS apresentou evidências de validade e pode ser utilizada para identificar o desenvolvimento de habilidades relacionadas à inovação organizacional e compreender a contribuição do treinamento para os resultados da inovação nas organizações do Setor Público. Esta tese avalia os resultados da inovação organizacional de forma inovadora e avança na literatura ao propor a escala TCOIPS para avaliar a contribuição do treinamento para a inovação por meio do desenvolvimento de habilidades específicas.

Palavras-chave: inovação organizacional, inovação de processos, efetividade de treinamento, avaliação da qualidade do desenho instrucional, antecedentes de inovação.

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SUMMARY

INTRODUCTION

Innovation has become a fundamental dynamic of sustainable economic growth for national and regional economies, and the level of social development and prosperity for societies, as well as competitive power for both business and national economies (Esendemir & Zehir, 2017). Public sector innovation may follow a different path than in the private sector. This may be related to the different environments in which the public sector operates - less autonomous, less flexible and exposed to greater political influences compared to the private sector environment. Public organizations continually interact with citizens who receive services, based on interests that are not necessarily financial and diffuse (Lamb, 1987). Evidence shows that public organizations regularly implement new services and service delivery methods. These innovations occur in response to changes in the external environment – deregulation, resource scarcity and customer demands – and are based on internal organizational choices, such as perceived performance gaps, pursuit of a higher level of aspiration and increasing the extent and quality of services. The service sector is increasingly relevant to the world economy and has significantly expanded its participation in generating wealth. The public sector, mostly a service provider, has been the target of an increasing search for efficiency improvement in its processes and, therefore, in the services delivered to society (Aiken & Alford, 1970; S. P. Osborne & Brown, 2005; Walker, 2014).

The field of innovation studies has been gaining important epistemological and theoretical advances from the pioneering analyzes of the Austrian economist Schumpeter (1997) on the importance of innovation for economic development to the integrative approaches of the Service-dominant Logic of Vargo & Lusch (2004), the Service Science Perspective by Maglio & Spohrer (2008), and the approach of component characteristics of services (and/or goods) present in the seminal article by (Gallouj & Weinstein, 1997). With a more comprehensive approach, organizational innovation studies (Damanpour, 2020;

Damanpour & Wischnevsky, 2006) include other types of innovation (Damanpour et al., 2009) and seek to investigate their antecedents (Damanpour, 1991; Ganter & Hecker, 2013), facilitators and barriers. At the same time, innovation in the public sector (Albury, 2005; Arundel & Huber, 2013; Bloch & Bugge, 2013; Djellal et al., 2013; Gonzalez et al., 2013; S. Osborne & Brown, 2013) has become a focus part of the studies on innovation, but still lacks the development of a general explanatory and predictive model, being a phenomenon that has an effect at all levels of analysis and a subject not yet understood as a whole.

The Public Sector is defined by OECD/Eurostat (2018) as the general government sector at the local, national, and regional levels in addition to all public corporations including the central bank. According to Arundel & Huber (2013), based on this definition, public sector accounts for between 20% and 30% of the Gross Domestic Product (GDP) in economically developed countries, representing a substantial share of the economy's output and considerably greater than the share of the manufacturing industry in most countries. Some innovation theories, such as the chain link model, Kline & Rosenberg (1986) and innovation systems theory emphasize that innovation is not a linear, sequential process, and that it involves many interactions and feedbacks in the creation and use of knowledge. Additionally, it is understood that innovation is based on a learning process that originates from multiple inputs and requires continuous problem solving (OECD/Eurostat, 2018). When considering the intrinsic participation of the human component in the process of organizational innovation, given the need to mobilize individual skills and the fact that their cognition and learning processes are closely related to the results of the most diverse types of innovation, it can be assumed that there is a strong relationship between the results of formal learning processes and the outputs of innovation programs that provide training in their activities. (Antonioli & Della Torre, 2015; Bauernschuster et al., 2009; Børing, 2017; Dostie, 2018; Gallouj & Weinstein, 1997; Sung & Choi, 2014).

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 (Bauernschuster et al., 2009). Nonetheless, a broad systematic literature review (Gonçalves & Abbad, in press)[1] shows that, despite of the large amount of studies about innovation, it was identified a gap related to the scarcity of studies about training contribution to organizational innovation, or even on its effects on the level of organizational change and final value. Relatively few studies examine the relationship and effects of training on innovation performance at the organizational level (e.g., (Dostie, 2018; Sung & Choi, 2014), and even fewer 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). In this sense, it is noteworthy that studies focused on investigate the impact of training on innovation have focused efforts mainly on organizational level analyzes, making use of perceptual measures collected from secondary data national surveys made with different organizations managers. Commonly, these studies relate subjective secondary data to objective secondary data at the same level, without making use of important information relevant to lower levels of aggregation, such as individual learning and training transfer to produce innovations (Børing, 2017; Dostie, 2018; Naranjo-Valencia et al., 2018; Sung & Choi, 2014).

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 organizational processes. Training also encourages innovation results in organizations, as trained workers obtain cutting-edge knowledge to understand complex products and production

[1] Article 1 on this thesis. It was accepted for publication on *Future Studies Research Journal* in november, 2021, and it is currently undergoing copywriting procedures, aiming to be published.

processes and are more likely to achieve technological improvements, suggesting that there is a relationship between innovation training and innovation outcomes (Bauernschuster et al., 2009; Børing, 2017).

However, the present thesis shows that the association between training and innovation results is not yet well explored on relevant literature, with few exceptions (Børing, 2017; Dostie, 2018; Naranjo-Valencia et al., 2018; Sung & Choi, 2014) among a vast production about innovation. The literature portfolio reviewed in this thesis, shows that studies on this topic make use of secondary data collected with scales about perceptual data on variables about innovation outcomes and variables that are directly related to investments in training. These perceptual data are often related to objective secondary data from organizational indicators or even econometric panels, both with a more objective nature (Bauernschuster et al., 2009; Børing, 2017; Naranjo-Valencia et al., 2018; Sung & Choi, 2014). These measures and methodological approaches do not address data on individual level about the contribution of training to organizational innovation in the public sector, revealing a relevant research gap in this field of knowledge and leading the path to a new research agenda.

In this context, literature gaps found showed that there is a need to advance with the development and application of new multilevel and longitudinal research frameworks of mixed nature that take into consideration the multidimensional and procedural characteristics of both training and innovation phenomena in organizations, in an integrated way. The studies reported by Børing (2017), Dostie (2013), and Naranjo-Valencia et al. (2018), reinforces the notion that the relationship training-innovation is not yet well explored. Also, there is a need to construct specific research instruments to collect relevant data on individual level, with the target audience of innovation training, that are able to support inferences on this likely causal multilevel relationship.

To accomplish the empirical studies that composes this thesis the following theoretical basis were used: the concept of service innovation by Gallouj and Weinstein (1997) because it is more comprehensive, considers individual skills that are internal to an organization and deal with process innovation by means of modifying an existing process (or some of its characteristics), integrated with the conceptual dimensions used by Damanpour et al. (2009) that focus into process efficiency and effectiveness for organizational innovation, and the concept elaborated by Anderson et al. (2014) which unifies creativity and innovation constructs in a multilevel form. To understand the innovation program studied, the logical model was used in conjunction with the Integrated Model of Impact Assessment of Training at Work – IMPACT (Abbad, 1999) for considering the relationships between antecedent variables, such as training participants' characteristics and organizational support, addressing evaluation about reactions, learning and training transfer to work (Abbad et al., 2012; Damasceno et al., 2012). The methodological approach presented in Nascimento & Abbad (2021) guided the description of the innovation program, its components and relationships, and the assessment of training instructional quality. Theoretical and empirical references in the field of Training, Development and Education (TD&E) were also used in this thesis construction: instructional theories, instructional design approaches, training transfer, and training evaluation (Abbad, 1999; Aguinis & Kraiger, 2009; Bell et al., 2017; Blume et al., 2010; Ford et al., 2018; Kraiger & Ford, 2021; Lacerenza et al., 2017; Salas et al., 2012).

Following this theoretical and methodological line, this thesis has proposed to investigate the following research questions: (a) How does training contribute to organizational innovation? (b) What are the possible relationships and expected effects of training on the results of an organizational innovation program in the public sector? (c) What are the instructional characteristics of innovation training that foster its contribution to the application,

at work, of process innovation skills? (d) Which are the skills taught by training that prepares people to drive process innovation?

Considering these research questions and the arguments mentioned above, the following thesis was proposed: ‘Training activities can contribute to organizational innovation outcomes in the public sector at the individual, group and organizational levels, by developing work related skills that prepare people to execute innovation process’. The main goal of this thesis is to analyze the contribution of training activities to organizational innovation. To achieve this main goal, the following specific objectives were proposed:

1. Analyze conceptual, theoretical, and methodological approaches about training contribution to organizational innovation as a starting point to investigate how this relationship is addressed on relevant scientific literature.
2. Propose an integrated theoretical methodological research framework about the contribution of training activities to organizational innovation results in the context of public sector to guide investigations on the topic.
3. Assess an organizational innovation program in the public sector to identify its components, relationships, expected results, contextual variables, and analyze the instructional design and delivery characteristics of its training activities to evaluate how much they have instructional design and delivery characteristics that are favorable to innovation related transfer of learning.
4. Describe and investigate validity evidence of a measurement scale for the contribution of training to organizational innovation in the public sector.

This thesis can be classified as a descriptive in-depth case study of mixed nature (qualitative and quantitative methodological approaches). It was adopted a mixed research approach, combining qualitative and quantitative studies to answer the research questions and achieve its correlated objectives, with triangulation of methods and multiple data sources

(documental, and human), aiming to extract the best of each approach when it comes to explore the complementarity of observations and results analysis. To achieve the thesis main goal, this research is structured in a series of four sequential and interdependent studies that are presented as scientific articles. In the end of each thesis part a correspondent bibliographic references set is presented, but the appendices are all presented together in the end of the thesis to facilitate reading.

This research structure allowed to propose and execute a mixed-method approach in a qualitative-quantitative way, using theoretical-methodological results of the two initial qualitative studies to guide the qualitative investigation of the third one. Finally, results of the three initial studies were used as a basis to fulfill theoretical and methodological requirements to properly apply the quantitative final one. This mixed approach was necessary due to the in-depth case study research type chosen to address this thesis objectives and research questions. Theoretical and methodological research gaps found on systematic literature review (Gonçalves & Abbad, in press) also guided the research design.

In this sense, Study 1 was structured to present literature gaps and new research avenues based on relevant literature about the contribution of training on organizational innovation in the public sector, with a qualitative systematic literature review about the topic and applying *Methodi Ordinatio* structured protocol. In sequence, Study 2 aimed to propose a theoretical-methodological research framework about the contribution of training to organizational innovation in the public sector. To do this, the methodological approach chosen was to analyze knowledge production about the contribution of training to organizational innovation and present a conceptual model and theoretical propositions. At first, theoretical and conceptual references were analyzed, followed by identification of findings about the relationship of training and innovation, leading to the proposition of the theoretical-methodological research framework that scientifically guide the subsequential studies.

Following Study 2, the Study 3 aimed to describe an organizational innovation program in the public sector with training as one of its essential activities in order to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning. This study made possible to describe the innovation program components and raise hypotheses of relationships between groups of variables related to the program context (origin, problem, training participants' characteristics, innovation object), inputs (human, financial and material resources), activities (training, application and recognition), products (participants trained and prepared to execute process improvement innovation, improved organizational processes, and operational excellence) and outcomes (reaction, learning, participants recognition, training contribution to organizational innovation, and training transfer at the individual level; organizational innovation, program impact, operational excellence and continuous process improvement at the team level; and operational excellence and continuous process improvement at firm level). These described program outcomes correspond to the effects of training and innovation program components at the participants behavior at work and at the work processes improvement (organizational innovation).

Through a qualitative documentary analysis using the logical model components and a training instructional design and delivery assessment on Study 3, it was also possible to identify from training objectives which process innovation skills were taught to employees, described in terms of observable behaviors of graduates at work. At last, Studies 1, 2 and 3 results combined made possible that Study 4 could construct, investigate validity evidence, and test the Training Contribution to Organizational Innovation in the Public Sector (TCOIPS) scale, a research instrument there is able to measure the contribution of innovation training activities to the application at work of process improvement innovation skills.

The first article shows the proposition of a research agenda about how training activities contribute to organizational innovation, based on an integrative and systematic review of a

scientifically relevant literature portfolio. Results show that the analyzed literature is composed by studies that are primarily based on measures focused on the organizational level and predominantly quantitative. Within this research limits, literature presented itself as being fragmented between the fields of enquiry Economics, Management and Psychology, with an emphasis on the second one. 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. 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.

Thus, the second article presents the proposition of a theoretical methodological investigation framework about the contribution of training activities to organizational innovation in the context of public sector. It presents dimensions from individual, team and organizational levels that can influence organizational innovation in the public sector. The model was developed from scientific relevant literature, especially the one about organizational innovation and service innovation theories, and public sector innovation theoretical approaches. It was presented and analyzed a set of concepts about innovation, their dimensions, typologies and categories commonly used in scientific literature with a high impact factor and, according to the conceptual analysis performed, the field of innovation studies has characteristics of polysemy, with polytomous concepts that do not integrate all possible dimensions of the innovation phenomenon in public sector organizations and encompass an excess of typification that can confuse the research paths necessary for the development of increasingly robust knowledge on the subject.

The third article describes an organizational innovation program in the public sector with training as one of its essential activities to evaluate how much this training have design

and delivery characteristics that are favorable to innovation related transfer of learning, through program theory evaluation using logical model associated with systemic TD&E effectiveness evaluation approaches. Hypotheses were raised about the expected results of an innovation program in the public sector, planned relationships between its components were described, training instructional quality was evaluated and expected training participants' work performance objectives were extracted with documental analysis. Results shows a set of behaviors at work taught by training that are related to organizational innovation in the public sector and indicate that the training activities were adequately planned accordingly to the contextual variables of the innovation program (origin, problem, training participants' characteristics, and innovation object) and instruction design and delivery scientifically recommended principles. In addition, results demonstrate evidence of the degree of training instructional quality and its potential to contribute to the program's expected individual results (reaction, learning, training transfer, egress recognition), team and organizational results (organizational innovation, operational excellence, and continuous process improvement). Since training and innovation are multifaceted and complex constructs with procedural characteristics, are affected by contextual variables and impact multiple analysis levels, the use of logical models associated with training effectiveness evaluation approach was a necessary solution to describe the innovation program assessed in this thesis.

Finally, the fourth article presents the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale. The measurement scale was built from the qualitative analysis of individual performance goals extracted from instructional design secondary data (see Article 3 results) and expected to be developed on public service employees trained to participate in an organizational innovation program. Descriptive, reliability, exploratory, and confirmatory factorial statistical analysis were conducted to obtain the one-factor empirical structure

constructed to assess the degree of training contribution to the development of organizational innovation individual skills in public sector. TCOIPS presented validity evidence and can be used to identify the development of organizational innovation-related skills and understand the contribution of training to innovation results in the Public Sector organizations.

The present thesis simultaneously contributes to theoretical advances on organizational innovation, public sector innovation and training effectiveness research fields as it presents an overview of scientifically relevant state of the knowledge literature about the contribution of training to innovation. It also highlights literature main gaps and research agenda, helping researchers to plan new relevant studies. The application of *Methodi Ordinatio* (Pagani et al., 2015, 2017) protocol is not common in this knowledge field and methodologically contributed to propose new robust systematic review with an objective method to select and analyze relevant literature.

This thesis describes an organizational innovation program in the public sector and its subjacent training component using program theory approach associated with systemic training effectiveness evaluation theories. Also, it proposes a multilevel and integrated theoretical research framework about the contribution of training activities to organizational innovation results in the context of public sector and describes the development and psychometric validity evidence of a unidimensional scale able to measure the contribution of training to organizational innovation in the public sector, in terms of job-related skills development, that can be replicated.

The four articles allowed fulfilling the general objective of this thesis, i.e., to analyze the contribution of training activities to organizational innovation in the public sector. Figure A1 summarizes the parts that make up this thesis, in addition to the objectives and methodological strategies of each study.

Figure 1

Thesis' overview and methodological matrix

	INTRODUCTION			
	Title	**Goals**	**Research type**	**Method**
Article 1	*How does training contribute to organizational innovation? New research avenues*	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	Descriptive and bibliographic research of mixed nature (qualitative and quantitative approaches).	Systematic Literature review, *Methodi Ordinatio* protocol, Scientifically relevant literature analysis.
Article 2	*Training contribution to organizational innovation in the public sector: proposition of a theoretical methodological framework*	To propose a multilevel and integrated theoretical methodological research framework about the contribution of training activities to organizational innovation results in the context of public sector.	Descriptive and bibliographic research of qualitative nature.	Conceptual analysis, theoretical methodological research framework construction based on theories, concepts and dimensions of organizational innovation, innovation in the public sector, service innovation, training effectiveness and training impact on innovation.
Article 3	*An organizational innovation program in Brazilian public sector – a qualitative assessment of its components, relationships and expected results*	To describe an organizational innovation program in the public sector with training as one of its essential activities in order to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning.	Descriptive, documental, and case study research of qualitative nature.	Documentary analysis, content analysis, descriptive analysis, instructional design quality analysis. 3,476 documents from the organizational innovation program (planning, executing and reporting documentation, training instructional design material and online instructional environment).
Article 4	*Training Contribution to Organizational Innovation in Public Sector: TCOIPS Unidimensional Scale Construction and Validity Evidence*	To report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale.	Descriptive, documental and survey of mixed method nature (qualitative and quantitative).	Documentary analysis, content analysis, content validation (CVC), semantic validation, survey, quantitative validation (descriptive, exploratory, confirmatory factorial statistical analysis, reliability, and discriminant). Survey application with 287 cases.
	CONCLUSIONS AND RECOMMENDATIONS			

The results obtained within the four articles contribute theoretically and methodologically to the fields of organization innovation in the public sector and training effectiveness evaluation by proposing a theory-driven integrated concept and a practical guiding framework to apply it alongside with a multilevel and longitudinal theoretical research framework to more robust approaches. It also offers an innovative way for practitioners and managers to plan and evaluate their organizational innovation structured initiatives.

As a managerial contribution, the logical model associated with the IMPACT training assessment model, and the TCOIPS scale can be used by organizational innovation programs stakeholders either to plan new interventions or to assess specific results of their interventions, improving the overall structure or some components of it. As a social contribution, this thesis can help public sector organizations to better understand their organizational innovation initiatives, plan better training needed for innovation-related skills development in its employees and, as a distal consequence, offer better service to citizens by means of improving its processes efficiency and effectiveness.

In addition to this introduction chapter and the four articles presented in the next chapters, this thesis has a concluding chapter, where the main contributions, limitations and suggestions for future studies are presented.

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ARTICLE 1

How does training contribute to organizational innovation? New research avenues[2]

Abstract

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. 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*. 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. 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. 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

[2] This thesis article was accepted for publication on *Future Studies Research Journal* in november, 2021, and it is currently undergoing copywriting procedures, aiming to be published.

How does training contribute to organizational innovation? New research avenues

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.

Bibliography

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.

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).

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 (Borges-Andrade and Pilati, 2006).

Frequent lack of definition for organizational results indicators that are clearly associated with training programs, and lack of methodological prescriptions may be seen as reasons for the low level of knowledge development about the relationship between training and organizational performance (Meneses and Abbad, 2009). These authors 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 training participants 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.

Research Method 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 $\propto$ 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). Appendix A 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.

Discussion and Result Analysis

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 directly 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.

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 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 author.

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.

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.

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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ARTICLE 2

Training contribution to organizational innovation in the public sector: proposition of a theoretical methodological framework[3]

Abstract

Organizational innovation is a complex phenomenon with a multifactorial nature that requires efforts to build integrative and comprehensive research models to be better understood. In this way, relevant antecedents relative to the impact of cognition, creativity and learning processes to innovation outcomes should be addressed in a multilevel approach. As an activity that could embody these constructs, training contribution to organizational innovation results needs to be more explored considering its multivariate nature. Organizational innovation conceptualization needs to be refined, as it works with polysemic and polytomous concepts that are not integrated and need to be complemented in a way that helps the field to build new research paths. This article proposes a multilevel and integrated theoretical methodological research framework about the contribution of training activities to organizational innovation results in the context of public sector. A qualitative approach was used after applying *methodi ordinatio* protocol to select relevant literature about the relationship between training and organizational innovation. Based on a systematic review on this literature, innovation concepts are analyzed and integrated with training interventions systemic approaches to propose an integrated, multivariate, and multilevel theoretical methodological framework able to guide investigation about the contribution of training activities as an antecedent of innovation results in public organizations through a mixed and longitudinal approach.

Keywords: Organizational innovation, Training contribution to innovation, Public sector innovation, Innovation research framework

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Training contribution to organizational innovation in the public sector: proposition of a theoretical methodological framework

Following the pioneering analyses of the Austrian economist Schumpeter (1997) on the importance of innovation for economic development, researches on specific innovation types such as organizational innovation has been producing epistemological and theoretical advances, passing by the product/service characteristics approach of Gallouj and Weinstein (1997), until the modern approaches of dominant logic by Vargo and Lusch (2004) and 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 [OECD]/Eurostat, 2018).

The conceptual advances in literature regarding theories, types, dimensions and relations between components and procedures related to the phenomenon of innovation in organizations brought to light the comprehension that innovation has a dynamic and processual disposition, beyond its final result (Anderson et al., 2014; Damanpour, 2020; Damanpour et al., 2009; Djellal & Gallouj, 2018; Gallouj & Weinstein, 1997; Gallouj & Zanfei, 2013; OECD/Eurostat, 2018). Also, its idea generation process demands continuous learning by the individuals involved with creative processes that will end up in new products or processes, where training activities may have some contribution. This specific body of knowledge lacks better integration. The purpose of this paper is to present an integrated, multilevel, and multivariate theoretical methodological research framework about the contribution of training

activities to organizational innovation results in the public sector when training activities are used as an antecedent of innovation. The main assumption used for this study is that organizational innovation requires the use of knowledge and creativity, constructs from the individual level that can be developed through training.

After reviewing literature, Alves *et al.* (2018) affirm that it does not exist any accordance with regard to definitions for an understanding of organizational innovation, despite the existence of a concept for it since the 1960s. Organizational innovation is a multifactorial social phenomenon that continues to demand new understanding efforts based on theoretical and conceptual integration that embraces multiple dimensions and contextual dependency. Nonetheless, organizational innovation in the context of public sector lacks the development of a general explanatory and predictive model, being a phenomenon that has an effect at all levels of analysis and a subject not yet understood as a whole.

Thus, at the workplace, one can theoretically imagine the importance of learning processes for the organizational development and for the employees that are inserted in corporate innovation programs, since they may be driven to seek knowledge along with application of creative processes to carry out an innovation process and generate organizational value. However, despite the importance of organizational innovation phenomenon to individual, social and economic development, innovation research field stands with a conceptual polysemy which requires advances to encompass all the complexity and dimensions of this construct. This paper contributes for the field advancement presenting an integrated concept and research framework that are driven by related theories and able to support new studies that seek to explore and understand the relationship between training activities and the outcomes of organizational innovation in the public sector.

Theoretical Framework

Innovation as a Competitive Advantage and a Dynamic for Sustainable Development

Innovation has become a fundamental dynamic for sustainable economic growth for national and local economies, and for the social development level and societies prosperity, as well as for business and national economies competitive power (Esendemir & Zehir, 2017). It may be seen as a disruptive economic activity, as theorized by Schumpeter (1997) in his Economic Development Theory, that postulates how firms search for new opportunities and competitive advantage over current and potential competitors and introduces the concept of "creative destruction" to describe the existing economic activity disruption caused by innovations that create new goods or services production forms, or even completely new industries.

Service innovation, by its turn, has been presenting conceptual evolution from the initial approaches that comes mostly from the economic development analysis based on production, and arriving at the most recent organizational approaches that consider its intrinsic features and its dynamic and processual dimensions, surpassing the reductionist vision of innovation as being only a creation of a new product. This evolution can be noted in the conceptualization used throughout studies like Barras (1986), Djellal & Gallouj (2018), Gallouj & Savona (2009), Gallouj & Weinstein (1997), and Morrar (2014).

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, where process innovation fits as a typology (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.

Human participation is essential to having an innovation generated and implemented from the ideas generation to the final stages of implementing what was created. In a review that conceives innovation and creativity in organizations as being parts of the same process, Anderson et al. (2014) analyze a body of research in this area considering that this constructs are vital to any organization successful performance.

Public Sector Innovation

There are important differences between public and private services, and many differences among public services themselves and several factors distinguishing both sectors in terms of innovation. For example, there are institutions providing services to businesses, to individual users, to all citizens, and administrative institutions providing services to other governmental organizations (Bloch & Bugge, 2013).

In a recent study that examined the joint effect of innovation and strategic planning on organizational performance of Dubai Police, Alosani et al. (2019) affirm that innovation in public organizations is receiving increasing academic interest and although innovation is of great interest to both private and public sector organizations, in the public sector it is viewed differently from innovation in the private sector. It could be that the main public sector idiosyncrasies can act as barriers or facilitate many kinds of innovation process in its organizations.

With some exceptions, public services are more or less like monopolies free of competitive pressures, are under political influence, suffer with lack of resources that could be invested in risky projects (as the innovation ones) and lack of incentives to innovators and entrepreneurs, have rigid bureaucratic structure that induces to inertia and groups of professionals may prevent innovation that threatens their privileged positions (Djellal et al., 2013). The field of organizational innovation in the public sector is even more recent than the one of service innovation and needs methodological and theoretical advances. Regarding its

measurement, for example, it requires a scientific consensus about the conceptual definition of the constructs involved in it, which opens a space for theorization and implementation of new studies for this phenomenon measurement, evaluation, and comprehension.

Public sector innovation is conceptualized with multiple definitions of different innovation types, as it can be seen in Arundel and Huber (2013), Bloch and Bugge (2013), Djellal et al. (2013), Gallouj and Zanfei (2013), Gonzalez et al. (2013) and Osborne and Brown (2013). This literature characteristic may also reveal a certain difficulty for obtaining more robust theoretical and methodological approaches in this field of studies, since the existence of different definitions should imply in making it difficult to understand what is being study and blurring the limits of investigation about a specific topic. On the other hand, it represents a vast opportunity and direction for future research.

Even with this so called polysemy, a common theme is that innovation in public sector involves novelty and the intention of doing something better, for example, through new or improved services or processes (Arundel & Huber, 2013). Nonetheless, the need for more efforts to integrate this conceptualization and advance in more robust research frameworks that could capture all relevant dimensions about organizational innovation in the public sector remains. In this article, by the application of a conceptual analyses and a literature review it is proposed a new integrated concept for the topic that grounds two new research frameworks that are presented in the next sections, after the description of the method used.

Method

A qualitative method was chosen to address the purpose of this study, after applying *Methodi Ordinatio* structured protocol to select relevant literature about the relationship between training activities and organizational innovation, composing a current bibliographic portfolio to be analyzed (Pagani et al., 2015). A systematic review was performed on the selected articles, aiming to identify, analyze and integrate innovation concepts, dimensions,

typologies and theories presented, in order to fill theoretical gaps with the proposal of a new theoretical methodological research framework (Badger et al., 2000; Pagani et al., 2015). At first, the sample space was defined as all the databases accessible through *Coordenação para o Aperfeiçoamento de Pessoal do Ensino Superior* (CAPES) organization, in accordance with its scope and recognition by the Brazilian scientific community. *Portal de Periódicos da CAPES* indexes 116 databases referring to the Applied Social Sciences knowledge area.

A 360-degree search was performed at *Portal de Periódicos da CAPES* for the initial selection of articles related to the topic using the inclusion and exclusion criteria chosen to achieve the study objective, as related hereafter. Since organizational innovation in the public sector 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: "*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 databases were searched nine times, individually performing three combinations of each first group keyword with the ones from the second group, 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".*

In a first basis, it was selected only manuscripts that matched the following inclusion criteria: complete scientific articles, peer-reviewed in the blind review system, exclusively published in English language, 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-science for the last 8 years (2013-2020) following studies by Anderson *et al.* (2014) and Araújo *et al.* (2015) that reviewed literature until 2013. The final articles sample included only studies that presented concepts, typologies and theoretical frameworks with antecedents and dimensions of organizational or service innovation, as well as those that explicitly dealt with the relationship between training effects and innovation results.

Articles that did not present any conceptual or theoretical knowledge about the relationship between training and organizational innovation were excluded. At last, using cross-references after reading the selected articles, it was added four literature reviews and seminal works, in view of its importance for a broader understanding of the topic and to allow a conceptual analysis of the progress in the field.

The nine literature searches at *Portal de Periódicos da CAPES* using the keywords combinations resulted on more than 100,000 publications listed, with repeated sources appearing between then. 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. After applying all the inclusion and exclusion criteria, the literature search portfolio resulted in a total of twenty-six studies. 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.

The articles final sample was analyzed considering the following categories: field of enquiry, year of publication, research objectives, theoretical issues, relationship between training and innovation, methodological design (when available), suggestions for future research, limitations, and results. Then, a conceptual analysis was performed based on this systematic review to propose an integrative concept for the topic and a framework for applying it in future research and supporting organizational innovation project managers.

After this, to promote advances in knowledge about organizational innovation in the public sector, it is proposed a framework that aggregates and integrates concepts of learning through training and innovation to assess the training contribution to the success of innovation processes. Logical models and training evaluation models were also integrated in this framework, based on common methodological references from the systemic approach, allowing to address this relationship in a more holistic way.

Conceptual Analysis

Organizational Innovation

A more accurate literature analysis demonstrates that, beyond ubiquitous technological and product innovation, a relevant number of subareas emerged, interested in innovation aspects as diverse as: business model innovation, organizational innovation (Azar & Ciabuschi, 2017; Damanpour, 1991; Ganter & Hecker, 2013; Sung & Choi, 2014; Van Lancker *et al.*, 2016), public service innovation (Arundel & Huber, 2013; Bloch & Bugge, 2013; Djellal et al., 2013; Gallouj & Zanfei, 2013; Gonzalez et al., 2013; Osborne & Brown, 2013), service innovation (Barras, 1986; Djellal et al., 2013; Djellal & Gallouj, 2018; Ferraz & de Melo Santos, 2016; Gallouj, 2002; Gallouj & Savona, 2009; Gallouj & Weinstein, 1997; Morrar, 2014) and process innovation (Hervas-Oliver & Sempere-Ripoll, 2015; Piening & Salge, 2015; Walker, 2014).

The conceptualization of innovation and its underlying dimensions may concern the intrinsic need for previous definition of what is a product (a good, a service, or a mix of them), since innovation may be understood as a phenomenon related to the complete implementation of a new process or product (good and/or service) or improvement of an existing one. In this sense, the knowledge advance about innovation phenomenon as a whole, and the economic movements since global industrialization until the current servitization, where the frontiers of what would be a manufactured good or a pure service becomes more and more blurred with services being aggregated to simultaneous good production and vice-versa, the integrative theoretical approach presented in the seminal work by Gallouj and Weinstein (1997) tends to be an embracing definition of a product, since it may be applied in public or private organizations contexts, it considers the sets of specific characteristics (and its arrangements) from each object that is under an innovation process and still catches a glimpse of a clear typification of this processes results.

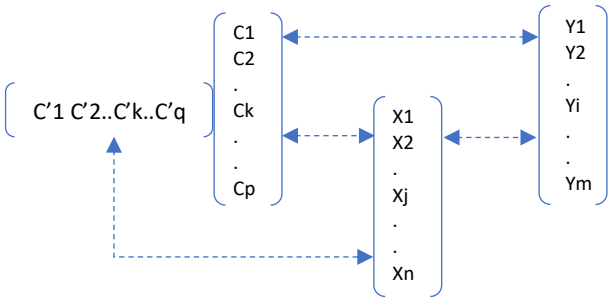
Regarding the alleged boundaries between goods and services, it can be said that, once produced, a pure good acquires an autonomous and physical existence and it has a high degree of exteriority concerning the individual who produced it and the person that will consume it. A pure service, by its turn, is intangible in general and does not have the same degree of exteriority. It is identical, in substance, regarding who made it an who consumes it (cannot be stored, therefore), and practically does not exist out of its producer and its consumer, being an act or a process more than a result (Gallouj & Weinstein, 1997).

Gallouj and Weinstein (1997) present a framework that features any “product”, in the form of a good or service provision, as being represented by an integrated system composed by a vectors set of technical characteristics (X), individual competences internal to an organization (C) and those related to this product clients (C’), all interconnected in a dynamic and processual

form by the mobilization of these competences, generating its final characteristics (Y), as reproduced in Figure 1.

Figure 1

Framework for schematic representation of the general shape of a product (good or service).



Source: Gallouj & Weinstein (1997) p. 546

The general representation of a "product" used by Gallouj and Weinstein (1997) has the advantage of not excluding processes in its approach and it can be used in different contexts, as well as it can be applied for studies approaching any organizational analysis level and/or innovation type. Table 1 presents some theoretical approaches relative to innovation and its types, where it can be observed some similarities and distinctions, reinforcing the existence of different conceptual streams that could work better in a more integrated form that fill individual conceptual gaps.

Table 1

Concepts related to innovation types

Concepts	Description of concepts	Main authors
Product innovation	The reverse product cycle "starts with process improvements to increase the efficiency of the delivery of existing services, moves to process innovation, which	Barras (1986)

	improves service quality, and then leads to product innovations through the generation of new types of services" (p. 161)	
Organizational innovation	The "adoption of an internally generated or purchased device, system, policy, program, process, product or service that is new to the adopting organization" (p. 556).	Damanpour (1991)
Service innovation	"Any change that affects one or more terms of one or more vectors of product characteristics (of whatever kind – technical, service or competence)" (p. 547).	Gallouj and Weinstein, (1997)
Management innovation	"Introduction of management practices that are new to the firm and intended to enhance firm performance" (p. 1269).	Mol and Birkinshaw (2009)
Process innovation	It has "an internal focus and aim to increase the efficiency and effectiveness of internal organizational processes to facilitate the production and delivery of goods and services for customers" (p. 654).	Damanpour et al. (2009)
Public service innovation	"Implementation of a significant change in the way your organization operates or in the products it provides. Innovations comprise new or significant changes to services and goods, operational processes, organisational methods, or the way your organisation communicates with users" (p. 143).	Bloch and Bugge (2013)
Innovation at work	"Innovation at work is the process, outcomes, and products of attempts to develop and introduce new and improved ways of doing things" (p. 1298).	Anderson et al. (2014)
Business process innovation	"A new or improved business process for one or more of the business functions that differs significantly from the business processes previously existing in the firm and that has been brought into use by the firm" (p. 21).	OECD/Eurostat (2018)

Source: Elaborated by the author.

The publications analyzed try to define innovation as a whole either for conceptual improvement in theoretical essays or as a theoretical basis to allow the achievement of empirical

studies, but also attempt to some innovation types, as organizational innovation (Damanpour, 1991, 2020), management innovation (Mol & Birkinshaw, 2009), process innovation (Damanpour et al., 2009), product innovation (Barras, 1986), service innovation (Gallouj & Weinstein, 1997), innovation at work (Anderson et al., 2014), public services innovation (Bloch & Bugge, 2013) and business process innovation (OECD/Eurostat, 2018), revealing the multifaceted and context-dependent character of innovation concepts.

When these definitions are put aside and analyzed together in comparison, it is possible to note the multidimensional characteristic of innovation phenomenon and some conceptual similarities and differences. The procedural and dynamic dimension of an innovation, for example, is evident among the similarities between the concepts of Barras (1986) reverse product cycle, in which the sequential steps of the innovation process goes from the processes improvement until the product innovation itself, and the Gallouj and Weinstein (1997) proposal, that depict innovation as the process of changing the characteristics of a product (good and/or service). Both are approaches from the Economics field of enquiry that focus on the process of generating an innovation.

By its turn, Management science approaches (Damanpour, 1991, 2020; Damanpour et al., 2009; Mol & Birkinshaw, 2009) are more focused on the process of adopting or introducing new products or production processes in the organizational environment, which seems to be even a similarity between them when it comes to the procedural dimension but also a distinction in relation with the focus of attention. The concepts pointed out by Bloch and Bugge (2013), Damanpour (1991); Gallouj and Weinstein (1997) and Mol and Birkinshaw (2009) have in common the fact that they are more comprehensive and deal with process innovation inside the innovation concept that they refer to, be it organizational or product innovation, by means of modifying an existing process (or some of its characteristics), or by the creation or acquisition of a new one.

In a longitudinal study that analyzes the combinatory effect of innovation types, Damanpour *et al.* (2009) present concepts that focus into process efficiency and effectiveness but, at the same time, limit service innovation to the delivery of new services to new or existing clients or the existing services to new clients, excluding from this concept the procedural dimension that is inherent to the creation of an innovation, as discussed above and depicted in Gallouj and Weinstein (1997). From an extensive literature review between 2002 and 2013, Anderson et al. (2014), considering that creativity and innovation have been increasingly important determinants of success, organizational performance and long-term survival, coined a concept bringing new perspectives for the field of organizational studies about innovation and attempting to the fact that organizational innovation has antecedents and results in the three levels of analysis, including the individual one, it is an emergent phenomenon at the workplace and has a procedural character over time.

The need for innovation to be characterized by its novelty dimension is present in almost all concepts analyzed and is treated here as its degree of differentiation from the previously existing innovated object whether in relation to the external environment or even internally to the organization. It appears on definitions with terms like: significant change (Bloch & Bugge, 2013), new to the organization (Damanpour, 1991; Mol & Birkinshaw, 2009), differs significantly (OECD/Eurostat, 2018). This restricts and delimits better what can be treated as an innovation, instead of treating it only as a simple change that does not reflect in something truly new to the organization or its stakeholders.

The theoretical essay by Gallouj and Weinstein (1997) is seminal because integrates technological and process (or non-technological) innovation, managing to be a general interpretative synthesis of the various innovation dimensions and also adaptable to empirical validations in different contexts. Besides, Gallouj and Weinstein (1997) study amplifies the comprehension of innovation when it includes the competences and interactions between

people involved in the process as fundamental components of a product and its innovations, which has a procedural nature with an heuristic value that allows researchers to evaluate why some innovation initiatives in organizations work well and others fail. Furthermore, considering the importance given to competencies in this concept of innovation, it is clear how formal and organizationally planned learning processes may be a strategic human resources practices by fostering the development of skills in trained employees and its teams, generating innovations.

Conceptualization produced by Damanpour et al. (2009) focus on the increasing of process efficiency and effectiveness and elaborates important process innovation dimensions allowing it to be studied by the lenses of broader approaches. It is also relevant to the theoretical framework proposed in this article considering that aggregating value with new or improved organizational processes at public sector may imply in innovation for its services end user. Bloch and Bugge (2013) advocates for a necessary improvement in conceptualization with an integrative approach and development of new frameworks to measure innovation in the public sector. The authors propose concepts that focus on innovation dimension of novelty for changes in operation or products provided by public organizations.

In this article, conceptual characteristics described by Bloch and Bugge (2013), Damanpour *et al.* (2009) and Gallouj and Weinstein (1997) are used as a basis to analyze innovation concepts and types founded in literature and to propose a new integrative concept for organizational innovation in public sector. The conceptualizations chosen as a basis for the theoretical propositions in this article complement themselves insofar as process innovation dimensions from Damanpour et al. (2009), characterized as a type of organizational innovation that aims to facilitate the production of goods and delivery of services to clients, complements the seminal conceptualization of Gallouj and Weinstein (1997), which theorizes the improvement of processes as a type of service innovation and match with Bloch and Bugg (2013) focus on implementation and internal novelty dimension for the public organization.

Finally, these approaches are more generalist and do not restrict organizational innovation to a particular sector of the economy or type of process, and focus on increasing the added value to the client of the innovated processes or products, but lacks integration about all innovation dimensions cited at OECD/Eurostat (2018).

Dimensions, Typologies, and Categories of Organizational Innovation

The distinction between innovation types has been pursued by researchers because there are evidences that they have different characteristics, their adoption is not affected identically by the same environmental and organizational factors, besides the fact that there are researches suggesting that, to different innovation types, its generation process on industry level is not the same of its adoption on organizational level, suggesting more possible differentiations (Damanpour et al., 2009). Accordingly to Damanpour (2020), external and internal conditions that induce organizations to engage in generating or adopting innovations are examined by studies of organizational innovation, as well as estimating and assessing the impact of innovation on organizational conduct and performance.

Zaltman *et al.* (1973) identified twenty innovation types and grouped them in terms of the state of the organization and innovation focus and result. Another largely recognized typology is the one about the distinction between technological (or technical) and administrative innovation, also known as organizational innovation (Damanpour et al., 2009).

When evaluating some theories of innovation, the Oslo Manual (OECD/Eurostat, 2018) points out to the existence of four dimensions that can guide this phenomenon measurement: knowledge, novelty, implementation and value creation, which means that it is possible to measure and evaluate questions related to, for example, learning and application of new knowledge, the fact of the innovation result being new or not, the condition of have been implemented or stayed only in the ideas field and, furthermore, if it has created or not value for

the client. These dimensions are useful to base innovation measurement situations in support to the definitions and concepts more commonly used in the literature.

Literature analyzed to produce this article present some innovation types that may get confused in relation to their attributes and dimensions, depending on the locus of application and the fields of enquiry that addresses the phenomenon, as for technological innovation (Damanpour et al., 2009), marketing innovation (Azar & Ciabuschi, 2017) and open innovation (Peris-Ortiz et al., 2018).

Inside the integrative approach of innovation presented in Gallouj and Weinstein (1997) it is also proposed six service innovation categories (radical, incremental, ad-hoc, improvement, recombinative and formalization) applicable to other analysis situations related to any innovation type, amplifying its seminal value for the field and allowing it to categorize innovation construct nuances that can, theoretically, be attached to distinctive predictors, whether they are facilitators or barriers for their generation or adoption.

Product versus process innovation dichotomy is usually found in literature. While the first refers to new and final goods or services introduced by an organization, the latter reflects changes in the way organizations create and deliver these goods and services (Piening & Salge, 2015). There are several taxonomies in the studied literature, with several ways to classify innovation in organizations, varying only the focus, but all of them involve a dynamic process, with transformation over time, that requires learning processes, ideation and implementation. For example, reflecting on how training, development, and innovation by which organizations manage change, Sartori, Costantini, Ceschi & Tommasi (2018) consider organizational innovation as the process of transforming ideas or inventions into goods or services that generate value and for which customers will pay.

Proposal for an Integrative Concept of Organizational Innovation in the Public Sector

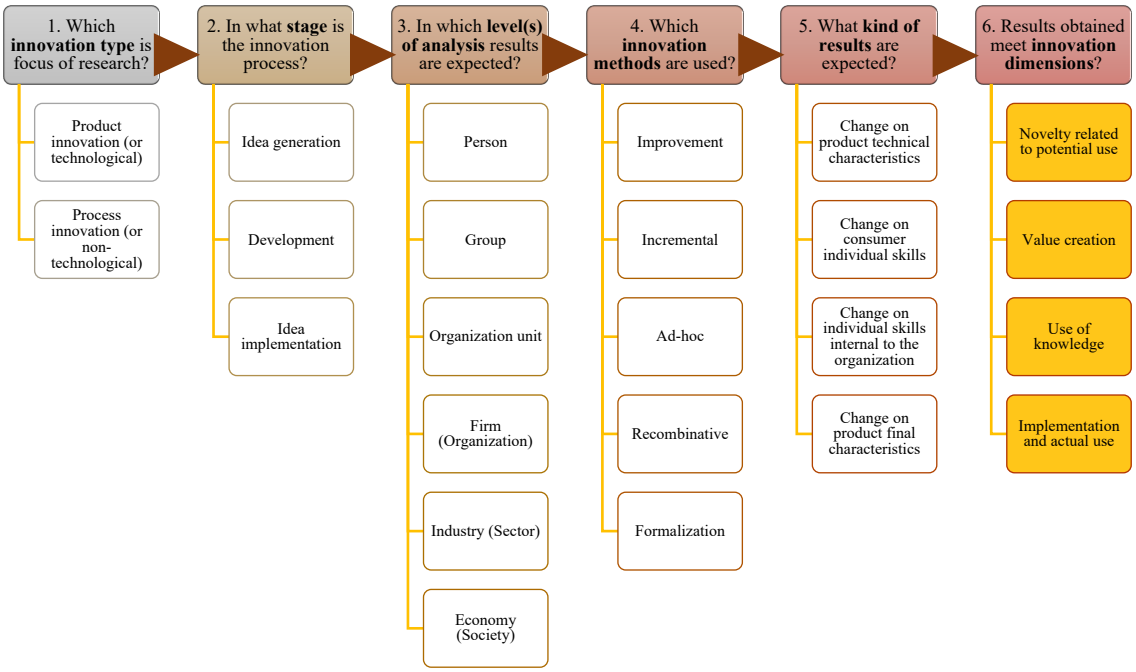
From these findings, it is easily perceived a need for theoretical integration in a concept that can be used in a more comprehensive and assertive way for scientific investigation on organizational innovation in the public sector phenomenon with a focus on components related to the internal environment of these organizations. Using theoretical inspirations from different perspectives by economic (Bloch & Bugge, 2013; Gallouj & Weinstein, 1997), organizational (Damanpour, 1991; Damanpour et al., 2009) and behavioral sciences (Anderson et al., 2014), it is proposed here a polytomous and integrative concept for organizational innovation in the public sector, aiming to contribute for the field organization and guiding to new research avenues for improving this phenomenon understanding, researching and management.

Taking account the limitations of this research and unifying conceptual dimensions, it is proposed that organizational innovation in the public sector is "an overtime multilevel value creation process, composed by phases of generation, development and implementation of new ideas, that requires the use of knowledge and creativity involving human participation in organizational context, and whose results may be any change that affects one or more components of one or more sets of characteristics of the product or process that is new for the unit, organization, market or society."

Based on these groups of conceptual characteristics found in literature, Figure 2 organizes organizational innovation program components into a six-step framework of inductive questions that could support planning research on the topic. It can be used to generate insights on how to approach the phenomenon and deciding about research methods for collecting and analyzing results obtained. It also could help to manage organizational innovation in practice, being a guide to determine tools, resources and processes that better fit innovation project goals.

Figure 2

Research framework of components and characteristics of organizational innovation in the public sector



Source: Elaborated by the author.

This conceptual construction results from qualitative content analysis from literature description of distinct dimensions (OECD/Eurostat, 2018), typology (Bloch & Bugge, 2013; Damanpour, 1991; OECD/Eurostat, 2018), categories (Gallouj & Weinstein, 1997), analysis levels (Anderson et al., 2014; Damanpour, 2020), innovation adoption process (Anderson et al., 2014; Damanpour, 1991; OECD/Eurostat, 2018) and change possibilities (Gallouj & Weinstein, 1997). This analysis result was concatenated into one single concept and makes it easier to identify relevant construct characteristics that could support researchers and practioners.

Theoretical Methodological Framework

Considering the conceptual analysis carried out in this study, the heuristic needs for development of progresses at the field and the possible training contribution to organizational

innovation in the public sector, a framework is presented using as a main theoretical basis the concept of service innovation by Gallouj and Weinstein (1997), integrated with the conceptual dimensions used by Damanpour et al. (2009) for organizational innovation and the concept elaborated by Anderson et al. (2014) which unifies creativity and innovation constructs in a multilevel form.

This proposal uses an approach from the program evaluation field, the logical models of program assessment (McLaughlin & Jordan, 2010), associated with integrated training effectiveness assessment frameworks that aggregates a systemic approach to the comprehension of training interventions in work organizations including, in addition to results, variables of context and other components of instructional systems like relevant measures about individual characteristics, training process, organizational support and transfer of training support as predictors for training results (Abbad, 1999; Borges-Andrade, 1982). These systemic approaches and theoretical models have been used as references for researchers in training evaluation (Abbad, Souza, Silva & Souza, 2012; Araujo, Abbad & Freitas, 2019) because they present evaluable specificities and dimensions of training interventions.

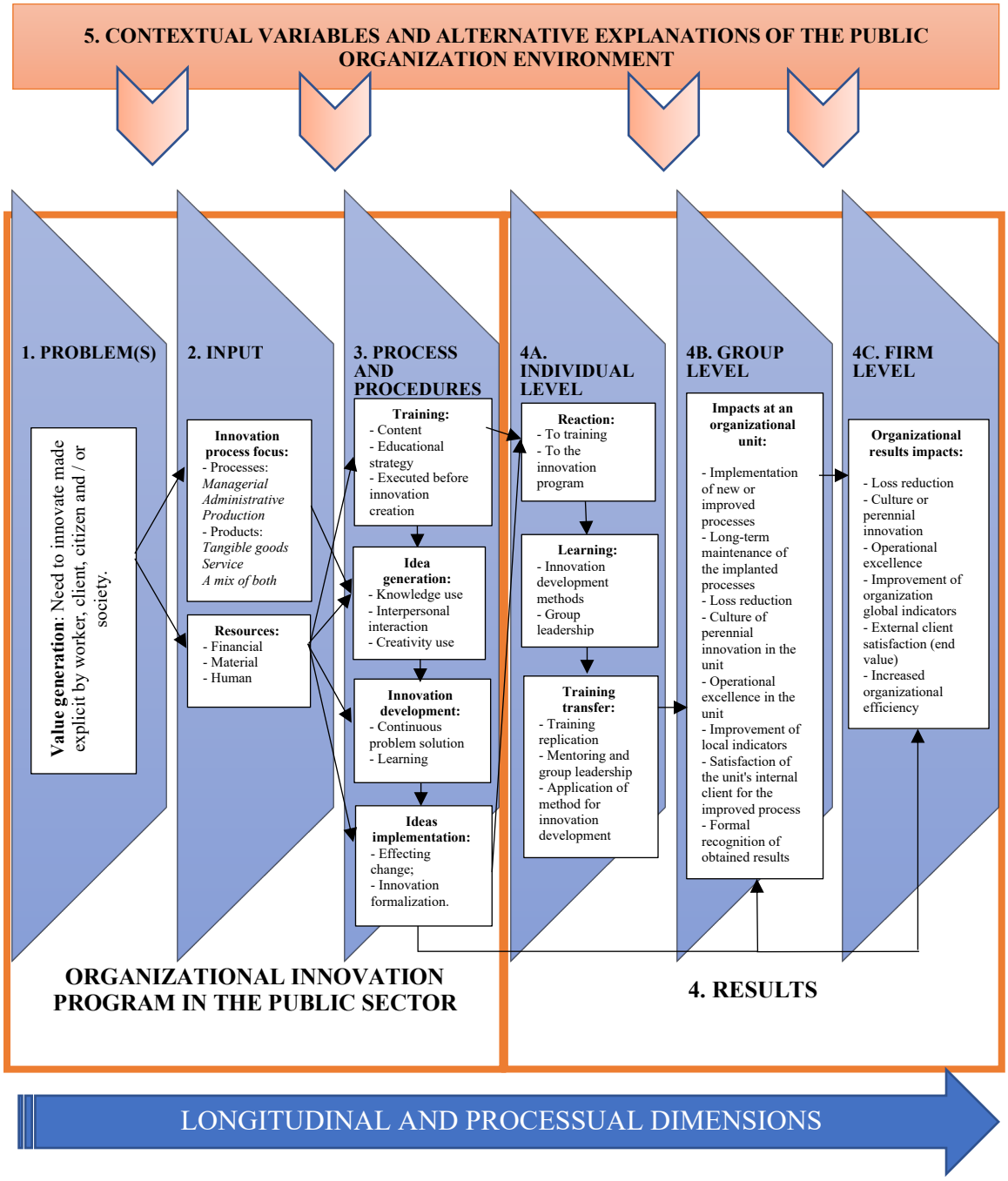
Considering recent findings presented in studies about the relationship between training investment and organizational innovation results that indicates the need of exploring this research path (Neirotti & Paolucci, 2013; Sung & Choi, 2014; Dostie, 2018), this article proposes a theoretical multilevel research framework to analyze the relationship between training contribution over innovation in work processes in order to evaluate organizational innovation programs in the public sector aiming to help in selecting constructs and variables that are more adequate to evaluate such interventions in their pertinent analysis and complexity levels, covering all theoretical inspirations presented before.

It is theoretically proposed in Figure 3 the use of constructs grouped in five interdependent longitudinally related variables sets that are used in research related to training

effectiveness evaluation interconnected with constructs related to organizational innovation results, added by possible alternative explanations variables that are related to public organizations context.

Figure 3

Theoretical framework for multilevel evaluation of training contribution to organizational innovation results in the public sector.



Source: Elaborated by the author.

As shown in Figure 3, a program of organizational innovation is represented by the variables set 1 to 3, unifying since the definition of value generation to be achieved until the procedural phases of the program, including human resources training. Results expected are represented in set number 4. Set number 5 completes the *framework* with contextual variables affecting the other sets and their supposed relationships.

Framework Components

Organizational innovation needs could start from **problems (1)** viewed in terms of needs made explicit by its *stakeholders*. In order to work on building a solution to these problems, it is necessary to use certain sets of **inputs (2)** represented here by identification of which organizational processes or products will be the focus of an innovation process and by the use of resources necessary to its achievement. The **process and procedures (3)** component refer to a set of activities that compose the processual dimension of organizational innovation in the public sector, being directly affected by variables that characterize inputs and starting in the phase of: **training design and implementation**, implying consequences in the next phases of **idea generation**, with strong use of creativity; **innovation development**, with learning by continuous problems solution during the prototyping phase and test of the ideas generated in the previous phase; and, lastly, the **ideas implementation** phase, with innovation effecting and formalization.

Next, it is supposed that the four phases of the **process (3)** variables set must generate immediate impacts on **results (4)** at **individual (4A)** level and, therefore, one can assume that training causes medium- and long-term impacts on **results (4)** in **group (4B)** level at organizational units where there is effective application of an innovation program.

Therefore, the results obtained in each group aggregate to contribute for achievement of planned **results (4)** at **firm (4C)** level, as a more distal training phase consequence and planned goal for medium- and long-term results of innovation program. In addition, it is supposed some

relationships of a distinct **contextual variables (5)** set that can affect the relationship between some predictors and subsequent levels of impact on organizational innovation results. Add to this organizational context dimensions specific public sector characteristics that can affect the relationships expected in this model as the prevalence of organizational resources competition in relation to the market one, risk aversion, the nature of the appropriation regimes and bureaucratic inertia and rigidity, as stated by Gallouj and Zanfei (2013).

In this framework it is also considered the existence of innovation process effects that are independent of the results obtained with training, as well as the procedural and longitudinal effects dimensions, which should guide elaboration of hypotheses about relationships between variables related to the framework components and methods to measure their effects and subsequent analysis of the results obtained in empirical studies that aim to test the model.

Conclusion

Organizational innovation in public sector, while a multifactorial social phenomenon, demands scientific comprehension efforts that embrace refining existing concepts to define it and, thus, align paths to new knowledge generation. In this way, this article aimed to present a theoretical investigation framework that considers training as an antecedent of innovation processes at public organizations.

This purpose matches with the integrative concept proposed and the presented model, even as tends to be valuable to innovation science taking account the importance of training activities on the promotion of new ideas, knowledge and behaviors generation and development, by individuals and their groups, that can have their effects enhanced with the support of a larger innovation process where training is an inseparable part of their activities, thus leading to the implementation of these results.

It was presented and analyzed a set of concepts about innovation, their dimensions, typologies and categories commonly used in scientific literature with a high impact factor and,

according to the conceptual analysis performed, the field of innovation studies has characteristics of polysemy, with polytomous concepts that do not integrate all possible dimensions of the innovation phenomenon in public sector organizations and encompass an excess of typification that can confuse the research paths necessary for the development of increasingly robust knowledge on the subject.

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ARTICLE 3

An organizational innovation program in Brazilian public sector – a qualitative assessment of its components, relationships and expected results

Abstract

Organizational innovation has been studied as a strategy for organizational differentiation and sustainability in competitive markets. In public sector, there is a movement to expand innovation management in its organizational environments aiming to generate efficiency improvement in service provision to citizens. However, literature about evaluation of organizational innovation programs in the public sector and training contribution to their results is scarce. This article objective is to describe an organizational innovation program in the public sector with training as one of its essential activities in order to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning. This article presents an empirical case study with a qualitative design and data collection carried out through content analysis of 3,476 documents relevant to the evaluated program. Using a logical model associated with training evaluation systemic approaches, hypotheses were raised about its expected results, the components and its relationships were described. Training instructional quality was evaluated accordingly to instructional design theories and expected training participants' work performance objectives were extracted. It was found that the training component was conceived in such a way that its design and delivery characteristics prepared training participants to effectively improve organizational processes in a public sector organizational context. Results also showed that the training component contributed to achieve expected innovation results through development of specific process innovation work related skills.

Keywords: Innovation training, Organizational innovation, Public Sector Innovation, Process improvement, Innovation program evaluation

An organizational innovation program in Brazilian public sector – a qualitative assessment of its components, relationships and expected results

At the organizational scope, programs work with a set of inputs and resources (human, financial and material), through the coordinated execution of interdependent activities focused on achieving the results expected by their stakeholders. Organizational innovation can be object of a program of this nature, when an organization's strategic planning aims to implement improvements in its processes, products, or services with a focus on their value for the customer. Training, by its nature and components, can also be planned and managed as an organizational program in human resources management or be part of a larger program, to contribute for expected results developing the human capital involved in the program. This article objective is to describe an organizational innovation program in the public sector with training as one of its essential activities in order to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning. Using a logical model associated with training evaluation systemic approaches, hypotheses were raised about the expected program results, its components and the relationships between them were described. The instructional quality of training was evaluated accordingly to instructional design theories and expected work performance objectives from graduates were extracted from instructional material.

Training and development activities occupy a central role in the set of practices that are called people management in organizational contexts. Its impacts are fundamental, both for the individual-work adjustments, translated into differences between collective and individual performances, as well as for the relationships between

organizations and their contexts, affecting productivity and competitiveness (Bastos, 2006). Examining the evolution of research in training and development through a systematic review based on studies published since 1918 in the renowned Journal of Applied Psychology (JAP), Bell et al. (2017) draw attention to the urgent need to carry out more research that is theory-driven, takes more account of training participants roles and training context, examines learning that takes place outside the classroom, and understands the impacts of training at different levels of analysis.

Comprehension about how a program works can be a relevant factor for the quality of the evaluation process of its results and can be considered as a component of the evaluation process itself. As each program has several specificities (whether within the scope of society, or enclosed within organizational boundaries), Weiss (1998) recommends that evaluations take into account the program theory to be analyzed, in order to properly formulate evaluation questions, better understand collected information, and propose recommendations that are feasible and acceptable by the program management team.

Evaluation practice has been developed to help, support and extend the naturally human abilities to observe, understand, and make judgments about policies and programs (Mark et al., 2000). In this area, the logical model is a tool that can contribute to the process of evaluating organizational programs, as it explains the relationships between the elements that compose it and the results expected by its stakeholders (Abbad et al., 2012). However, when it comes to programs that involve training activities (or when training is the program itself) the adoption of a logical model to explain the theory of the program does not eliminate the need to use a theoretical model of training evaluation (Mourão & Meneses, 2012). Thus, the logical model is a tool that, associated with training

evaluation models, presents the relationships of training context, inputs used, processes, activities performed, and the short and long-term results (McLaughlin & Jordan, 2010).

Using figures as graphic organizers about information collected from the logic models approach makes it possible to visualize the components and assumptions of relationships between them, the results and their context and facilitates the synthesis and interpretation of data from different sources (human and documentary), and the construction of evaluation measures for use in combination with other research methods (Damasceno et al., 2012). Organizational programs that have training as one of their inseparable parts can be based on the consideration that human and organizational learning processes can generate changes necessary for the achievement of predetermined objectives. To Kraiger & Ford (2021), learning is the engagement in mental processes that result, over time, in the acquisition and retention of knowledge, skills, attitudes and/or affections and that are applied when necessary. Considering that training activities are means to promote learning in an organization, the approach used in its instructional design is a relevant element for evaluating its effectiveness.

Therefore, this study has specific objectives: (a) to describe the components of an innovation program in the public sector that included training of employees that are responsible for the expected innovation; (b) to describe the innovation program prescriptive elements, identifying relationships between the components (problem, input, processes, products, result), context and expected results; (c) to identify indicators of training effects (products and results) pertaining to the evaluated program, at the levels of individuals, teams and organizational results; (d) to identify contextual variables that affect relationships between the program components and its results; (e) to describe and to assess the instructional quality of the training component.

The logical model was used in conjunction with the Integrated Model of Impact Assessment of Training at Work – IMPACT (Abbad, 1999) for considering the relationships between antecedent variables, such as training participants' characteristics and organizational support, addressing evaluation about reactions, learning and training transfer to work (Abbad et al., 2012; Damasceno et al., 2012). The combined use of concepts and variables of context (support), training participants' characteristics, and characteristics of training as antecedents of training individual results (reactions, learning and training transfer) with program evaluation logical models tool can contribute to the advancement of knowledge about the contribution of training in innovation programs, which can reduce gaps identified in previous studies on the impact of training on organizational innovation (Børing, 2017; Dostie, 2018; Sung & Choi, 2014).

Research gaps found in a literature review on the contribution of training to organizational innovation (Gonçalves & Abbad, in press)[4] illustrate scientific need to qualitatively evaluate the effectiveness of an organizational innovation program in the public sector through in-depth analysis of empirical evidence on its origin, the relationships between its components, externalities, hypotheses and effectiveness indicators, since the literature approaches this relationship mostly at broader levels of analysis, without investigating the relationships between variables and relevant dimensions of training and innovation at the lower levels, of the individual and teams, nor the multilevel relationships that can occur therefrom. Thus, carrying out a qualitative assessment using a systemic approach to organizational innovation programs in the public sector, detailing the components of interest, can contribute to advance the research field.

The study originality stands out for the use of specific models that make it possible to demonstrate the relationships between antecedent variables, context and indicators

[4] Article 1 in this thesis.

sensitive to the results of an organizational innovation program with training as an inseparable part, which differs from previous studies in literature that do not consider relevant predictor variables linked to instructional design characteristics when evaluating the relationship between training impact and innovation results, such as those of (Bauernschuster et al., 2009; Børing, 2017; Dostie, 2018; Manresa et al., 2019; Sung & Choi, 2014) and those that use generic training evaluation models focused only on their results and without prior analysis of relationships between variables that are training components, such as those by (Hamblin, 1978; Kirkpatrick, 1976). This study presents theoretical foundations on the use of logic model tool on evaluation of programs linked to models of training effectiveness evaluation, as well as theories and approaches about the quality of training instructional design. Then, there is the detailing of method, in addition to results, discussions and considerations sections.

Theoretical framework

Organizational Innovation in Public Sector

According to De Vries et al. (2016), most articles reviewed by then do not provide a definition of innovation, and the boundaries of the concept were not referred to, often. Various authors defined innovation as 'the adoption of an existing idea for the first time by a given organization'. Innovation can also be understood as a complex, multifaceted phenomenon that impacts both organizations and society. For Castro et al. (2017), public sector innovation can be seen either as a qualitative or quantitative substantial modification in previous techniques or practices, or as a new organizational structure, or a new administrative system, a new plan or program belonging to members of an organization, resulting in a new product, service or practice new to the state of the art; or new, at least, to the organizational context in which it finds itself (Beinare & McCarthy, 2012; Damanpour & Wischnevsky, 2006).

In a Brazilian study on the antecedents of innovations in public organizations, Castro et al. (2017) mentions that relevance of studies on innovation in the public sector is great when considering the importance of its services for economies and societies (Grugulis & Haynes, 2014; Vargas et al., 2013), and adds that the main objective of innovation in public service is to optimize available resources, through innovative forms of management and organization, generating greater benefits for society, which is the user of its service (Soares, 2018). It is known that public sector is mostly a service sector, focusing on citizen as a customer, composed of organizations that have some idiosyncrasies in relation to the private productive sector, such as acting in a non-competitive market (mostly), affecting the motivation to innovate. However, due to the limitations of available resources and precisely because of its nature as a provider of services, most of which are free for the end user, it requires that they seek to innovate by optimizing their organizational processes with a focus on improvements for the citizen.

Although studies on innovations in services have constantly advanced, it is clear that the focus of action has been, primarily, on private companies (Gomes & Machado, 2018). This fact seems to be due to a mistaken perception that public sector has just a supporting role to innovation, whose main role involves regulating and financing innovative activities or even acting as a consumer of innovative products created by private companies (Koch & Hauknes, 2005; Windrum & García-Goñi, 2008). Innovation in this context can also be generated from a set of resources and activities structured through an organizational program aimed at achieving expected results, in a given time, and producing value for its customers by optimizing processes, services or products.

Distinguishing types of innovation is necessary for understanding organizations' innovative behaviors because they have different characteristics and adopting innovations is not affected identically by, for instance, organizational antecedents (Walker, 2006).

Organizational innovation, by its turn, represents a wide field of research that can be studied as a type of innovation that embodies product or service innovation, process innovation and its subtypes (e.g., administrative, or technological process innovation). When reviewing literature about innovation types in the public sector, De Vries et al. (2016) found that the largest category (40%) consisted of administrative process innovations (a subset of process innovations), often driven by New Public Management (NPM)-like reform ideas. The next largest category found was product or service innovations.

They state that literature seems to lean towards intra-organizational process innovations, which are often closely related to two major reform movements in public administration, namely NPM and e-government. Process innovation focus on improvement of quality and efficiency of internal and external processes (Walker, 2014a). Regarding innovation goals, De Vries et al. (2016) also found that the most frequently mentioned motivation for innovation was improving performance, expressed in terms of effectiveness (18%) or efficiency (15%). Studies that referred to this, highlighted notions such as ‘performing with less’. So, the former common-sense notion that public sector organizations do not need or are not interested on innovating their processes services or products, seems to be untrue. Which, on the other hand, still leads to new possibilities of studies to unlock conceptual, theoretical, methodological, and empirical specific knowledge on this area, like how does innovation process may occur on this organizational context, which are the relevant innovation antecedents for each innovation type, and which relevant relationships should happen to achieve desirable innovation goals? There is much to be done.

Program Evaluation: The Program Theory and Logical Model Methodological Approach

Social programs can be defined as a set of systematic efforts to achieve pre-planned objectives coming from the public or private sectors. Program evaluation emerged as a methodological concern of the social sciences with the evolution of social policy and public welfare administration (Fernandez-Ballesteros et al., 1998). Evaluation refers to the process of determining the merit, worth, or value of something (Scriven, 1994). Thus, Program Evaluation (PE) usually refers to the process of determining the merit, worth, or value of social programs, such as a public policy, private projects, public regulations, or other public or private interventions. (Fernandez-Ballesteros et al., 1998). Merit, or value, is associated with the achievement of goals, objectives, or other pre-established outcomes, tested after program implementation (Tyler, 1950). Knowledge of definitions for social programs and methods of evaluating their effectiveness can and has been used in evaluation processes of organizational programs, as they also represent a set of specifically planned efforts to achieve pre-established goals and objectives.

Knowing the causal chain of a program allows the evaluator to identify with greater precision which of its components contributed (or not) to program's results achievement. Program theory can be approached according to three different levels of analysis, according to (Weiss, 1998): program theory, which emphasizes the relationship between the implemented actions and the achievement of program objectives; the theory of implementation, which is concerned with the materialization of the objectives in the processes and in the provision of services by the program; and the theory of change, which is the combination of these two theories. Program theory is used to analyze the evaluability of a program before the evaluation itself, verifying the quality of the program design, exploring the reality of its implementation and, when necessary, even redesigning the program to become assessable.

Assumptions about resources and activities and how these are expected to lead to intended outcomes are often referred to as program theory. A logic model is a useful tool for describing program theory. The hypothesis, often implicit, is that if the right resources are transformed into the right activities for the right people, then these are expected to lead to the results the program was designed to achieve. One of the assumptions that evaluators make is that a useful evaluation approach is based on an understanding of the objectives of the program and of the ways in which the program intends to achieve these objectives. Logic modeling can be a useful tool for performing an evaluability assessment. It can serve as an advance organizer for designing and conducting an implementation evaluation. The model presents a description of how the program staff members or other stakeholders believe the program works (McLaughlin & Jordan, 2010).

Logic models elaboration, a tool used in program evaluation area, necessarily goes through the steps of collecting information related to the program, description of the problem addressed by the program and its context, definition and graphic organization of elements from the logic model, causal relationships determination between its elements and verification of the logic model previously built with those responsible for the constitution of the program under evaluation (Meneses, 2007; Mourão & Meneses, 2012; Nascimento & Abbad, 2021). Applying these steps prior to program evaluation provides the development of an advanced organizer or focus mechanism for measuring key elements of organizational performance indicators (McLaughlin & Jordan, 2010).

Instructional Design Quality and TD&E Effectiveness Assessment Theories

Organizations invest large amounts of financial, human, and material resources in TD&E activities with various purposes and expectations of their stakeholders for the results to be obtained with this investment. According to (Ho, 2016), businesses are making ever-increasing investments in training their workforces believing that training

and development enhance organizational competitiveness. A growing body of research has found that training investments are related to a variety of important firm outcomes and can contribute substantively to competitive advantage (Birdi et al., 2008; Kim & Ployhart, 2014; Salas et al., 2012; Sung & Choi, 2014). For example, Kim & Ployhart (2014) examined 359 firms over 12 years and found that the amount of internal training investment over time was significantly related to firm profit growth via the impact of that training on labor productivity (Ford et al., 2018).

Learning in an organizational context is multidimensional, must have intentionality and must last. Learning is defined as the engagement in mental processes - learning events - that result in acquisition and retention of knowledge, skill and/or affect over time and even when needed, together with the ability to identify performance conditions and respond to them properly (Kraiger & Ford, 2021). Based on a systemic approach, Training, Development and Education (TD&E) system can be defined as a continuous flow of interdependent activities, consisting of needs analysis, planning, execution and training evaluation, the latter being responsible for ensuring the instructional system feedback (Borges-Andrade et al., 2012). The evaluation stage is defined as the systematic process of data collection to identify training effectiveness (Goldstein & Ford, 2002).

Due to the multidimensional and complex nature of an evaluation stage, research models are needed to guide the evaluation process. Integrated and summative training evaluation models make use of the instructional systems approach to evaluate variables that may interfere and predict the expected effects of training, allowing to evaluate beyond the existence of the result obtained. Kirkpatrick (1976) developed a T,D&E evaluation model that uses four levels of effects: reactions, learning, behavior on the job and results, as a cause and effect sequence between the levels (Borges-Andrade et al.,

2012; Salas & Cannon-Bowers, 2001). The first two levels are considered immediate effects of training, commonly assessed at the end of the instructional event, while the last two are defined as medium or long-term results, respectively. This distribution of the possible effects of a training action is similar to the expectations of short-, medium- and long-term results for an organizational program, for example, facilitating an integrated approach between training evaluation models and program evaluation.

In the seminal model of Kirkpatrick (1976), *reaction* level measures satisfaction or training participants opinions on aspects such as infrastructure, instructor and content, *learning* measures the acquisition of competences by participants (Borges-Andrade et al., 2012), and *on the job egress behavior* measures the effective on-the-job application of knowledge, skills, or attitudes learned by training participants during training, with related definitions on international literature, such as training transfer to work (Blume et al., 2010; Ford et al., 2018; Taylor et al., 2009). In Brazil, this level is defined as the impact of training on the egress' work. The last level, *results*, evaluates the effects of training on organizational results, measured in terms of the achievement of objectives and the occurrence of changes in the organization. Hamblin (1978) reviewed this model and split the last level, results, into two: *organizational change* and final *value* (Borges-Andrade et al., 2012; Steensma & Groeneveld, 2010). Changes refer to training effects on organization and its work processes (in terms of increasing efficiency and effectiveness of work processes), while final value is measured in terms of comparisons between training costs and benefits, in order to measure social and financial returns or other desired organizational outcomes. These two models were classified as generic, as they organize the field of knowledge and describe relevant variables to TD&E (Borges-Andrade et al., 2012).

Two Brazilian theoretical and methodological research frameworks about training effectiveness evaluation are precursors of studies in this area, in the country: the Integrated and Summative Assessment Model - MAIS (Borges-Andrade, 1982), and the Integrated Impact Assessment Model – IMPACT (Abbad, 1999). Built upon the theoretical systemic approach of the first one, IMPACT model aims to test relationship between variables: perception of organizational support, training characteristics, training participants' characteristics, reaction, learning, transfer support, and training impact at work. *Organizational support* refers to practices of organizations for employee appreciation that may imply training impact. *Training characteristics* investigate the type of action, course, and area of knowledge to which it belongs, through factors such as duration, instructional objectives, didactic characteristics, and instructor performance. *Training Participants characteristics*, on the other hand, encompasses a set of information about participants, such as functional, sociodemographic, and motivation to carry out training and use learned skills. *Training transfer organizational support* is divided into three dimensions: *managerial support*, which indicates the support received by training participants to take part in the activities of the instructional action; *psychosocial support to transfer*, which portrays support of supervisors and colleagues support to use at work the skills learned during training; and, *material support to transfer*, which is the analysis of material and financial resources that influence training transfer (Borges-Andrade et al., 2012; Zerbini & Abbad, 2010). *Training impact at work* refers to evaluation of effects on training participants' work performance levels, motivation, self-confidence, and work processes, also known as training transference, which refers to the correct use of knowledge, skills or attitudes acquired in training situations, in the work environment (Abbad, 1999). Considering the relevant inclusion of context variables in the systemic models of TD&E assessment, in this study it was chosen to use the IMPACT

integrated model linked to a program theory logical model to allow establishing relationships between studied variables.

Grounded on an extensive systematic meta-analytic review that shows substantial evidence collected from the analysis of 335 leadership training evaluation studies, Lacerenza et al. (2017) argue that these programs are effective and should be used across a variety of domains. Regarding training characteristics, results suggest that leadership training programs can lead to a 25% increase in learning, 28% increase in leadership behaviors performed on-the-job (i.e., transfer), 20% increase in overall job performance, 8% increase in subordinate outcomes, and a 25% increase in organizational outcomes. The results obtained by Lacerenza et al. (2017) also suggest that the extent to which a program is effective is related to various design, delivery, and implementation elements.

The review showed that, when it comes to desired outcomes on transfer level, training characteristics that potentiate results are using multiple delivery methods, conducting a needs analysis, providing feedback, using a face-to-face setting, making attendance voluntary, having multiple sessions and include hard and soft skills. On the other hand, regarding desired outcomes on results level, leadership training is more likely to be effective when uses multiple delivery methods, hold on-site, requires mandatory attendance, have multiple sessions, provide as much training as possible, and include hard and soft skills (Lacerenza et al., 2017). This knowledge is important for this study insofar as it enables the assessment if the training activities on the innovation program have design and delivery characteristics that could positively affect its impact (training transfer). Additionally, the metanalysis addressed by Lacerenza et al. (2017) was used in this research because the evaluated training has leadership skills related content alongside with innovation related ones.

Workplace training is a systematic approach to learning and development to improve individual, team, and organizational effectiveness. The science of workplace instruction is the application of evidence-based principles that have been found to help individuals learn knowledge, skills, and attitudes related to job performance and organizational effectiveness. Instructional principles are empirically supported propositions that guide the design and delivery of effective training. Instructional principles can affect how training is structured and designed, how learners interact with material, and lead to learning outcomes. The most effective instructional methods are rooted in sound theories of human behavior and incorporate evidence-based instructional principles. Five core instructional principles have empirical support and can be applied in multiple ways to facilitate learning. A useful principle must be actionable, resulting in instructional design or learning events that result in knowledge/acquisition and retention (Kraiger & Ford, 2021).

The science of workplace instruction postulates that learning is facilitated by active processing of the learner and sound application of instructional principles and delivery. In this context, Kraiger & Ford (2021) provide five empirically supported instructional principles that should be considered when it comes to training effectiveness approaches: organize content, optimize sequencing of material, engage learner in own learning, conduct effective practice and develop past initial mastery. The recent findings from Kraiger & Ford (2021) and Lacerenza et al. (2017), when integrated in a systemic view shows evidence of particular training characteristics that should be considered to evaluate what kind of trainings are more likely to rise training impact on egress' work and potentially achieve changes in organizational outcomes.

Theories of training effectiveness evaluation (Abbad, 1999; Aguinis & Kraiger, 2009; Arthur et al., 2003; Borges-Andrade, 1982; Goldstein & Ford, 2002; Hamblin,

1978; Kirkpatrick, 1976) and instructional design quality (Arthur et al., 2003; Khalil & Elkhider, 2016; Kraiger & Ford, 2021; Lacerenza et al., 2017) demonstrate that the existence of a positive transfer of training to the egress's work can impact organizational results if the instructional planning has been carried out considering some assumptions (e.g., complexity learning level and performance objectives expected from egress at work, adequacy of the content covered, training delivery strategies, exercises, feedback, simulation of work reality, spacing). Innovation training also, is supposed to benefit from this links to desired outcomes, if they are thought, planned and carefully designed with this evidence in mind.

Effective transfer has proven to be a complex and often elusive outcome, so isolating the individual and contextual factors that influence or impede transfer is an important part of any major training implementation. Generalization and repetition of what was learned may favor effective transfer. Training activities, by itself, may not be able to match all sort of situations, issues and types of problems faced by training participants on the job. Thus, key principles and skills from training must then be applied by training participants in the appropriate way with a diverse range of settings and people. Generalization involves more than mere mimicking of responses to events that occurred in training by focusing on the extent to which training participants exhibit new behaviors on the job in response to settings, people, and situations that differ from those presented during training (Ford et al., 2018).

Based on several empirical studies and synthesized through various meta-analytic studies, some consensus has been obtained that there are a set of factors impacting transfer regarding training participants personal characteristics, training design and implementation, work environment, and transfer measurement. In order to facilitate training transfer, individual differences and well-known learning principles should be

incorporated in training instructional design, as well as providing opportunities to apply trained skills immediately on the job. Also, providing ways for leaders and peers to support training participants on the job and follow training participants after training to find out what has worked and what has not worked to aid in redesign and continuous training improvement (Ford et al., 2018). So, situations where training is well planned and implemented considering contextual factors and following these major theory-driven and empirically tested guidelines are more likely to impact on transfer and further effectiveness outcomes.

Method

The research carried out in this study is qualitative in nature and makes use of documentary data and several analysis procedures, which increases the results validity and corresponding analysis using methodological triangulation. The *locus* of this study case is a major Brazilian public service organizational. It was chosen due to its scope, size, market position and relevance on Brazilian public sector. The organizational innovation program selected as the object of study on this research has training as one of its inseparable parts and is of strategic relevance to the organization studied because it aims to generate results at all levels of analysis, and it has been originated directly in attention to specific objectives of the organization's strategic plan.

The training that underlies the innovation program described in this article belongs to a Corporate University of a large Brazilian federal public organization, which has been working directly in corporate education processes since 2011 and manages less complex on-the-job training actions, with little workload, long-term corporate scholarship programs, and strategic training programs. This Corporate University activities include application of face-to-face, online, or hybrid courses, partnerships to promote courses,

and financing of external training through opportunity events (e.g. congresses, courses, lectures, symposia).

This study took place and is organized in three sequential stages, as follows: documentary analysis, construction of the logical model, and instructional design quality assessment; following the approach applied in other national studies who used logical model (Damasceno et al., 2012; Meneses, 2007; Nascimento & Abbad, 2021) and a script to evaluate training instructional design quality (Nascimento & Abbad, 2021) for a similar step in training evaluation studies. The analyzes and data syntheses were carried out by this article main author and discussed with his advisor, who is experienced in evaluating TD&E programs. Table 1 summarizes the methodological approach used to achieve the objectives of this study.

Table 1

Methodological approach synthesis

Data collection procedures	*Instruments*	*Sample*	*Analysis procedures*
Documental analysis Application of script to evaluate planning and instructional didactic material	Documents and files of the studied organization, in different formats Script for instructional design quality assessment	Archival and documentary data about the innovation program Archival and documentary data of training instructional planning	Documentary evaluation about planning and implementation of the organizational innovation program Qualitative analysis of the organizational innovation program grounded on logical model associated with IMPACT model Logical model construction Documentary evaluation of didactic material carried out by different pairs of specialists in training instructional design and planning Analysis of training instructional design quality

According to the organization's intranet, its Corporate University is based on a system of people development through competence and with a restricted connection to the company's goals and results, unified as corporate education management, promoting a continuous collective and strategic instructional process, empowering the entire value chain and making use of new technologies in their educational process.

Data Collection Procedure

The first moment of data collection was identification of the innovation program to be studied, found on the organizational data documental analysis. To support the innovation program choice, six relevant criteria were used: (a) organizational innovation program that had strategic relevance for the organization, as defined by its organizational planning; (b) program that was comprehensive in the organizational context evaluated, spanning more than one functional area; (c) program that was focused on internal changes in the organization at more than one level of analysis; (d) program with an employee training component that had potential to generate effects on egress behavior, staff and organizational results; (e) program with a number of trained participants that was compatible with the requirements of the statistical techniques chosen for analysis of results; (f) an innovation program whose training is representative for the corporate university in terms of impact assessment interest.

Then, a document analysis was carried out to identify the elements necessary for composition of the logical model, such as: a) organizational innovation references for the organization; b) program and training internal reports of participation and obtained results; c) report defining the planned structure for the organizational innovation program; d) strategic objectives of the organization (2015-2019); e) didactic and instructional training material; f) presentations and documents related to the creation, implementation and management of the program; g) selection of participants and processes to be

innovated; h) preliminary evidence of results obtained with program execution; and, i) internal recognition awards. Table 2 classifies the secondary data collected about the program. This phase aimed to identify the program components and their predicted relationships, understand internal and external factors that gave rise to the program, factors that facilitated and hindered work performance of trained participants, program's history, number of participants and characteristics of training instructional design.

Table 2

Classification of secondary data collected on the Public Sector Organizational Innovation Program

Information classification	*Number of folders*	*Number of files*	*Document typology*	*File types*	*Document subjects*	*Examples of documents*	*Temporal coverage*
Strategic Map and Business Plan	1	20	Presentations, Reports	PDF	Description and update of organizational strategy containing corporate identity and strategy deployment structure, mentioning strategic projects. Business planning, indicators and strategic goals.	Banner, Slides with presentation, reports, strategy map and infographics.	2011 a 2020
Training instructional design	3	36	Scripts, Presentations, and Videos	DOC, DOCX, PDF, PPTX, MP4	Facilitator's script, class slides, support material for face-to-face classes and dynamics scripts.	Scripts, Slides with presentation, and group dynamics.	2019
General coordination of the organizational innovation program	7	3153	Reports, Presentations, Communication, Term of Commitment, Ordinances and Videos, Books, Booklet	DOC, DOCX, PDF, PPTX, XLSX, XLS, JPG, MSG, PNG	Planning, description, governance and records of execution and results of the evaluated program with selection and participants awards.	Project plan, testimonials, desired profile for specialist position, management results report, lists of selected participants and processes, program management emails, images of teams in training and in practice, A3 reports with results per team, bibliography used, training evaluation	2018 a 2021

Based on documentary data, a first version of the logical model figure was prepared, following previous research that used this method for similar objectives (Abbad et al., 2012; Mourão et al., 2014; Nascimento & Abbad, 2021). The logical model was constructed with the description of the following components: (1) context; (2) inputs such as financial, material, and human resources; (3) activities, containing the characteristics of the program components including training (workload, type of content, method, and others); (4) products; (5) short-term results; (6) medium-term results; and (7) long-term results. It was not necessary to carry out interviews and complementary focus groups with the program planners or with the training instructional planners, as the document analysis allowed the extraction of all relevant information for the study.

After elaboration of the innovation program logic model, and in continuity with its description and qualitative evaluation, training instructional material was analyzed to allow its description and evaluation regarding the instructional quality and potential to generate valid results to meet the needs and hypotheses of the innovation program of which it is a part.

Data Collection Instruments

The first moment of this study made use of secondary documentary data that explain the characteristics of the organizational innovation program, the origin, structure, history, results obtained, the context and collected from the organization with the program's stakeholders. In the second moment, to evaluate the instructional quality of the training that is a component of the organizational innovation program, a specific script was used (Appendix 1), containing 40 items for the evaluation of courses in the online format and 40 items for evaluation of courses in face-to-face format. This script was built by the *Impacto* Research Group, from Brasília University, inspired and grounded on relevant literature about quality assessment of training instructional design (Arthur et al.,

2003, 2003; Bell et al., 2017; Ford et al., 2018; Khalil & Elkhider, 2016; Kraiger & Ford, 2021; Lacerenza et al., 2017; Salas et al., 2012). It also has been continuously updated and used to support similar research in the Brazilian context, as it can be seen in (Nascimento & Abbad, 2021).

Data Analysis

Data collected from documentary analysis were synthesized and organized in an electronic spreadsheet, according to each component of the logical model associated with IMPACT framework. The data set referring to the quality analysis of the instructional design of the training activity was organized in an instructional quality design script at an electronic spreadsheet.

It was sought to identify the presence of common elements among the information obtained in the reports provided by the organization. The analysis used content analysis according to similar studies which used documental analysis and organized the data according to the logical model components combined with the IMPACT evaluation model (Mourão & Meneses, 2012; Nascimento & Abbad, 2021). In this study, it was used a set of *a priori* content categories extracted from the program theory logic model associated with the IMPACT training evaluation model. The construction and qualitative evaluation of the logical model and the training instructional quality subsidized the investigation in further research about the contribution of training in an organizational innovation program, since it allowed the extraction of work performance objectives expected from the egress after participating in the program, evidenced training potential to affect program results and contributed to the development and application of a measurement instrument on this subject.

Results

This section is intended to present the main descriptive characteristics of the studied organization and its corporate university, the detailing of the organizational innovation program according to the program's theory and the instructional design of the training that composes it.

Organizational Context Studied

The studied organization is a large Brazilian public company operating throughout the Brazilian territory that requested the confidentiality of its name and has the structure of a corporate university for planning and execution of training solutions for strategic development of its human capital. The organization goes through a long strategic process of optimization in search of achieving and maintaining long-term operational excellence and modernizing its operations, gradually introducing new services, continually improving existing ones and adding value to the end customer.

According to the Bulletin of Federal State Companies for the third quarter of 2018, the Brazilian Government had 135 active state companies under its governance and coordination. In the first nine months of 2018, results of the Federal State Companies conglomerates jointly recorded a profit of BRL 51.9 billion, demonstrating their strength in the national economy. The continuous need to cut waste to maintain or even increase this financial return, consequently, places greater importance on the need to invest in strategic initiatives related to the search for excellence and innovation for customer satisfaction, generating more return to society, in the end.

Obtaining data for the research was made possible by adhering to a partnership agreement between the IMPACTO Group (research group linked to the Graduate Program in Social, Work and Organizational Psychology and to the Graduate Program in Administration at University of Brasília) and the company’s Corporate University.

Corporate University Context

The studied organization has a Corporate University structure that acts directly in the Corporate Education processes and contains from less complex training actions, with little workload, such as on-the-job training, to the management of long corporate scholarship programs, through strategic training programs. Its activities include the application of face-to-face, online, hybrid courses, partnerships to promote courses and financing of external training through events such as congresses, courses, lectures and symposia.

As published on the organization's intranet, its Corporate University is a people development system guided by competency management and aims to be closely linked to the company's goals and strategic results, unify education actions, promote a collective learning process and continuous training, train the entire value chain and make use of new technologies in their educational process. Its structure covers the planning and development of educational solutions and the coordination of state centers distributed throughout the country. Additionally, it operates in the execution and management of technical cooperation agreements and accreditation of educational institutions through public calls to expand the service to organizational demands for the development of competences with the least possible financial expenditure.

The Organizational Innovation Program Studied

The organizational strategy of the company to be researched has a medium-term phase aimed at recovering the level of operational excellence and which, among other initiatives, is worked on with the execution of a program about continuous process improvement that seeks to generate an increase in service quality, and a reduction of operating costs throughout the organization. The program has a strategic training and an employee recognition plan in its constitution. This organizational innovation program is

the focus of application of this research, as it is a strategic initiative, sponsored by the company's top management, bringing an eminently strategic character to the training associated with it, due to the direct connection with the operational excellence pillar of the strategic planning that was valid at the time of its elaboration and planning. This association theoretically makes that both the innovation program and its training could be evaluable at different levels of results aggregation, including the organizational one.

The program aims to mobilize the entire organization in the search for continuous improvement focused on generating value for the customer and is organized around three inseparable and sequential pillars: training, execution and recognition. In 2018, this program trained 500 professionals from the organization, located in organizational units distributed throughout Brazil, and worked on understanding and improving 100 work processes, both operational and administrative. The program began a new phase in 2019, with the expansion of its offer to all functional areas of the organization, and the beginning of a new application cycle with the addition of new levels of complexity and scope of the program. In 2020, due to the restrictions imposed by the fight against the COVID-19 pandemic in the country, there was no execution cycle of the program, which is in the phase of readaptation in the 2021 cycle.

Regarding the innovation related content and method embedded in the program and its subjacent training activities, both are focused on the *Lean Six Sigma* philosophy of process improvement that aims to prevent defects, variability and all things that might undermine customer loyalty. Six Sigma is a methodology that can be used to improve business processes, being a structured approach to problem-solving that can be applied to any process. It can be used to reduce variation from any source and thus improve costs, quality, and hence customer satisfaction. Inside Six Sigma, the standard methodology that is used to improve existing processes is called DMAIC (Define, Measure, Analyze,

Improve, Control). DMAIC is a data driven five-phase strategy that puts a heavy emphasis on measurement and analysis to achieve greater results and impact. The Define phase accomplishes efforts to have a good definition of what is the problem to be faced. Secondly, in the Measure phase ensures that the data used for further analysis is free of measurement errors. The Analyze phase is about making hypothesis and using data to either prove or disprove them. Improve phase focus on getting the best possible solution to solve the root cause of the problem. At last, Control phase ensures that the solution is sustainable in the long run.

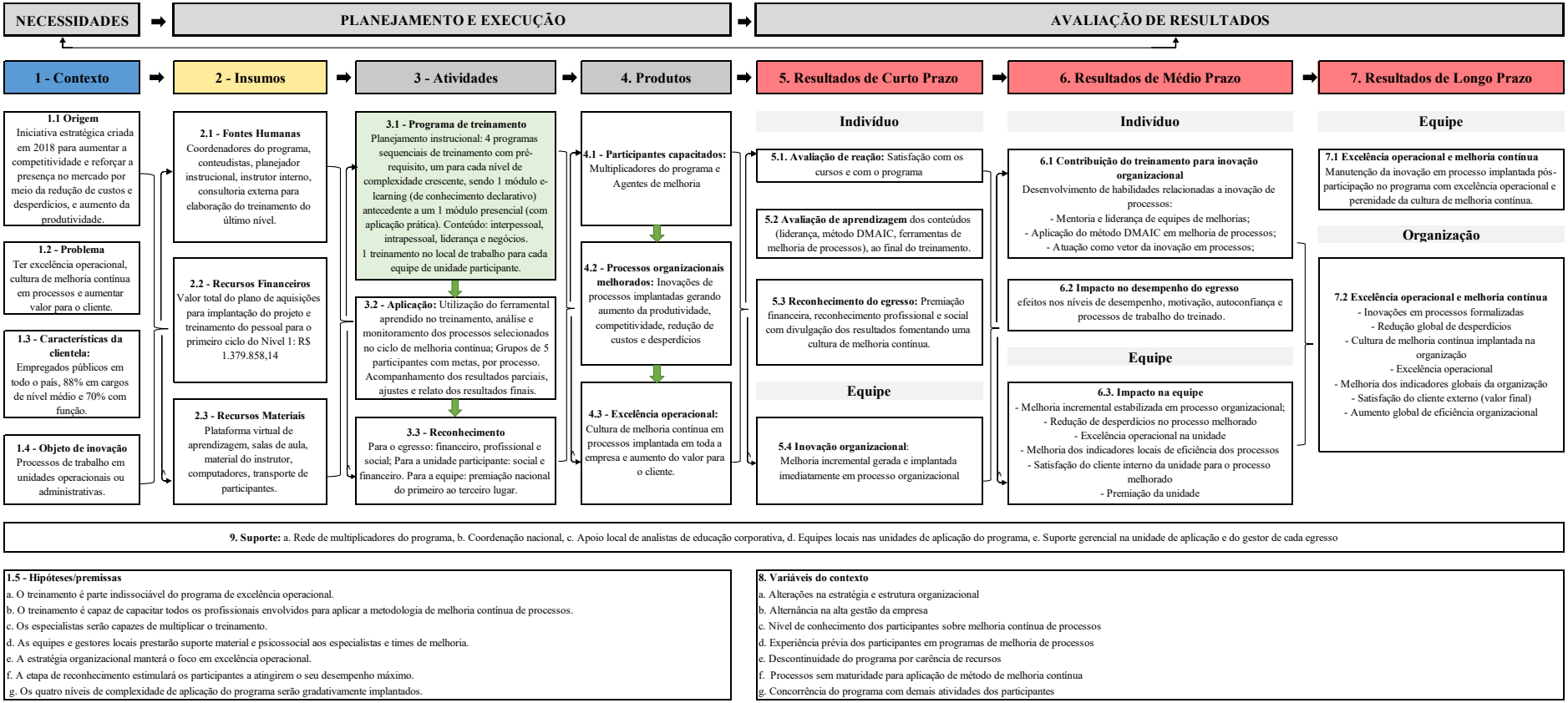
Logical Model

The elaboration of a logical model, along the lines of this study, provides construction of a graphic representation of the innovation program results evaluation structure and, consequently, of the training, aiming to support the selection of constructs and variables more suitable for evaluating interventions results, including the ones at different levels of aggregation. The organizational innovation program evaluated based on the logical model associated with the TD&E system and the IMPACT model was represented in Figure 1, which summarizes the theory of the evaluated program, a work process improvement program with training as an inseparable part, and that occurs before interventions in the processes. The text presents the results, aiming to describe elements contained in the logical model and represented in Figure 1.

Elaborated from a methodological triangulation, the logical model allowed to describe the program and training that belongs to it, to build a corresponding graphic organizer, analyze relationships between the context (origin and problem) and its components (inputs, activities, products, and results), and evaluate the training program subcomponent (3.1) and its influences on the innovation program results.

Figure 1

Logical model of a strategic program of organizational innovation in the public sector with training as an essential part.



Source: The author.

The innovation program evaluated here is based on international benchmarking as a solution model to face challenges like those faced by the organization studied to execute its strategy. Figure 1 shows that the organizational innovation program in the public sector, object of this research, originated (1.1) at the end of 2018, from the need to implement a solution that was systematically planned to meet a strategic initiative created to increase competitiveness and reinforce the company's market presence, by reducing costs and waste, and increasing productivity, due to the following problem (1.2): generating operational excellence, implementing a continuous process improvement culture and increasing customer value. Completing context (1) component, program's clientele (1.3) is formed by participants of planned activities, with the following characteristics: public employees distributed throughout Brazil, 88% in mid-level positions and 70% with a tenured function. The innovation object (1.4) for the program execution is work processes in operational or administrative organizational units.

Based on this context (1), a set of inputs (2) was mobilized to carry out the planning, development and systematic execution of an organizational innovation program in work processes structured in three sequential steps (training, execution and recognition), considering premises (1.5) that training is an inseparable part of the operational excellence program (all stakeholders must be trained to be able to act in the program), content and instructional design of training are capable of enabling all professionals involved to apply the methodology planned and standardized for the program, specialists will be able to multiply the training, teams and local managers will provide material and psychosocial support to the specialists and improvement teams, organizational strategy will maintain the focus on operational excellence, recognition phase will stimulate the participants to reach their peak performance and that the program's four levels of execution complexity will be gradually implemented.

The set of inputs (2) mobilized is composed by (2.1) human resources (program coordinators, content writers, instructional planner, internal instructor and external consultancy), (2.2) financial resources (estimate of R$ 1,380,000.00 for Level 1 implementation), and (2.3) materials (virtual learning platform, classrooms, instructor material, computers, participant transport, participant notebook, slides, flip chart, paper, pen, materials needed for group dynamics exercises, practical didactic activities and institution's training rooms). Investment in such inputs generated a set of activities (3) planned in six-month cycles of sequential target audience training, immediate post-training application of a specific process innovation methodology, and recognition of the obtained results. The innovation program was structured in four increasing levels of complexity and scope of action regarding the scope of processes to be improved called: yellow, blue, green, and black, in this sequence. Participants in each cycle were assigned through a simplified selection process and could only participate in one level after participating in a complete cycle at the previous one.

Employees selected to the Program are trained through a training program (3.1) which includes in its instructional planning four sets of courses (one per program level) composed by an e-learning format module (focused on declarative knowledge) that precedes a face-to-face module (containing practical exercises about innovation knowledge and method trained). The content used is mixed, being interpersonal, intrapersonal, leadership and business in nature. Additionally, a short on-the-job training was also planned for each organizational unit team, as additional support for the application of the program.

Immediately following training stage (3.1), application stage (3.2) provided opportunity to transfer the knowledge and method learned by the clientele (1.3), through the expression of skills to define, measure, analyze, improve, and control work processes previously selected for a determined cycle of the program. At this stage, training participants are organized into groups of five participants who are given specific goals for each process to be improved. The program's

governance structure (national coordination and state supporters) was responsible for monitoring partial results, proposing, and implementing adjustments, in addition to documenting the results obtained by each group. At the end of each cycle of activities (3), the recognition stage (3.3) was planned to recognize the results obtained by the participants and their teams, in a financial, professional, and social way. Additionally, each participating unit that achieved the established goals for selected processes was also entitled to social and financial recognition. Finally, as a way of encouraging participation in the program, each team that reached the pre-established goals would participate in the national award with cash prizes, trophies from first to third place and participation in a national corporate event to formally present the results achieved.

Mobilization of inputs (2) and planned activities (3) in each program cycle had expected products (4), as: a) training (4.1) innovation method multipliers and agents of continuous work process improvement; b) improvement of organizational processes (4.2) through generation and implementation of innovations themselves, generating increased productivity, competitiveness, cost and waste reduction; and, c) operational excellence (4.3) with a culture of continuous processes improvement implemented throughout the company, with increased value for customers.

To verify short-term results (5) at the individual level, it was expected from a reaction assessment that participants were satisfied (5.1) with training activities and with the program itself, and that they had learned its contents (e.g., leadership, DMAIC method, process improvement tools) evaluated (5.2) in a seminar at the end of training. The whole planned training activities presents indication of some novelty degree for training participants, making it possible to infer a potential training contribution to new job-related innovation skills development. This is possible due to an instructional design that combines a mixed content and innovation tools (already of public domain and massive use in other organizational contexts)

with the use of them in a practical method specifically built for participants organizational reality.

Training participants reaction assessment results were not made available for this research, making it impossible to evaluate this result. This evaluation was carried out by the Corporate University with its own method already disseminated in the organization and applied at the end of all training, regardless of format. There was no learning assessment prior to training, however, at the end of each training there was a formative learning assessment through seminars organized to simulate teams award ceremony, with presentations of results obtained with practical exercises. Evaluated documents present evidence of learning of content pertaining to training. It was also expected that egresses would be recognized (5.3) soon after their participation in a program's full cycle, which could be evaluated through findings related to grant of financial awards, professional and social recognition with dissemination of results, fostering a continuous process improvement culture.

When analyzing short-term results (5) at group level, there is also evidence of organizational innovation (5.4) with reports of each participating group in an "A3 format" report synthesizing the path taken and results obtained with work processes incremental improvement generated and immediately implemented. The medium-term results (6) were evaluated through: the use of a questionnaire[5] built specifically to evaluate training contribution to organizational innovation (6.1) which deals with the development of process innovation related skills; and the use of a self-assessment scale about worker's performance impact (6.2) measured by effects on worker performance levels, motivation, self-confidence, and work processes. Finally, at group level impact (6.3), it is expected effects like: stabilized incremental improvement in organizational processes, waste reduction in improved processes, operational excellence at organizational unit level, improvement of local process efficiency indicators,

[5] Presented in Article 4, on this thesis.

internal customer satisfaction about the improved process, and organizational unit rewards and recognition.

For the long-term results (7), it is expected: achievement and maintenance of operational excellence and continuous improvement represented as permanence of process innovation implemented with operational excellence and perpetuity of continuous improvement culture, at the group level (7.1); yet, formalized process innovations, operational excellence with global waste reduction, continuous improvement culture implemented throughout all organization, improvement of organization's global indicators, external customer satisfaction (final value), and global increase in organizational efficiency, at the organization level (7.2).

Among factors that are external to the program (8) and can affect the verification of expected results, the following were identified: changes in strategy and organizational structure, alternation in company's top management, knowledge level of participants about continuous process improvement techniques, prior participants experience in process improvement programs, program discontinuity due to lack of resources, low level of process maturity to use a continuous improvement method, competition with other participants daily routine activities.

Then, the adopted theoretical model allowed to infer that the assessed innovation program was systematically planned to meet strategic challenges for the organization, with availability of adequate inputs and resources for its implementation and production of expected results, as well as evidenced the importance of training as an inseparable program subcomponent with expected contribution relationships with following subcomponents (execution and recognition) and the results component.

Instructional Quality Assessment of The Process Innovation Training Subcomponent

From instructional theories and research results on training effectiveness (Ford et al., 2018; Khalil & Elkhider, 2016; Kraiger & Ford, 2021, 2021; Lacerenza et al., 2017), a qualitative evaluation of training instructional design was carried out through content analysis

of secondary data collected from the Corporate University and program national coordination (e.g., didactic, instructional, and training planning material), aiming to deepen knowledge about training potential of contributing to program expected results in multiple levels of analysis. Documentary analysis was performed by a group of six master and doctoral students specialists on training instructional quality assessment and it was guided by content categories defined *a priori* in a theory driven instructional quality assessment script (Bell et al., 2017; Ford et al., 2018; Kraiger & Ford, 2021; Lacerenza et al., 2017) and allowed to identify that there was a simplified analysis of training needs, with identification of some target audience characteristics and analysis of training context related variables with consequent definition of learning objectives and work performance to be developed in training participants.

Level 1 - Yellow and Level 2 - Blue program levels were implemented since program creation until data collection for this research, while other two levels were not already fully implemented. Thus, evaluated documentation refers only to those two levels, and it was decided to separately evaluate training instructional quality for each level. This approach resulted in the use of four assessment scripts being, one for self-instructional online course and another for tutored face-to-face course for each program level. To participate in execution and recognition program phases, participants must accomplish all training activities provided for each level. Data and virtual training environment access to carry out the research was granted by the Corporate University.

Instructional planning of Level 1 – Yellow training

Instructional planning for Level 1 – Yellow training has a delivery format composed by two sequential courses being a self-instructional e-learning followed by a tutored classroom. This is the program entry level, where training participants must learn skills directed related to knowledge and use of process improvement basic concepts and tools. Approval in a simplified internal selection process is a prerequisite for participation in this training.

The Level 1 – Yellow self-instructional training features business category content (Lacerenza et al., 2017) and focuses exclusively on cognitive domain learning using an instructional method based only on information with non-tutored knowledge exposure, having its construction compatible with the expected egress performance after this stage: knowing the program and methodology used in it. As for the instructional strategy, it is adequate to instructional objectives cognitive nature, but the content has high complexity and high textual density, presenting low compatibility with target audience diversity. There is no diversification of teaching-learning strategies, and the course does not present a structured program with essential information for training participants self-planning. Workload is overestimated but the strategy of reading texts and assessing knowledge is compatible with instructional objectives cognitive nature. As for the content, there is a large volume of descriptive text with no indication of examples close to the real work situation, with few practical examples and does not use dialogic language. There is no diversification of exercises and interactions, but there is formative learning assessment compatible with instructional objectives, and with single-source feedback on training participants performance.

Level 1 – Yellow face-to-face course features business-type content (Lacerenza et al., 2017), and deals with a methodology for continuous improvement of processes that aims to reduce the complexity of work processes and shorten processing time, considered conceptually and methodologically adequate for the prescribed learning objectives. This course is focused on learning in the cognitive and skill-based domains (Lacerenza et al., 2017) and makes use of multiple training methods, including practicing skills considered necessary for process improvement with similarity to the egress' work reality. However, two-thirds of this course is considered to use information instructional method, as it is based on presentation of text-based content and delivered in a presentation and lecture format. Instructional objectives are partially described in terms of observable work performance, with no specific statement of egress

expected performance in the instructional material. As for the instructional strategies used, it contains an instructor's manual with a well-designed and detailed lesson plan describing all activities, resources and expected time, but does not present a complete course program when training at the beginning of the course. The estimated workload of 32 hours/class was considered adequate in relation to content volume, and multiple instructional strategies adopted are compatible with instructional objectives cognitive and psychomotor nature.

Addressed content refers to real work situation and explains tools, techniques, and specific methodology to be used in practice by egress and it also addresses high fidelity practical activities. There is diversification of exercises and interactions throughout the course, with group activities inside and outside classroom, multiple interaction moments from different sources and learning exercises that simulate real work situation, being compatible with learning objectives complexity described in the instructional material. There is no description of formal summative learning assessment.

Didactic material has an appropriate graphic design and provides opportunities for learning as planned in the instructional objectives, but it does not have potential to stimulate or favor learning by itself, as it has an unattractive presentation in the format of an electronic handout without animations or interactions. As the material says little about specific situations of application in the organization, there are no exercises or application examples close to the reality of the training participant, the stimulus for discussions remains hampered. It can generate some discussion considering content novelty for the organization and for target audience, and for being aimed at directly use in a specific program.

Instructional planning of Level 2 – Blue training

Level 2 – Blue training instructional planning is similar in delivery format to the one from Level 1 – Yellow, but differs in covered content, including specific training on team leadership and presenting additional concepts and tools, expanding the scope of action and

potential for achieving expected program results. It is mandatory the completion of at least one cycle of Level 1 - Yellow and approval in a simplified internal selection process to participate in this training.

Level 2 – Blue self-instructional course features business content category (Lacerenza et al., 2017) and focuses exclusively on cognitive learning domain using an instructional method based only on information with non-tutored exposure of knowledge. As for the instructional strategy, it is suitable for instructional objectives cognitive nature and clientele characteristics. There is no diversification of teaching-learning strategies, and the course does not present a structured program with essential information for training participant's self-planning. Estimated workload is adequate and examples used are close to real work situation in the organization. As for the content, it uses dialogic language with indication of examples with high proximity to the real work situation. There is no diversification of exercises and interactions, but there is formative learning assessment compatible with instructional objectives and with single-source feedback on training participant performance.

Level 2 – Blue face-to-face course features interpersonal, intrapersonal, leadership, and business content (Lacerenza et al., 2017), and is considered conceptually and methodologically adequate for the prescribed learning objectives. This training was structured to produce learning in affective, cognitive and skills-based domains. (Lacerenza et al., 2017) and makes use of multiple training methods, such as information, demonstration and practice. There is a statement previously presented to training participant about expected work performance at the end of the course, but instructional objectives are not precisely described in terms of observable performances. As for the instructional strategies used, the material contains an instructor manual that does not present a complete course program. The estimated workload was considered adequate in relation to the volume of content, and the multiple instructional

strategies adopted are compatible with affective, cognitive, and psychomotor nature of the instructional objectives.

Contents covered do not use dialogic language but refer to the real work situation and are appropriate to the complexity of egress expected work performance described in general objective. As for the exercises and interactions, there is diversification throughout the course, simulating the real work situation and they are compatible with the learning objectives complexity as described in the instructional material. There is no described formal learning assessment.

In sum, the complete training set evaluated has design and delivery characteristics that are compatible with the program's objectives and was effective in preparing people for process improvement. The training demonstrates and encourages practice, foresees the application as part of the training, has content of multiple natures, provides varied feedback, and mixes different forms of delivery, thus enhancing its ability to contribute to the transfer of learning, which was evidenced by the A3 reports delivered by graduates at the end of the program application cycle, which demonstrate that there was learning and application of the process improvement methods expected by program stakeholders. These characteristics are discussed with literature in the next session.

Discussion

The proposed theoretical model allowed the construction of a results evaluation structure representation for the innovation program assessed and, consequently, for the training that is an essential and inseparable part of it, serving as support for the selection of the most appropriate constructs and variables for results evaluation of planned interventions, including at different levels of aggregation. The model supported organization and analysis of an innovation program with training activities from its origin to its evaluation process, and allowed the identification of relationships between its components using the TD&E systemic approach

in conjunction with Logical Models and IMPACT Model, but also contributed to identification of gaps and proposals to improve training instructional design and the program itself, as proposed by Damasceno et al. (2012) and Souza et al. (2017).

Results obtained corroborate literature findings (Damasceno et al., 2012; Nascimento & Abbad, 2021; Souza et al., 2017) regarding the need to associate the logical model with an instructional theory so that training effectiveness assessments can be guided on essential components in phases of data collection, organization, and interpretation of results. Results also show that using of a logical model as a methodological tool for evaluating an organizational innovation program in the public sector can be useful so that the program's stakeholders can understand what should be theoretically considered at each stage of design, development and results evaluation, so that improvement opportunities of program activities are identified and, thus, increase positive influence potential of its activities on individual, team and organizational results. Additionally, the use of an integrative approach of instructional theories and program theory with the use of a logical model in the construction of a theoretical framework in the context of an organizational innovation program proved to be relevant for description and qualitative evaluation of its components and relationships, as well as evidenced the essential characteristics of training involved as a planned activity. Then, the logical model supported the next step of detailing and evaluating the instructional design, by clarifying context, origin and externalities linked to this activity within the evaluated program.

Needs analysis, the initial step to be developed in an organizational program planning, is also essential for the success of a training, even if it is organized as an internal activity of a larger program. This macro stage is composed by a previous analysis of organizational context that will allow identification of the problem to be solved with program execution, and its origin, in addition to which gaps in skills and competences correspond to learning demands to be

considered in the choice of an instructional design that is more appropriate to clientele characteristics and that has potential to generate results expected by program's stakeholders.

In this case study, as there is evidence that there was a simplified needs analysis, the other planning and evaluation subsystems of both program and training were not harmed, corroborating literature (Arthur et al., 2003; Bell et al., 2017; Ferreira et al., 2020; Ford et al., 2018) that reinforce the importance of conducting a training needs systematic assessment as a crucial part of its effectiveness. Process innovation focus on improvement of quality and efficiency of internal processes, and the most frequently mentioned motivation for innovation in the public sector was improving organizational effectiveness or efficiency (De Vries et al., 2016; Walker, 2014b), which is corroborated by the needs component described at the innovation program logical model in this article.

Planning and implementation, the second step, comprises inputs, activities and products of the organizational program. Regarding inputs, it was observed that stakeholders collaborated together, for the most part, demonstrating alignment between implemented activities and mapped demand, positively interfering with expected result. (Brousselle & Champagne, 2011; McLaughlin & Jordan, 2010). Connection between these components is evidenced by instructional quality presented by training activity, appropriate to characteristics of the origin, problem to be addressed, and target audience of the organizational innovation program of which it is a part. As different stakeholders have different roles, responsibilities and opportunities to influence the results of a training, it is necessary that the stages of needs assessment, planning, implementation and results evaluation are properly connected (Borges-Andrade, 2006; Damasceno et al., 2012; McLaughlin & Jordan, 2010). Additionally, evidence of diversification and communication between objectives, strategies, methods, materials, resources and expected results demonstrates that the program fits the dimensions present in instructional design theories (Bell et al., 2017; Ford et al., 2018; Kraiger & Ford, 2021), and evaluation of programs and

training (Abbad, 1999; Brousselle & Champagne, 2011; Eduardo Tasca et al., 2010; Kirkpatrick, 1959; Mourão & Meneses, 2012).

The use of a theory driven instructional quality assessment script to evaluate training activities planned for both Level 1 - Yellow and Level 2 - Blue demonstrated that, in general, the instructional objectives were developed based on observable work performances, as suggested by instructional design theories for courses that have the potential to generate results at different levels of analysis (Abbad et al., 2006; Bloom et al., 1956; Khalil & Elkhider, 2016) only when full participation in both courses provided for each level of development in the program is considered. If analyzed separately, the self-instructional courses by themselves do not present instructional characteristics with the potential to develop skills that will contribute to the future expression of specific behaviors in the egress' work that are desired by stakeholders of the innovation program. However, when fully carried out by the participant, there is no doubt that training activities provided in the evaluated program theory (Brousselle & Champagne, 2011; McLaughlin & Jordan, 2010) have the potential to produce the expected results in the public sector organizational innovation indicators described in the logical model, since that program assumptions and expected support occur as planned.

Self-instructional e-learning courses at both program levels have the potential to develop specific knowledge about the innovation program and its methodologies and tools to be used, being compatible with instructional objectives described in the didactic material. However, by itself, it does not have potential to develop skills or attitudes related to this knowledge, which is not foreseen in its objectives. Face-to-face courses, on the other hand, have the potential to develop skills related to their instructional objectives, since their teaching material deals with explaining main concept and dynamics of the innovation program, its underlying concepts, methodology to be used and the necessary tools, in addition to using knowledge during training and the fact that training participants go through high-fidelity on-

site workplace simulated experiences during training (Kraiger & Ford, 2021; Lacerenza et al., 2017).

In the third step, evaluation of results, it is observed that, regarding training as the focus activity of this article, the use of post-training work reality simulation exercises, knowledge assessments and presentations at the end of face-to-face training may be considered as summative learning assessments insofar as they provide feedback for instructional planners to improve instructional design in order to amplify this expected short-term outcome. As for reaction and impact assessments, for them to be used as an effectiveness assessment, it is suggested that the instructions need to be self-explanatory, with items harmoniously related to the scale used and the application should not be done by the instructor, and can be self-administered (Martins & Zerbini, 2015).

Thus, given the characteristics found in evaluated materials, it is evident that the general set of training activities of the two levels evaluated presents instructional quality capable of developing knowledge, skills, and attitudes according to the objectives described in didactic material. It also has potential to contribute to the use of behaviors at work related to process improvement type of organizational innovation, since the training activities make use of multiple delivery methods, it was based on a needs analysis, provides feedback, makes use of face-to-face setting and voluntary attendance, include hard and soft skills, and have multiple sessions, which is corroborated by findings of Lacerenza et al. (2017) when it comes to potentiate results on transfer of training level.

Regarding desired outcomes training effectiveness on results evaluation level, the training subcomponent assessed has some characteristics that helps to potentiate results, like the use of multiple delivery methods, the multiple sessions, providing as much training as possible, and include hard and soft skills (Lacerenza et al., 2017). Consequently, and considering the other components and relationships presented in the logical model, the

organizational innovation program assessed has potential to produce the effects expected by its stakeholders at the levels of coverage described, which was evidenced in the results description presented on the A3 reports produced by each participant group after application phase. The A3 reports analyzed clearly showed evidence of the direct application of the taught knowledge and skills, since they contain graphics, descriptions, lists, and figures that represent a summarization of the DMAIC cycle phases framed at an A3 format sheet alongside with obtained results.

The training instructional design analyzed in this article shows characteristics that corroborates the five empirically supported instructional principles of the science of workplace instruction (Kraiger & Ford, 2021) potentializing training effectiveness, given that there is a well-connected representation of the essential ideas to be learned; knowledge, principles and ideas are presented closely associated in space and time; the mandatory online activities previous to the face-to-face training present introductory material that provides the learner with examples of what is to be covered in training; task complexity is gradually built in; different kinds of problems and training content are mixed in a practice schedule; learners are called to explain concepts to others and provide self-explanations that connect the material to what they already know; learners have opportunities to apply skills across different tasks, people, and job-relevant situations; retrieval of learned concepts; existence of feedback; and, repetition of practice. Additionally, the opportunities provided in the evaluated training for generalization and repetition of what was learned during training, and to apply trained skills immediately on the job corroborates Ford et al. (2018) when it comes to facilitate training transfer.

Positive training transfer can impact organizational results if the instructional planning has been carried out considering some assumptions like complexity learning level and performance objectives expected from egress at work, adequacy of the content covered, training delivery strategies, exercises, feedback, and simulation of work reality (Aguinis & Kraiger,

2009; Arthur et al., 2003; Bell et al., 2017; Khalil & Elkhider, 2016; Kirkpatrick, 1976; Kraiger & Ford, 2021; Lacerenza et al., 2017). All these characteristics can be seen at the design of training evaluated in this article, confirming its potential to contribute to the expected innovation results.

Using Logical Model, associated with the IMPACT Model and TD&E Systems approach corroborates the literature empirical findings (Damasceno et al., 2012; Nascimento & Abbad, 2021; Souza et al., 2017) by demonstrating advantages of using systemic approaches in evaluation processes to understand the internal logic of a program and how its components relate to the context in which the program is inserted. Identification of possible causal relationships, contextual variables, and planning process and program development gaps, facilitate both the improvement of interventions planned for the program and also support identification of outcome indicators to provide assessment of their effectiveness at more than one level, which corroborates literature (Abbad et al., 2012; Damasceno et al., 2012; Nascimento & Abbad, 2021; Souza et al., 2017), bringing practical and methodological implications.

Final considerations

It was concluded that, when analyzed as a whole, the set of training activities evaluated in this article has the potential to develop knowledge, skills and attitudes compatible with objectives of its associated organizational innovation program as described in the logical model presented. It was possible to extract from the analyzed documents a set of behaviors that apprentices can apply at work after the completion of training activities, qualitatively showing that there is a potential for training contribution to results of the innovation program in the public sector.

Also, the methodological approach triangulating the use of a logical model associated with training effectiveness assessment IMPACT model, and a literature grounded script for

quality assessment of training instructional design, confirmed its methodological scientific and practical relevance, since both instruments and methods effectively supported the difficult task of getting together a dispersed amount of relevant information for qualitatively evaluate an organizational program of this nature. It also helps the systemic comprehension of program components and relationships and a detailed analysis about the quality of a strategically planned training.

Although the program theory and training instructional quality evaluated in this article presents qualitative evidence of a potential contribution from training activities to organizational innovation results in the public sector, the research also evidenced some internal and external factors that affected the program results: the program was not yet completely implemented in all four complexity levels; organizational strategy, leadership and structure changed affecting program planning and available resources; and, routine work activities of training participants competed with participation in the program.

This article presents the following theoretical-methodological contributions: a proposal to evaluate the contribution of training to organizational innovation results in the public sector through a case study grounded on organizational innovation, instructional design and training effectiveness assessment theories integrated with the logical models approach; an interpretative synthesis of the results through a qualitative approach of a theoretical model to describe and direct the process of conception, planning, implementation and assessment of an organizational innovation program in the public sector; and, a proposal to use the instructional design theoretical approach to assess the instructional quality of an innovation training.

Regarding practical contributions, the following stands out: the construction of the program theory for the organizational innovation program assessed that allows to summarize it, enhance systemic comprehension about the program, and guide improvements on components, subcomponents, or its relationships for others application cycles of the program;

and the evaluation of the training pedagogical didactic material based on instructional design theoretical approach with proposals for improvements on the lesson plan, teaching strategies, reaction evaluation, and learning evaluation so that the training can enhance its contribution to the innovation program results.

As limitations, this article used only documentary data without triangulating the information collected with data from other different data sources, hindering the analysis of different points of view about the expected innovation program results and the contribution of training to them; also, the lack of systematic data about the evaluation of reactions and learning in the data collected made it difficult to pair all expected immediate results from the program; and, in spite of the temporal coverage of the documentary data collected, the transversal methodological approach used combined with the lack of data about organizational performance indicators prevented the gathering of information on the long term program results, hindering more robust analysis about training contribution to innovation on the organizational level and if the expected effects are permanent or decay quickly.

As a research agenda, it is suggested to pair information from different data sources (e.g., program stakeholders, documentary, training participants) to enrich and strengthen the understanding of an innovation program needs, components, internal relationships and external factors that could affect the contribution of training to organizational innovation results in the public sector; to use logical models integrated with training evaluation models in future research on the contribution of training to innovation in other organizational contexts; to use organizational innovation theory associated with instructional design theory to link the description of organizational innovation needs to training needs, learning objectives and expected innovation results after training; to evaluate and compare innovation programs in different organizational contexts using mixed methods that allow investigating its components relationships and their prediction in a multilevel analysis; and, to apply longitudinal methods

to investigate the contribution of training to the long-term expected innovation results in the public sector and other organizational contexts.

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ARTICLE 4

Training Contribution to Organizational Innovation in Public Sector: TCOIPS Unidimensional Scale Construction and Validity Evidence

Abstract

Public sector organizations have been claimed to continually innovate their processes and improve the quality of their services. Organizational innovation embodies use of knowledge and creativity to generate value through the mobilization of diverse resources and individual skills focused on improving its change object. These skills can be systematically developed by training. This paper aimed to report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale. The measurement scale was built from a qualitative analysis of individual performance goals extracted from instructional design secondary data and expected to be developed on public service employees trained to participate in an organizational innovation program. A total of 283 public service employees participated and responded to the survey. Descriptive, reliability, exploratory, and confirmatory factorial statistical analysis were conducted to obtain the one-factor empirical structure constructed to assess the degree of training contribution to the development of organizational innovation individual skills in public sector. TCOIPS presented validity evidence and can be used to identify the development of organizational innovation-related skills and understand the contribution of training to innovation results in the Public Sector organizations.

Keywords: Organizational innovation, Innovation skills, Scale development, Public sector.

Training Contribution to Organizational Innovation in Public Sector: TCOIPS Unidimensional Scale Construction and Validity Evidence

Innovation, as part of a firm strategical planning to build competitiveness (Schumpeter, 1997), may be seen as a time-dependent and multivariate process that makes use of knowledge, creativity, and human capital to change a set of characteristics pursuing to aggregate value for its client by improving a service or a product that can be seen as new by its stakeholders (Damanpour, 2020; De Vries et al., 2016; Gallouj, 2002; Gallouj & Weinstein, 1997; OECD/Eurostat, 2018). Public sector organizations have been claimed to continually innovate their processes and improve citizen services, a difficult but not impossible goal, as it can be seen in literature (Albury, 2005; Bloch & Bugge, 2013; Choi & Chang, 2009; de Vries et al., 2018; Djellal et al., 2013; Elliott, 2020; Gallouj & Zanfei, 2013). Considering that there it would not be possible to innovate without the use of knowledge and human participation, individual skills related to the procedural dimension of innovation may be an essential tool for innovation process in organizational environments, among other components that could contribute to generating and implementing innovation. The development of these skills may be achieved by planned training activities that can contribute to organizational innovation results after they are transferred to work alongside other innovation components.

Literature about the contribution of training to organizational innovation was built upon the use of data collected mostly on organizational level of analysis, not showing essential details about what happens on lower levels (individual and group) that help to construct this relationship (Anderson et al., 2014; Araújo et al., 2015; De Vries et al., 2016; Dostie, 2018; Sung & Choi, 2014). In this scenario, research in this area is commonly designed with the application of data collection tools that fail to capture all necessary information, leading to some relevant knowledge gaps. It is impossible to determine if, and to what degree, specific types of training instructional design truly contribute to organizational innovation only by analyzing

information about the existence (or not) of trained employees and innovation patents, for example. This kind of analysis does not enable researchers and practitioners to understand and compare what kinds of training are more effective to innovation results, or even help practitioners and leaders to improve the quality of its innovation programs and training.

A recent systematic review about this theme (Gonçalves & Abbad, in press)[6] did not identify a specific research instrument able to capture data about the development of specific organizational innovation skills on public service employees. It also showed that research about the impact of training on innovation has been conducted with secondary data collected from continental or national surveys correlated with documental information about innovation results and observed only on organizational level of analysis. This kind of approach seems to overlook training and innovation dimensions that could be relevant to understand, for example, what types of instructional design are more effective to contribute to each innovation type, as they are considered on related theories (Arthur et al., 2003; Bell et al., 2017; Damanpour, 1991, 2020; Damanpour et al., 2009; Gallouj & Weinstein, 1997; Kraiger & Ford, 2021). This study aimed to report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale, a research instrument constructed to assess the degree of training activities contribution to the development of organizational innovation individual skills in the public sector, covering a relevant methodological gap on studies that focused to investigate this relationship and contributing to the advancement of the field.

The field of innovation is broad, encompassing studies from different perspectives, like psychology, administration, and economics sciences, each one of them with different methodological approaches and theoretical basis. But it is possible that, for most of them, the need to innovate is somehow related to organizational survival, it happens in a processual and

[6] Article 1 in this thesis.

multilevel way, and some individual and group phenomena occur to get through the generation phase until the adoption of an innovation in organizations. This can be seen in multivariate research frameworks used for service innovation (Gallouj & Weinstein, 1997), organizational innovation (Damanpour, 2020), creativity and innovation (Anderson et al., 2014), process innovation (Carneiro & Junior, 2017; Piening & Salge, 2015; Walker, 2014), and public service innovation (Osborne & Brown, 2013).

In the private sector, innovation is an established field of study that tries to explain why and how innovation takes place, but scholars and practitioners have also become increasingly interested in innovation in the public sector (de Vries et al., 2018; Djellal et al., 2013; Elliott, 2020; Osborne & Brown, 2013; Walker, 2014). Many embrace the idea that innovation can contribute to improving the quality of public services as well as to enhancing the problem-solving capacity of governmental organizations in dealing with societal challenges (De Vries et al., 2016). Considering that public service organizations commonly act in a non-competitive external environment, innovation process and results also have their importance for improving organizational processes productivity, management effectiveness, final value for citizens, and costs reduction.

In this context, the awareness of human capital participation in the innovation process as a relevant component, and the need to understand better what and how some individual-level phenomena may contribute to innovation organizational-level results is a wide research agenda in which it is allocated the studies about training impact on organizational innovation results (Børing, 2017; Dostie, 2018; Sung & Choi, 2014). Nevertheless, even with literature review studies pointing out relevant factors related to individual antecedents (Damanpour, 1991; De Vries et al., 2016; Gallouj & Weinstein, 1997; Gallouj & Zanfei, 2013), there are still theoretical and methodological gaps to be fulfilled in order to improve these phenomena approach.

This study aims to report the development and investigation of psychometric and discriminant validity evidence and reliability of a scale to assess the contribution of training to organizational innovation results in the public sector. It contributes to reduce theoretical gaps related to the description and learning of innovation skills through training and its direct relationship with organizational innovation by means of their application, at work. It also contributes to fulfill methodological gaps like the construction of a measurement instrument to evaluate training contribution to organizational innovation in the public sector.

Theoretical Framework

Organizational Innovation Skills

Innovation adoption is meant to encompass the generation, development, and implementation of new ideas or behaviors. In this context, innovation can be a new product or service, a new production process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members. Thus, innovation is defined as the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization (Zaltman et al., 1973). This definition is sufficiently broad to include different types of innovations pertaining to all parts of organizations and all aspects of their operation (Damanpour, 1991).

The innovation process is complex and multi-faceted, by nature, requiring multiple antecedents in different levels that can facilitate or even make barriers to both phases of innovation (generation and adoption), as it is shown in systematic reviews about the topic (Anderson et al., 2014; Damanpour, 1991; De Vries et al., 2016; de Vries et al., 2018; Piening & Salge, 2015; Walker, 2014). At the individual level, it is widespread the assumption of creativity as an essential skill to the innovation process, mainly at the idea generation phase, as the review by Anderson et al. (2014) presents. But, creativity, as a human attribute, does not support, by itself, organizational innovation theories that aim to guide robust research on multi-

level and multivariate approaches to investigate innovation dimensions, types, causal effects, determinants, barriers, facilitators, components, and its relationships. There is more room to be explored in this context.

When reviewing literature about organizational innovation in the public sector, De Vries et al. (2016) identified various individual-level antecedents to innovation outcomes in this context: employee autonomy (empowerment), organizational position (tenure, mobility), job-related knowledge and skills (professionalism), creativity (risk-taking, solving of problems, demographic aspects (age, gender), commitment/satisfaction with job, shared perspective and norms, innovation acceptance, and others. They observed that job-related skills are highly valued and saw that agents have an important role in enabling innovation both on the organizational level (encompassing a strong focus on leadership) and the individual level (where there is a strong focus on innovative employees and their characteristics). Key publications in that review include (Borins, 2000) that highlights the importance of creative individual entrepreneurs who are able to break through a risk-averse administrative culture. This finding also aligns with the notion of empowered employees, who are frequently mentioned as an important source of successful innovation.

The authors also investigated whether these antecedents are present in both the generation and the diffusion/adoption stages of the innovation process. They found that studies related to the individual level similarly include autonomy and skills in both stages and that their findings suggest that the differences between these two stages are not as large as is sometimes suggested if one looks at relevant drivers and barriers. Concerning the 'publicness' of public sector innovations, De Vries et al. (2016) review found environmental antecedents that appeared to be typical of public sector innovation, such as political and public demands. The 'publicness' concept (Bozeman & Bretschneider, 1994) can make the distinction clear between public and private sector innovations. This can be defined as "a characteristic of an organization

which reflects the extent the organization is influenced by political authority" (Bozeman & Bretschneider, 1994, p. 197).

Although innovation is often perceived as volatile and difficult to replicate, it can be stimulated and the specific skills that support it can be developed. Organizations have devoted effort to improving product development practices and implementing advanced processes and methods, such as Agile and Lean methodologies. The best-performing companies engender a wide variety of innovation-supporting skills in product development personnel, including project management, market research, use of social media, engineering management, and intellectual property management (Markham & Lee, 2013). Skill development in all these areas is typically supported by technical resources and training. What is not often provided is training in the skills needed not for innovation support but for innovation itself (Michaelis & Markham, 2017). Since organizational innovation has a recognized procedural dimension, which means that it is not only the innovation results that define this construct but also the time-dependent and multivariate process made by idea generation, implementation/adoption phases, there should exist a set of job-related knowledge and skills that are essential to positively executing this strategical organizational process.

Literature differentiates between *hard skills* (technical skills that involve working with equipment, data, software, etc.) and *soft skills* (intra-personal skills such as one's ability to manage oneself as well as interpersonal skills such as how one handles one's interactions with others.) Identifying learning needs of *hard* and *soft skills,* described in terms of observable behaviors applicable at workspace environment, and measuring them, contributes to decisions about specific training programs (Laker & Powell, 2011).

Once organizational innovation possibly requires from employees the mobilization of knowledge and skills related to the mastery of specific procedures and work tools demanded by each phase of this process, it is plausible that it also should require the mastery of socio-

emotional skills to face all the work social relationships demanded until achieving its results. So, it is important to understand which specific skills are essential to execute the innovation process in organizations and how much training activities can contribute to its results. Then, this knowledge can help organizations to better plan their innovation and related training programs, improving their effectiveness.

Training contribution to innovation results

Learning can be defined as an engagement in mental processes that result in the acquisition, retention, and transfer of knowledge, skills, and/or attitudes over time and until needed, along with the capacity to identify conditions of performance and respond appropriately. Workplace training is a systematic approach to learning and development to improve individual, team, and organizational effectiveness (Kraiger & Ford, 2021). Learning is multidimensional, consisting of cognitive outcomes and strategies, skill-based and affective outcomes. Training can be used to influence a broad array of criteria at the individual, team, and organizational levels (Bell et al., 2017).

The development of employees was found to be an innovation antecedent (Castro et al., 2017). Regarding the individual innovation positive antecedents found in literature (De Vries et al., 2016; Walker, 2014), employee autonomy (empowerment), and job-related knowledge and skills (professionalism) may be reinforced with the impact of systematic training activities that are directly planned to develop innovation-related knowledge and skills, since training effectiveness may be facilitated when it is well-designed to achieve specific and observable goals derived from detailed training needs assessment and taking into account specific training participants, organizational and job-related characteristics, as pointed out on literature (Aguinis & Kraiger, 2009; Alvarez et al., 2004; Arthur et al., 2003; Bell et al., 2017; Cheng & Hampson, 2008; Ford et al., 2018; Kraiger & Ford, 2021; Lacerenza et al., 2017; Salas et al., 2012).

Although companies have long recognized innovation as a priority and developed programs to support and nurture it, the connection between innovation and performance remains equivocal (Damanpour, 1991). Investment in innovation training has the potential to help firms create more successful product offerings, but the extent to which companies do innovation training is unknown. Human capital is a driving factor in profitable innovation (Leiponen, 2005). However, its development through training is too often neglected in favor of a focus on processes and tools. While tools and processes are clearly a necessary component of any successful innovation system, they are not sufficient for the emergence of ideas and implementation of innovation (Michaelis & Markham, 2017).

Results from a meta-analysis by Arthur et al. (2003) of design and evaluation features for the effectiveness of training in organizations suggest that the training method used, the skill or task characteristic trained, and the choice of training evaluation criteria are related to the observed effectiveness of training programs Practitioners and researchers have limited control over the choice of skills and tasks to be trained because they are primarily specified by the job and the results of the needs assessment and training objectives. However, they have more latitude in the choice and design of the training delivery method and the match between the skill or task and the training method. For a specific task or training content domain, a given training method may be more effective than others. Because all training methods are capable of, and indeed are intended to, communicate specific skill, knowledge, attitudinal, or task information to training participants, different training methods can be selected to deliver different content (i.e., skill, knowledge, attitudinal, or task) information (Arthur et al., 2003).

So, to achieve innovation results in organizations when using training to develop the human capital, between other components, it is useful to comprehend for whom, which, and when specific innovation-related skills are needed to choose the more adequate design and delivery methods to improve its effectiveness. In this context, a specific instrument about the

contribution of training to innovation focused on job-related innovation skills may aid practitioners and researchers when assessing innovation training needs, designing innovation training programs, defining training effectiveness evaluation criteria, and assessing it to generate feedback and training improvements.

Private and public organizations spend vast amounts of money on training and development and almost every working adult will spend hours of their lives participating in learning experiences (Bell et al., 2017). Nonetheless, several unanswered questions remain regarding innovation training. More work needs to be done to explore how innovation training relates to innovation performance.

Given that training relates positively to performance (Aguinis & Kraiger, 2009; Lacerenza et al., 2017; Salas & Cannon-Bowers, 2001), innovation training should be expected to relate positively to innovation performance. However, this relationship remains unproven (Michaelis & Markham, 2017). The existence of a research instrument that, when describing innovation skills extracted from training objectives, makes it possible to evaluate the contribution of formally designed training activities to the development and transfer of organizational innovation job-related skills, remains a methodological gap in the field.

Method

This study is descriptive, with a qualitative phase of instrument development and investigation of content and semantic validity evidence preceding a quantitative phase to investigate evidence of psychometric validity of the scale and aimed to report the process of developing and validating a scale of the contribution of training to organizational innovation in the public sector. As for the data sources, this study was based on documentary secondary and human primary sources in the scale construction phase, and primary human sources were used in the phase of searching for validity evidence of the scale. In phase 1, scale development, to construct the instrument items it was sequentially conducted: a documentary analysis of an

organizational innovation program components and relationships, an instructional design quality assessment[7], extraction of instructional objectives, identification of innovation skills taught by training, construction and organization of items in content categories, it was also carried out an evidence based test content validation by groups of experts, and a semantic validation. In phase 2, exploratory and confirmatory factorial structure of the scale, it was performed empirical validation with 213 respondents.

The items that compose the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale represent a set of job-related skills developed on public employees by a process improvement training in the context of an organizational innovation program in Brazilian public sector.

Research Context: The Program and Training Assessed

The organizational innovation program studied by this research is strategical for the organization and it was structured in four increasing levels of complexity and scope of action regarding the scope of the processes to be improved. The program embodies a training activity that is considered one of its essential parts. This training was chosen to be assessed for the scale construction because of its strategical nature for the organization studied and its theoretical link with some expected organizational results. It provides in its instructional planning four sets of courses (one per program level) composed of a module in the e-learning format (focused on declarative knowledge) preceding a face-to-face module (containing practical application of the knowledge and innovation method addressed). The content used is mixed, being interpersonal, intrapersonal, leadership and business, in nature.

The instructional planning for Level 1 training has a format composed of two sequential courses, one in the self-instructional e-learning delivery format and the other in a tutored

[7] Both the innovation program documentary analysis and instructional design quality assessment are reported in Article 3 of this thesis.

classroom. This is the entry-level in the organizational innovation program studied, where the training participant must learn skills related to the knowledge and application of basic concepts and tools on process improvement (e.g., Process mapping, 5 whys, Ishikawa diagram, 7 wastes, PDCA, A3). The Level 2 training instructional planning is similar in format to Level 1, but differs in the content covered, including specific training on team leadership, and presenting additional concepts and tools for the innovation program participant (e.g., Value Stream Mapping, Takt time), expanding the scope of action and potential for results. The employee's participation in this training has as a prerequisite the completion of at least one complete cycle of participation in all activities of Level 1 and approval in a simplified internal selection process.

The content addressed on both courses refers to the real work situation and explains the tools, techniques, and specific methodology to be used in practice by the training participant and addresses the application with high-fidelity activities, which are training activities with elements identical to those found in the workplace to carry out innovation and process improvement. Theoretical and practical activities are alternated so that at the end of the course training participants have, in groups, applied specific techniques and knowledge in a process improvement situation that is presented and evaluated in a pitch section. The three best ideas are selected by an appraisal board and awarded.

Phase 1 – Instrument Development and Validity Evidence of TCOIPS scale Content and Semantics

The instrument was built after systematic literature research about the contribution of training activities on the result of organizational innovation in the public sector (Gonçalves & Abbad, in press)[8] that presented methodological and theoretical gaps on researches on the topic (Børing, 2017; Damanpour, 1991; Dostie, 2018; Gallouj & Zanfei, 2013; Sung & Choi, 2014)

[8] Article 1 in this thesis

and a qualitative evaluation of an Organizational Innovation Program. In this context, this study was guided by literature methodological and theoretical research gaps and extensive document analysis on secondary data about the origin, inputs, activities, expected results, hypothesis, support, external factors, and its relationships of an Organizational Innovation Program held by a public Brazilian company, as well as the instructional design of training activities that compose the program.

When analyzing specific literature focused on evaluating training impact on innovation, it was not identified any instrument that assessed organizational innovation individual skills, nor even in the public sector. This shows a relevant methodological gap for data capture at the individual level regarding the topic, negatively impacting the scope of the findings. The Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale items are inspired on a set of desired observable behaviors extracted from a qualitative analysis of the instructional design artifacts of an innovation training program applied on a Brazilian public sector organization and were elaborated focusing on measuring in what extent the training program evaluated contributed to the improvement of job processes on the worker environment, in aspects related to a list of expected performances at work after being trained for it. The items were, then, elaborated from the instructional objectives of the course and the innovation-related skills identified in this qualitative step.

Participants

For the phase 1 of this study, instrument development and validity evidence of TCOIPS scale content and semantics, all participants were chosen non-randomly, by convenience. Phase 1 was carried out with a qualitative approach in four sequential steps: items construction, evidence-based content validation for each item, evidence-based content validation for categories, and scale semantic validation.

Six graduate students of Work and Organizational Psychology and Administration master and doctoral courses from a research group participated at the items construction step. They were chosen because of their expertise in training instructional quality assessment and scale validation research.

Then, six undergraduate public sector employees, program stakeholders, carried out an evidence-based content validation for the scale items. They were chosen due to their professional expertise and knowledge applied in the creation of the training and organizational innovation program that was studied for the TCOIPS scale construction. This group was formed by training content developers, instructional designers and innovation program coordinators.

The step of evidence-based content validation of categories built *a posteriori* was carried out by a group of seven graduate professors and Ph.D. in Administration or Psychology. They were chosen due to their scientific knowledge and expertise as specialists and researchers in organizational innovation in the Public Sector.

Finally, the semantic validation step was executed by a group of twelve undergraduate former training participants that took part at the innovation program. They were chosen because they represent a sample of the TCOIPS instrument target audience. Table1 shows participants and objectives of each step of validity evidence investigation.

Table 1

Content validation strategy employed for TCOIPS

Participants – Judge groups	*Steps of validity evidence investigation*	*Validation steps objectives*
Six master and doctoral students specialists on training instructional quality assessment and scale validation	Step 1 - Items construction	To construct the scale items derived from the extraction of the performance at work objectives expected from training participants, after training

Six stakeholders from the organizational innovation program in the public sector	Step 2 - Evidence-based content validation using the CVC method	To validate each item content by assessing its language clarity, practical and theoretical relevance
Seven professors and Ph.D. specialists in organizational innovation	Step 3 - Evidence-based content validation	To validate each content category constructed *a posteriori*
Twelve former training participants and participants of the innovation program, from the target audience	Step 4 - Semantic validation	To validate the scale semantics

Content and Semantic Validation Procedures

Twenty-one behaviors at work expected from training participants were extracted after the instructional quality assessment of the innovation training that belongs to an organizational innovation program in the public sector. Starting from this list of expected behaviors, the first version of the TCOIPS scale was built by the first group of judges containing 59 items allocated in nine content categories constructed *a priori*. Aiming to refine this initial version, this group of judges jointly with participants of the same research group reviewed the scale and a second version with 18 items distributed in 4 content categories was done. In this step, items that seemed to be closely related with each other were eliminated from the scale first version.

Following the first validation step, based on the expertise and knowledge applied by the innovation program stakeholders in the creation of the training, the instrument was submitted to an evidence-based content validation using the Content Validity Coefficient (CVC) method (Hernández-Nieto, 2002), where language clarity, practical pertinence, and theoretical relevance of the items content were assessed by a group of other six judges. A spreadsheet organized with all 18 items content and judges scores for language clarity, practical pertinence and theoretical relevance was used to calculate CVC per item using the judges scores mean as

a basis (CVCi, Error (Pei), and CVCic). For the application of CVC method, each scale items were associated with an anchored 5-point Likert-type scales of adequacy for language clarity, pertinence for practical pertinence, and relevance for theoretical relevance, all of them ranging from 1 (one) as “nothing” to 5 (five) as “too much”.

Another spreadsheet was used to compute for the entire TCOIPS scale its total Content Validity Coefficient (CVCt) for language clarity, practical pertinence and theoretical relevance, being the CVCic mean of all items for each of 3 validation criteria (Hernández-Nieto, 2002). According to Hernández-Nieto (2002), CVCt and CVCti values above 0.80 are considered valid for the instrument, considering the research context. Items with CVCti below the limit of 0.8 need to be evaluated by the author(s) of the instrument, considering the set of qualitative validation information and suggestions from the judges regarding clarity and/or practical relevance and/or theoretical relevance.

After this, the four content categories regarding sets of job-related skills developed by the evaluated training constructed *a posteriori* were validated by another group of 7 judges that are specialists in organizational innovation. Initially, these judges individually analyzed each item and content category definition in a blind review way (without knowing previous items categorization) and then indicated which dimension they believed each item belonged to in an electronic spreadsheet. Then, judges’ suggestions for items and categories definitions improvement were analyzed. The items that had an agreement among the judges were kept in their respective dimensions. The first three validation steps were supported using electronic spreadsheets specifically designed for each content validation phase.

It was also performed a semantic validation process with a group of judges represented by a sample (n = 12) from the target audience of the research instrument. This last qualitative validation step was, then, executed by public service employees that already had participated in the training and innovation program. In this step, participants were also chosen non-randomly

and invited by telephone or electronic messages to participate. The research objectives were previously explained to them. The scale semantic validation was supported by the same electronic environment where the validated questionnaire would be applied after the qualitative validation was completed.

The 18-item version of the TCOIPS scale was presented to this sample participants already in its digital format, with the scale instructions, and a Free and Informed Consent Form (FICF). They were asked to answer all questions and, at the end of each section, to inform if there was any difficulty in understanding the items or instructions, and they could suggest any needed wording adjustment to make the items potentially clearer to the target audience.

TCOIPS content and semantic validation procedures were performed by these different groups and sequential steps to guarantee the best possible arrangement of continuous feedback about the content quality of items and categories, coming from multiple specialized sources and aiming to correct content errors, minimize possible biases, possibilities of misinterpretation by the target audience and maximize clarity, practical and theoretical relevance of the instrument.

Phase 2 - Exploratory and Confirmatory Factorial Structure, Reliability, and Discriminant Validity Evidence of TCOIPS Scale

Following the four steps of the qualitative validation phase, it was carried out a quantitative phase of validity evidence investigation aiming to study the exploratory and confirmatory factorial structure, reliability, and discriminant validity evidence.

Participants

Participants were chosen non-randomly, by convenience. Participated in the study 283 employees of a large Brazilian public service company that planned and implemented an organizational innovation program that has training as one of its essential components. Invitation to participate in this research was sent to a list of 872 egress of the training that had participated in the innovation program. From the 283 questionnaires returned (37.2% of the 759

who effectively received the invitation email), 213 completely responded all items from TCOIPS scale and 70 did not respond any TCOIPS item. After data collection, it was possible to identify that the sample was characterized, in its major part, by male participants (59%), with ages between 33 and 37 (18%), between 38 and 42 (19%), between 43 and 47 years (23%), and between 48 and 52 (17%), with tenured function (63%), undergraduate schooling degree (31%), *lato sensu* post-graduation degree (56%). Only 3% had a graduate degree (master or PhD). The seniority range is from 6 to 37 years working on the organization. Half of participants (50%) declared that they did not have previous knowledge and skills at a necessary and sufficient level to execute continuous improvement in work processes.

Data collection procedures and ethical care

Data collection occurred online, at the Survey Monkey platform, during the end of June and through the months of July and August, in 2021. The questionnaire links were generated by the researchers and directly forwarded to 797 employees of a public service company that had formerly participated in an organizational innovation program with training as one of its essential parts. From the population invited to respond the questionnaire, 759 received the e-mail with 37,2% of return rate (n = 283) after four rounds of e-mails reinforcing the invitation to participate in the study.

A Free and Informed Consent Form (FICF) was included at the beginning of the instrument, which had to be accepted by the respondent so that data collection could take place. The FICF presented the research aims and assured to the participant the freedom to interrupt its participation at any time and in any phase of the research, the confidentiality of individual responses, and the grouped data treatment. Since this research used databases, whose information is aggregated, without the possibility of individual identification, it was not necessary to submit the research to be registered or evaluated by the Research Ethics

Committees and National Research Ethics Commission system in Brazil, accordingly to item V, Article 1, of the resolution 510 from Brazilian National Health Council.

Data Analysis procedures

Data collected was analyzed with the support of the software Microsoft Excel 16.57, at the preliminary database analysis phase and preparation for the subsequent exploratory phase, FACTOR 11.05.01, in the descriptive and exploratory phase, and JASP 0.14.1, in the confirmatory phase, network analysis and invariance analysis of the TCOIPS performed for gender, seniority and tenured function groups. Also, at the confirmatory phase, it was also used R 4.1.1 (R Core Team, 2018) with packages *lavaan* 0.6-9 (Rosseel, 2012) and *qgraph* 1.9 (Epskamp et al., 2012) for network analysis. Data adequation to the Exploratory Factor Analysis (EFA) assumptions was evaluated by means of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test. The factorial retention criteria used were Parallel Analysis (Horn, 1965) applied by the optimized implementation method (Timmerman & Lorenzo-Seva, 2011) that generates 500 random correlation matrices by permutation of sample values and the number of factors stability was estimated by a non-parametric Bootstrap Exploratory Graph Analysis (EGA) .

The exploratory phase analysis was implemented using a polychoric matrix and Robust Diagonally Weighted Least Squares (RDWLS) extraction method (Asparouhov & Muthen, 2010) for factorial model generation by robust factor analysis, with robust statistics of the model's correction (goodness-of-fit) by the chi-squared adjusted for the mean and variance. The decision on the number of factors to be retained was performed using the technique of parallel analysis with random permutation of the observed data (Timmerman & Lorenzo-Seva, 2011) and the rotation chosen was Robust Promin (Lorenzo-Seva & Ferrando, 2011, 2019). The model adequacy was evaluated using the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) fit indices. According to literature

(Brown, 2015), RMSEA values must be less than 0.08, with a confidence interval not reaching 0.10, and CFI and TLI values must be above 0.90, or preferably, 0.95.

The stability of factors was assessed using the H index (Ferrando & Lorenzo-Seva, 2018). The H index assesses how well a set of items represents a common factor (Ferrando & Lorenzo-Seva, 2018). H values range from 0 to 1. High H values (> 0.80) suggest a well-defined latent variable, which is more likely to be stable across different studies. Low values of H suggest an ill-defined latent variable, and probably unstable between different studies (Ferrando & Lorenzo-Seva, 2018). Finally, the discrimination parameter and the item thresholds were evaluated using the Reckase parameterization (Reckase, 1985).

A confirmatory factor analysis was performed to assess the plausibility of a one-dimensional structure for the scale. The analysis was implemented using the Robust Diagonally Weighted Least Squares (RDWLS) estimation method. The fit indices used were: χ^2; χ^2/gl; Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Standardized Root Mean Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA). Values of χ^2 should not be significant; the χ^2/gl ratio must be under 5 or, preferably, smaller than 3; CFI and TLI values must be bigger than 0.90 and preferably above 0.95; RMSEA values must be under 0.08 or preferably under 0.06, with a confidence interval (upper limit) under 0.10 (Brown, 2015). Standardized Cronbach's alpha, McDonald's ordinal omega and the composite reliability (CR) were used to measure the instrument reliability (Raykov, 2007). Omega can be interpreted as the square of the correlation between the scale score and the latent variable common to all the indicators in the infinite universe of indicators of which the scale indicators are a subset (McDonald, 1999, page 89).

The questionnaire applied to the sample also included a 12 items scale (Abbad, 1999; Zerbini & Abbad, 2010) about the impact of the evaluated training on general aspects of the respondent work, a 6 items scale (Abbad & Sallorenzo, 2001) of psychosocial support for

training transfer (both of then Likert-type agreement scale, ranging from 1 "Totally disagree" and 5 " Totally agree"), 7 questions about results of the organizational innovation program in the public sector (process type, innovations implementation, maintenance, barriers, and facilitators), and 8 questions related to participants socio-demographic characteristics (gender, age, education level, seniority, whether they had a tenured function, geographical location in the country, in which year they participated and in which roles they worked in the innovation program).

Results

In Phase 1, during the first qualitative validation step, the initial wording of the 59 items scale constructed as a result of the content analysis on secondary documentary data passed through a content refinement that resulted in an 18 items version of the TCOIPS scale distributed in four content categories related to innovation skills developed by training. The total Content Validity Coefficient (CVCt) for the entire TCOIPS scale was greater than 0.80, considered valid for the instrument regarding the research context (Hernández-Nieto, 2002), being 0.84 for language clarity, 0.90 for practical pertinence, and 0.82 for theoretical relevance. Regarding items individual validation, five items presented CVCti below the limit of 0.8 for language clarity (item 1 = 0.77, and item 3 = 0.70) and theoretical relevance (item 2 = 0.73, item 9 = 0.73, and item 17 = 0.77) and needed to be rewritten. In this second validation step no item was dropped, since the CVCt was acceptable.

Initially, items 1 to 6 were categorized as "*planning of process improvement*", items 7 to 10 represented the category "*generation of innovative solutions*", items 11 to 13 were grouped in "*implementation of innovative solutions*", and items 14 to 18 were categorized in "*team leadership for continuous improvement culture*". Judges disagreed on categorization of nine items, a new category was suggested to be constructed, 5 items were recategorized and the

definition of 3 categories were rewritten. In this step, the judges also made observations for improvements about the content of nine items.

The third qualitative validation step resulted in items 1 to 5 categorized as PLAN - "*planning of process improvement*", items 7 and 10 grouped into the category IDEA - "*generation of innovative solutions*", items 10, 11 and 14 allocated in IMPLE - "*implementation of innovative solutions*", items 6, 8, 12 and 13 were regrouped into a new category called ESTAB – "*stabilization of results achieved with innovative solutions*", and, finally, items 15 to 18 were categorized in LIDER - "*team leadership for continuous improvement culture*". In sequence, in the semantic validation step, four respondents made suggestions to improve clarity of the wording in four items (2, 9, 14, and 15), which were incorporated into the final version of the TCOIPS scale. The scale instructions did not receive any suggestion of improvement, being considered adequate for this research context. Considering all qualitative validation information and suggestions from the judges, the wording of 16 items were revised because they received improvement suggestions and were rephrased accordingly to recommendations of the judges. After the four steps of qualitative validation in Phase 1, the final version of TCOIPS scale resulted in 18 items organized into five categories of content.

For the quantitative scale validation, a survey questionnaire was applied to the former participants of the 2019 and 2020 applications of the Organizational Innovation Program assessed. The 213 valid numerical responses for TCOIPS scale were subjected to exploratory factor analysis and internal consistency, following the proposal by (Hair et al., 2010), who consider necessary that the number of respondents be at least five times the number of the instrument variables. All variables were, tested for normality assumptions (skewness and kurtosis) and the result showed negative asymmetry with skewness above |1.000| and two items with kurtosis above |1.000|. Test of Mardia (1970) for multivariate normality with statistically significant result ($p<0.001$), rejecting H0 and demonstrating non-normality of the data

distribution in all observed variables. Polychoric correlation is advised when the univariate distributions of ordinal items are asymmetric or with excess of kurtosis (Muthén & Kaplan, 1985, 1992).

The model with best psychometric properties and theoretical consistency was found through exploratory and confirmatory techniques. At the exploratory phase, it was extracted one factor by Parallel Analysis method, which indicated the presence of only one factor. The items polychoric correlation matrix met the EFA assumptions, as Bartlett's sphericity (2362.1, $df = 153$, $p < 0.001$) and KMO (0.88) tests suggested the interpretability of the items' correlation matrix. Items correlations were greater than 0.4, with the smallest value equal to 0.575 and most above 0.700 observed by visual inspection. The parallel analysis suggested an empirical structure with only one factor as being the most representative for the data (Table 2).

Table 2

Parallel analysis results

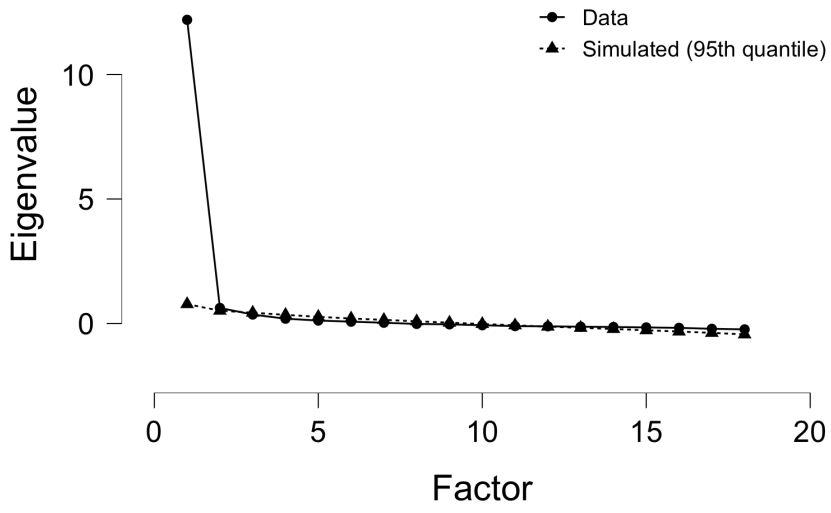
Factors	*Real data percentage of explained variance*	*Random data percentage of explained variance (95% CI)*
1	78.6729*	16.0659
2	5.2367	14.2385
3	3.8137	12.7880
4	2.4156	11.5662
5	1.8383	10.3948
6	1.7580	9.3925
7	1.4929	8.3643
8	1.2505	7.3352
9	1.0037	6.3093
10	0.9261	5.3360
11	0.7061	4.4016
12	0.4683	3.5955

Note: The number of factors to retain is one, as one factor from real data has explained variance percentage (78.67 %) higher than random data.

A reliability test of items was greater than 0.78 for all variables, indicating that no items should be removed. The EFA was, then, performed at FACTOR with the 18 scale items, indicating a structure of one factor by the Parallel Analysis method. This result was confirmed with a visual analysis of the scree plot sedimentation graph using JASP software (Figure 1), with only one eigenvalue greater than one, noted where a break of the curve is observed.

Figure 1

Parallel analysis scree plot for TCOIPS



AFE result indicated, therefore, a unidimensional factorial structure composed by 18 items (Table 3). These 18 items are related to a set of *soft* and *hard skills* composing the factor *training contribution to organizational innovation in the public sector*. The TCOIPS scale assesses how much the innovation training contributed to the participants to promote process improvements based on soft and hard innovation skills. The commonality analysis showed that no item had extreme values (close to 0 or 1), indicating the permanence of all items. The factor loadings of the items can be seen in Table 3. Composite Reliability indices are also reported and are adequate, as well as estimates of replicability of factor scores by H-index computation (Ferrando & Lorenzo-Seva, 2018).

Table 3

Unidimensional factorial structure of TCOIPS - training contribution to organizational innovation in the public sector

Code	*Innovation skills*	*Mean*	*Variance*	*Loads**	*Communalities*	*Uniqueness*
PLAN1	1. Seleção do processo de trabalho a ser submetido a um projeto de melhoria contínua.	2.662	1.097	**0.879**	0.773	0.227
PLAN2	2. Identificação do time que colaborará em um projeto de melhoria contínua de processos.	2.624	0.995	**0.882**	0.777	0.223
PLAN3	3. Especificação de indicador(es) a ser(em) utilizado(s) para mensuração e controle de melhorias de processo.	2.700	0.952	**0.857**	0.735	0.265
PLAN4	4. Diagnóstico de erros e desperdícios no processo de trabalho como oportunidades de melhoria.	2.981	0.957	**0.866**	0.750	0.250
PLAN5	5. Identificação das causas que geram mais impacto nos resultados finais do processo de trabalho.	3.009	0.911	**0.848**	0.720	0.280
ESTAB6	6. Demonstração da variabilidade do processo de trabalho com base no comportamento dos seus indicadores.	2.615	0.866	**0.800**	0.640	0.360
IDEA7	7. Compartilhamento de boas práticas para redução de perdas e desperdícios em processos.	2.901	0.943	**0.860**	0.739	0.261
ESTAB8	8. Criação de valor para o cliente por meio de soluções inovadoras em processos de trabalho.	2.761	1.102	**0.863**	0.744	0.256
IDEA9	9. Proposição de contramedidas para solucionar problemas em um processo de trabalho por meio da análise do seu fluxo de valor.	2.761	0.943	**0.891**	0.794	0.206
IMPLE10	10. Detalhamento do plano de trabalho para implementação de melhorias de processo geradas em projeto de melhoria contínua.	2.718	0.916	**0.913**	0.834	0.166
IMPLE11	11. Implementação de melhorias em processos de trabalho a partir da aplicação de técnicas de definição, mensuração e análise de processos.	2.728	0.959	**0.941**	0.885	0.115
ESTAB12	12. Melhoria do desempenho de um processo de trabalho no ambiente organizacional após otimização do seu fluxo de valor.	2.742	0.980	**0.909**	0.827	0.173
ESTAB13	13. Proposição de mudanças em estratégias de implementação de soluções inovadoras, a partir do monitoramento da sua efetividade.	2.531	0.916	**0.858**	0.735	0.265

IMPLE14	14. Construção de relatório (tipo organizador gráfico) contendo a descrição das etapas do processo de melhoria contínua e seus resultados.	2.554	0.998	**0.753**	0.567	0.433
LIDER15	15. Condução dos colegas de trabalho para o atingimento de metas de melhoria de um processo de trabalho no ambiente organizacional.	2.709	0.958	**0.883**	0.780	0.220
LIDER16	16. Fortalecimento da cultura de melhoria contínua a partir da comunicação participativa, ativa e colaborativa com os colegas de trabalho.	2.761	0.961	**0.898**	0.806	0.194
LIDER17	17. Mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a melhoria contínua de processos de trabalho.	2.615	0.997	**0.894**	0.800	0.200
LIDER18	18. Reconhecimento social do alcance de resultados obtidos pelos colegas de trabalho com a aplicação de métodos e técnicas de melhoria contínua de processos.	2.465	1.131	**0.845**	0.715	0.285
Total variance explained (%)				78.67		
N				213		
Composite reliability				0.98		
H-latent				0.984		
H-observed				0.907		

***** Unrotated factor loadings matrix, since a unidimensional solution was suitable for the data

The 18 scale items are associated with an anchored 5-point Likert-type contribution scale, 0 (zero) being *"Nenhuma contribuição"* (no contribution) and 4 (four) *"Enorme contribuição"* (huge contribution). Items presented adequate factor loadings, with high factor loadings in their respective factors. It was investigated whether the unifactorial model fits the polychoric correlation matrix of the items. This matrix was submitted to a goodness of fit test, suitable for categorical indicators of ordinal level that do not meet normality assumptions. The instrument fit indices were adequate ($\chi^2 = 285.19$, gl = 135; $p < 0.001$; RMSEA = 0.072; CFI = 0.997; TLI = 0.996; SRMR = 0.0572). The composite reliability of the factors was also acceptable (above 0.70). The factorial structure replicability measure computed by H-index (Ferrando & Lorenzo-Seva, 2018) suggested that the unique factor extracted may be replicable in future studies ($H > 0.80$). It is important to highlight that the unidimensionality indicators *Unidimensional Congruence* (UniCo = 0.996), *Explained Common Variance* (ECV = 0.938)

and *Mean of Item Residual Absolute Loadings* (MIREAL = 0.195) supported the unidimensionality of the scale (Ferrando & Lorenzo-Seva, 2018).

Discrimination parameters and item thresholds were evaluated using Item Response Theory and are shown in Table 4. As it can be seen in Table 4, the most discriminating item of the '*Training contribution to innovation*' factor was item IMPLE11, *'Implementação de melhorias em processos de trabalho a partir da aplicação de técnicas de definição, mensuração e análise de processos'* (a = 2.770). Regarding the items thresholds, no unexpected pattern of response was found, so that the higher the response category of the scale, the higher the level of latent trait needed to endorse it.

Table 4

Items discrimination and thresholds of TCOIPS scale

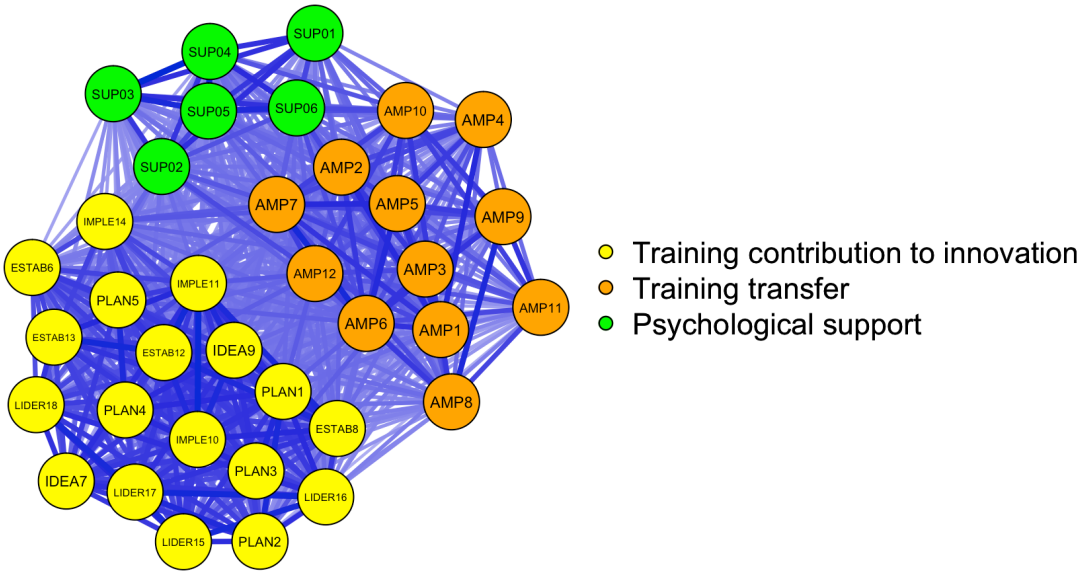
Code	*Item*	*Items discrimination*	*Threshold*$_{1-2}$	*Threshold*$_{2-3}$	*Threshold*$_{3-4}$	*Threshold*$_{4-5}$
PLAN1	1	1.848	-1.674	1.298	0.564	1.089
PLAN2	2	1.869	-1.799	-1.295	-0.489	1.221
PLAN3	3	1.665	-1.900	-1.604	-0.458	1.054
PLAN4	4	1.734	-1.991	-1.700	-0.889	0.558
PLAN5	5	1.602	-2.169	-1.658	-1.024	0.569
ESTAB6	6	1.334	-2.224	-1.515	-0.443	1.427
IDEA7	7	1.683	-2.220	-1.532	-0.772	0.688
ESTAB8	8	1.706	-1.942	-1.350	0.560	0.803
IDEA9	9	1.966	-2.141	-1.388	0.527	0.882
IMPLE10	10	2.244	-1.948	-1.327	0.573	1.049
IMPLE11	**11**	**2.770***	-1.834	-1.343	-0.499	0.924
ESTAB12	12	2.188	-1.842	-1.418	-0.531	0.918
ESTAB13	13	1.667	-1.953	-1.305	-0.298	1.443
IMPLE14	14	1.145	-2.053	-1.457	-0.454	1.578
LIDER15	15	1.883	-1.953	-1.373	-0.547	1.043
LIDER16	16	2.037	-1.983	-1.437	-0.523	0.875
LIDER17	17	2.000	-1.990	-1.277	-0.286	1.030
LIDER18	18	1.582	-1.877	-1.048	-0.203	1.274

Note: * most discriminating item for the one-dimension extracted.

Following the AFE, there was data exploration employing the network analysis (Epskamp et al., 2012) technique, in which items are represented by network nodes and the association between two items is represented by the network edges. It was used all 36 items that compose the set of 3 scales applied in the survey. Based on this technique, Figures 2 and 3 clearly illustrates the three distinct unifactorial structures and the relationships of the items in the network.

Figure 2

TCOIPS, Impact and Psychological Support scales network generated on JASP

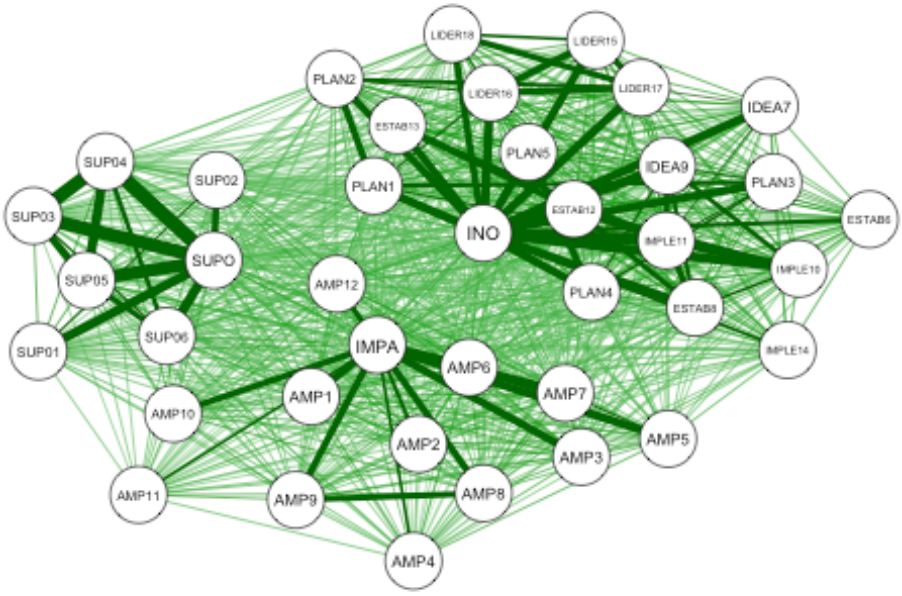


The human visual system is capable of processing highly dimensional information naturally. For instance, one can immediately spot suggestive patterns in a scatterplot, while these same patterns are invisible when the data is numerically represented in a matrix (Epskamp et al., 2012). Network analysis technique makes it possible to visually enhance researchers' capability of confirming the plausibility of theoretical factorial structures. In Figure 3, nodes (items of the instrument) are grouped around its corresponding latent variables, represented by

INO, for training contribution to organizational innovation, that is surrounded by the TCOIPS 18-items inter-connected with thicker edges, IMPA, for training impact 12-items (AMP1 until AMP12) and SUPO, that is closely surrounded and strongly connected to its organizational psychological support 6-items group (SUP01 to SUP06). It can be noted that there is no strong correlation of any item outside its expected factorial structure.

Figure 3

TCOIPS, Impact and Psychological Support scales items and factors network generated on Rstudio



The magnitude of positive correlations between items is represented by the edge thickness, the thicker and more intense the color, the stronger its association. This result also shows evidence of discriminant validity, since the 12-items of the unidimensional training impact scale (Abbad, 1999) and the 18-items TCOIPS scales are theoretically intended to measure different but highly correlated constructs about the training effectiveness at the transfer of training criteria (Zerbini & Abbad, 2010). The 6-items psychological support scale also appears in a different cluster at the network, reinforcing the evidence of discriminant validity. Softwares JASP and Rstudio generated similar outputs using correlations to generate the items

network and being able to confirm the distinction between groups of items that can represent different latent variables, showing visual evidence of the scales structure.

In the confirmatory phase, it was investigated whether the unifactorial model fits the polychoric correlation matrix of the items. This matrix was submitted to the robust DWLS estimation method, as it allows for more accurate and less biased estimates for indicators that do not meet normality assumptions. The model tested, with the eighteen items from the AFE, generated acceptable fit indices (Brown, 2015), in terms of the RMSEA, CFI, TFI and SRMR (Table 5).

Table 5

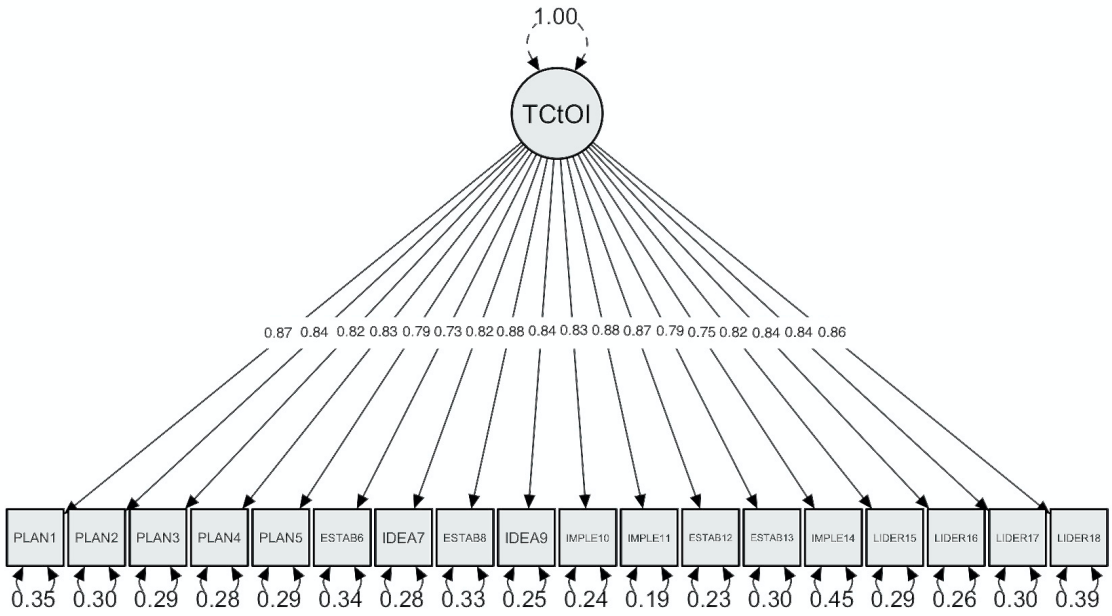
Goodness of fit for exploratory and confirmatory factor analysis of TCOIPS

Model	*X^2(gl)*	*CFI*	*TLI*	*RMSEA*	*SRMR*
Model 1 – Exploratory at FACTOR – Unifactorial (18 items)	285.19(135)	0.997	0.996	0.072 (0.050-0.080)	0.0572
Model 1 – Confirmatory at JASP – Unifactorial (18 items)	29.336(135)	1.000	1.024	0.000 (0.000-0.000)	0.048

The proposed unidimensional structure fits the data well. All fit indices evaluated supported the model (Table 5). The model's adjustment indicators were favorable, confirming that the one-factor structure pointed out in the exploratory phase is robust. In the final eighteen-item model, the items were found to share reasonable variance and form an underlying one-factor structure with adequate internal consistency ($\alpha = 0.98$; $\omega = 0.98$; CR = 0.98). Figure 4 represents the final model with its standardized factorial loads with all loads above 0.70.

Figure 4

TCOIPS scale final model standardized factorial loads



After the CFA, the measure invariance was verified, depending on the worker's gender, seniority or tenured function condition. To this end, through hierarchical tests, from the configural model (unrestricted), more restricted models were compared – metric, scalar and residual. Table 6 presents the parameters of the Multigroup Confirmatory Factorial Analysis (MGCFA).

Table 6

Multigroup Confirmatory Factor Analysis of TCOIPS

Gender invariance	*RMSEA (90% CI)*	*SRMR*	*TLI*	*CFI*	*ΔCFI*
Configural model (unrestricted)	0,000 (0,000 - 0,000)	0.997	1.050	1.000	-
Metric invariance	0,000 (0,000 - 0,000)	0.071	1.045	1.000	0.000
Scalar invariance	0,000 (0,000 - 0,000)	0.068	1.045	1.000	0.000
Strict invariance	0,000 (0,000 - 0,000)	0.076	1.043	1.000	0.000
Seniority invariance	*RMSEA (90% CI)*	*SRMR*	*TLI*	*CFI*	*ΔCFI*

Configural model (unrestricted)	0,000 (0,000 - 0,000)	0.065	1.077	1.000	-
Metric invariance	0,000 (0,000 - 0,000)	0.093	1.062	1.000	0.000
Scalar invariance	0,000 (0,000 - 0,000)	0.090	1.062	1.000	0.000
Strict invariance	0,000 (0,000 - 0,000)	0.098	1.059	1.000	0.000
Tenured function invariance	*RMSEA (90% CI)*	*SRMR*	*TLI*	*CFI*	*ΔCFI*
Configural model (unrestricted)	0,000 (0,000 - 0,000)	0.058	1.045	1.000	-
Metric invariance	0,000 (0,000 - 0,000)	0.075	1.039	1.000	0.000
Scalar invariance	0,000 (0,000 - 0,000)	0.073	1.038	1.000	0.000
Strict invariance	0,000 (0,000 - 0,000)	0.078	1.038	1.000	0.000

The invariance analysis seeks to investigate the assumption that the measure has adequate and similar psychometric properties for different participants (Damásio, 2013). The configural, metric, scalar and strict invariances were verified for gender, seniority, and tenured function groups. Thus, the unifactorial structure of the instrument is plausible for all groups analyzed, and the instrument is invariant regarding its structure, factor loadings, intercepts, and item errors. These result reveals that TCOIPS scale maintains its psychometric properties being adequate for different participants.

Discussion

The present study intended to report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector scale (TCOIPS). TCOIPS items were built based on a set of job-related behaviors expected from participants of an Organizational Innovation Program held by a public Brazilian company. This list of observable behaviors at work was extracted as a result of a quality assessment of the instructional design from the training that composes the innovation program after an extensive document analysis on secondary data about the program, related to its origin, inputs, activities, expected results, hypothesis, support, external factors, and their relationships. TCOIPS items were also constructed based on literature gaps shown on a systematic literature

research about the contribution of training activities on the result of organizational innovation in the public sector (Gonçalves & Abbad, in press). The objective was accomplished by proposing a measure that considers a specific situation of organizational innovation in the public sector and presenting a factor structure, internal consistency, and invariance.

TCOIPS has eighteen items grouped in one single factor about the contribution of training activities to the results of organizational innovation in the public sector. This contribution is measured in terms of the individual development and application at work of organizational innovation job-related skills in public sector employees, and it encompasses *hard skills* and *soft skills* needed to execute a systematic planned organizational innovation process. This confirmation is important, because public sector organizations have been claimed to innovate to improve its services overall quality in many countries around the world, aiming on increasing customer satisfaction, efficiency, effectiveness, tackling societal problems, involving citizens and even private partners as De Vries et al. (2016) found on literature review. In this context, to know the different employee skills to organizational innovation in the public sector can contribute to more effective implementation and management of innovation programs and planning the instructional design of specific innovation training activities in this kind of organizations.

The set of *hard skills* and *soft skills* presented in TCOIPS items represent sequential phases of the process dynamics of innovation implementation (Piening, 2011) and go from planning the intervention until monitoring the stability of innovation implementation, passing through the idea generation, knowledge sharing and team leadership. The unifactorial scale assess a set of technical, intrapersonal, and interpersonal skills that may be considered useful positive personal resources to effectively participate in systematic planned organizational innovation activities, contributing to their expected results when considering that job-related knowledge and skills (professionalism) is a positive antecedent related to the individual level

of innovation in the public sector (Castro et al., 2017; Damanpour, 1991; De Vries et al., 2016; Walker, 2014). Professionalism increases boundary-spanning activity, self-confidence, and a commitment to move beyond the status quo, and due to this, is expected to have a positive relationship with innovation (Pierce & Delbecq, 1977).

Relevant changes in a product, service or process component through the mobilization of internal knowledge and skills are theoretically considered an innovation (Gallouj & Weinstein, 1997). TCOIPS measures a group of *soft* and *hard skills* developed by innovation training in the context of an organizational innovation program in the public sector that are relevant to generation and implementation of process innovation in this context.

In addition to exploring and confirming the internal structure of TCOIPS, the measure invariance was also tested, aiming to record the psychometric quality of the instrument for employees of different genders, length of service and tenured function. Considering the extent of the range of this sociodemographic groups, it is suggested a wide application of TCOIPS in public sector organizations. The good internal consistency indices and goodness of fit obtained for the unidimensional model allows the indication of TCOIPS to measure the contribution of training activities to organizational innovation in the public sector, in terms of job-related skills development. As a training needs assessment, with change of instructions, the scale can be used before the implementation of an innovation program, aiming to assessing the mastery or perception of skills deficit and proposing appropriate interventions, such as offering educational actions to fill the identified gaps. The training instructional design can also take the skills described in TCOIPS scale as a starting point for choosing instructional methods and resources. The impact of training and training contribution to organizational innovation can also be associated to relate these two variables with innovation effects at team and organization levels of analysis, fostering future research on the topic with a multilevel approach.

Final considerations

The robustness of the data analysis techniques used, the proposition of a synthetic and parsimonious measure, enabling celerity in its application and results interpretation, and convergent validity in a nomological network with other constructs are some of the strengths of this study. However, some limitations should be pointed out, such as, the sample size for verifying evidence of psychometric validity and the non-inclusion of tests of concurrent or predictive validity. It is worth noting that concurrent validity remains a challenge for the TCOIPS, an innovative instrument in the national context, given the difficulty in finding similar instruments or measurement scales of recognized correlated constructs.

For future studies, predictive validity can be analyzed in longitudinal and multilevel research. However, this manuscript contributes to the beginning of this methodological path of consolidation of measuring instruments for the contribution of training to organizational innovation in the public sector. For this, rigorous methods were used to guarantee the internal and discriminant validity of the scale factors. Future research may use the TCOIPS in other samples and contexts (including different sizes and types of public and private organizations, and other countries, with minor adjustments), as well as investigate possible associations between these skills and other indicators, such as other types of innovation results.

This research presents some possible methodological, practical, managerial, and theoretical contributions. The application of TCOIPS scale has potential to contribute on the development of theories about what types of job-related skills are more relevant to organizational innovation results. TCOIPS scale is applicable in other organizational contexts, being useful to collect relevant data multilevel research about the relationship training and organizational innovation. It can support planning and development of organizational innovation programs in the public sector and can be used to measure post-fact training contribution to develop innovation and job-related skills that seems to be essential to process

improvement. With little adaptation on the instrument instruction, TCOIPS scale can also be used in Training Needs Assessment situations to measure gaps of specific innovation skills and helping to plan training interventions, aiding practitioners in instructional design planning when used as instructional objectives, to measure specific training impact about how much trained employees are applying these skills on their jobs.

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FINAL CHAPTER: CONCLUSIONS AND FINAL CONSIDERATIONS ABOUT THE FOUR STUDIES

This thesis main goal was to analyze the contribution of training activities to organizational innovation. This objective was fulfilled, since the mixed methodological approach applied generated results that enable to conclude that innovation training that is planned following theory-driven instructional design key principles and guidelines can develop specific innovation-related skills in the individual level, contributing to organizational innovation results in the public sector. Based on triangulation of methods and data sources and grounded in scientifically relevant and theory-driven research frameworks, four different studies were carried out in the context of a work process improvement organizational program in the public sector. The studies are presented in four articles herein, showing the objectives and contributions of each one. Figure 1 summarizes objectives, main results, and contributions of the four studies that make up this thesis and a research agenda.

The first study of this thesis, presented in Article 1, is a systematic literature review about the contribution of training to organizational innovation in the public sector to highlight relevant literature theoretical and methodological gaps and propose new research avenues. The use of *Methodi Ordinatio* structured protocol contributes to methodologically advance in this kind of research by supporting the selection of relevant bibliographic portfolio. New relevant research avenues based on state of knowledge research gaps are presented, aiding the field to advance. These new research possibilities can guide advancements on the field by contributing for better phenomenon comprehension.

Figure 1

Thesis'main results and research agenda

	Thesis main goal: To analyze the contribution of training activities to organizational innovation.			
	Goals	**Main results**	**Research contributions**	**Research agenda**
Article 1	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.	Literature reviewed is based on quantitative measures on the organizational level. 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.	The use of *Methodi Ordinatio* structured protocol contributes to methodologically advance in this kind of research by supporting the selection of relevant bibliographic portfolio. New relevant research avenues based on state of knowledge research gaps are presented, aiding the field to advance.	Evaluate if positive relationships will be found between antecedent variables related to training effects and their respective consequent variables corresponding to innovation constructs. Investigate more detailed explanations of why training may be related to innovation.
Article 2	Propose a multilevel and integrated theoretical methodological research framework about the contribution of training activities to organizational innovation results in the context of public sector.	Proposition of an integrated concept for organizational innovation in the public sector and an integrated, multivariable, and multilevel theoretical methodological research framework about the contribution of training to organizational innovation in the public sector.	Multidisciplinary approach linking different fields of knowledge. This study helps the selection of more adequate constructs and variables. The conceptual model can be used to generate insights on how to approach the phenomenon and deciding about research methods for collecting and analyzing data.	To completely test the theoretical research framework in a multilevel and longitudinal methodological approach, with mixed method and different data sources, testing effects of exogenous variables to better understand the relationships addressed.
Article 3	Describe an organizational innovation program in the public sector with training as one of its essential activities in order to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning.	The set of training activities evaluated has potential to develop knowledge, skills and attitudes compatible with objectives of its associated organizational innovation program as described in the logical model. A set of behaviors that apprentices can apply at work after training was extracted from the analyzed documents.	Construction of the program theory. Evaluation of the training instructional quality based on instructional design theoretical approaches proposing improvements on the lesson plan, teaching strategies, reaction evaluation, and learning evaluation so that training can enhance its contribution to the innovation program results.	To investigate factors such as innovative climate, motivation to learn, and motivation to transfer to identify if and how these factors impact the contribution of training to organizational innovation outcomes in the short, medium and long term. Compare contribution of innovation training using different instructional design didactic strategies.
Article 4	To report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale.	Validity evidence of a one-factor empirical structure constructed to assess the degree of training contribution to the development of organizational innovation individual skills in public sector (TCOIPS scale). Proposition of a synthetic and parsimonious measure with good internal consistency indices and goodness of fit.	Innovative instrument to assess the contribution of training to organizational innovation, based on trained and expected work performance. Discrimant validity test revealed that TCOIPS and IMPACT scales measure constructs that are conceptually and methodologically distinct. TCOIPS scale is applicable in other organizational contexts. TCOIPS scale can be used in Training Needs Assessment.	Use of TCOIPS to measure the outcomes of other innovation training in different organizational contexts. Transcultural adaptation of TCOIPS scale. Multilevel assessment of training impact on organizational innovation results. Investigate the mediating effect of training contribution to innovation in the relationship between organizational support and training transfer.
	Considerations about the main results: Innovation training that is well-planned following theory-driven instructional design key principles and guidelines and is an essential part of a major innovation program, can contribute to organizational innovation outcomes at the individual, team and organizational levels, by developing work related skills that prepare people to execute innovation process.			

Results of Article 1 shows that the studies analyzed are predominantly quantitative and primarily based on measures focused on the organizational level. 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. This leads to the conclusion that 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. Since organizational innovation and training contribution to innovation can be seen as procedural constructs with multiple dimensions and happens in more than one analysis level, this kind of research approach could be relevant to make the field advance, which, in turn, is highlighted in the construction of the framework presented in Article 2.

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: scarcity of studies about training contribution to organizational innovation, or even on its effects on the level of organizational change and final value; a priority on quantitative analysis without methodological triangulation with qualitative ones, which will allow greater accuracy on findings interpretation; 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; 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; 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; 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; and, few references to context variables, whether mediating or moderating, that affect the relationship between training effects and organizational innovation results, in general.

The theoretical and methodological gaps presented in Article 1 contributed to define the objectives and methodological approaches of Articles 2, 3 and 4, aiming to answer the thesis research questions and contribute to advance knowledge in specific fields of innovation and training effectiveness. For this, Article 1 made it clear the need to explore and describe the training contribution to innovation in the public sector in a mixed-method approach triangulating qualitative findings and sources with quantitative ones and constructing more representative measures. Regarding Article 1 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.

The second study of this thesis, described in Article 2, presents an integrated theoretical methodological framework about the contribution of training to organizational innovation in the public sector, aiming to guide multilevel research based on a broad overview of theoretical approaches to organizational innovation, innovation in the public sector and training effectiveness through a conceptual and theoretical qualitative analysis. It also proposes an integrated concept for organizational innovation in the public sector that was able to ground the theoretical methodological research framework proposition.

In a first basis, Article 2 proposes a conceptual model of components and characteristics of organizational innovation in the public sector organized into a six-step framework of inductive questions that could support planning scientific investigation on the topic and help

the management of organizational innovation in practice, being a guide to determine tools, resources and processes that better fit innovation project goals. It can be used to generate insights on how to approach the phenomenon and deciding about research methods for collecting and analyzing results obtained.

The conceptual construction represented on this theoretical framework (see Figure 2 on Article 2) resulted from qualitative content analysis from literature description of distinct dimensions (OECD/Eurostat, 2018), typology (Bloch & Bugge, 2013; Damanpour, 1991; OECD/Eurostat, 2018), categories (Gallouj & Weinstein, 1997), analysis levels (Anderson et al., 2014; Damanpour, 2020), innovation adoption process (Anderson et al., 2014; Damanpour, 1991; OECD/Eurostat, 2018) and change possibilities (Gallouj & Weinstein, 1997). The result of this analysis was concatenated into one single concept and makes it easier to identify relevant construct characteristics that could support researchers and practioners. In this context, organizational innovation in the public sector is defined as an overtime multilevel value creation process, composed by phases of generation, development and implementation of new ideas, that requires the use of knowledge and creativity involving human participation in organizational context, and whose results may be any change that affects one or more components of one or more sets of characteristics of the product or process that is new for the unit, organization, market or society.

Following these conceptual analysis and theoretical constructions, Article 2 presents an integrated, multivariable, and multilevel theoretical methodological research framework (see Figure 3 in Article 1) that proposes the use of constructs grouped in five interdependent longitudinally related variables sets that are used in research related to training effectiveness evaluation interconnected with constructs related to organizational innovation results, added by possible alternative explanations variables that are related to public organizations context. Results of Article 2 shows that the field of innovation studies has characteristics of polysemy,

with polytomous concepts that do not integrate all possible dimensions of the innovation phenomenon in public sector organizations and encompass an excess of typification that can confuse the research paths necessary for the development of increasingly robust knowledge on the subject. Organizational innovation in public sector, while a multifactorial social phenomenon, demands scientific comprehension efforts that pass-through refining existing concepts to define it and, thus, align paths to new knowledge generation.

The integrative concept and the theoretical methodological framework constructed in Article 2 tend to be valuable to organizational innovation science taking account the importance of training activities on the promotion of new ideas, knowledge and behaviors generation and development, by individuals and their groups, that can have their effects enhanced with support of a larger innovation process where training is an essential part of their activities, thus leading to the implementation of these results. The theoretical and methodological multilevel research framework proposed in Article 2 helps the selection of constructs and variables that are more adequate to evaluate such interventions in their pertinent analysis and complexity levels. Thus, the concept for organizational innovation in the public sector together with the integrated research framework of training contribution to innovation proposed in Article 2, theoretically grounded and methodologically oriented the study carried out on Article 3 of this thesis, favoring to investigate the contribution of training to organizational innovation results in the public sector in a qualitative way applying a logical model interconnected with training interventions systemic approaches in the context of an organizational program of work process improvement that has training as one of its essential parts.

The study presented in Article 2 contributes for the field advancement presenting an integrated concept and research framework that are driven by related theories and able to support new studies that aim to explore and understand the relationship between training

activities and the outcomes of organizational innovation in the public sector. Regarding limitations of the study on Article 2, having privileged scientifically relevant literature 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, possibly letting go other conceptual and theoretical approaches on the topic. Also, articles that did not present any conceptual or theoretical knowledge about the relationship between training and organizational innovation were excluded, which could have caused not to consider conceptual approaches about organizational innovation other than the ones analyzed.

The third study of this thesis, presented in Article 3, and important foundation for the last one (see Article 4), is qualitative research that uses content analysis of secondary documental data to describe an organizational innovation program in the public sector with training as one of its essential activities to evaluate how much this training have design and delivery characteristics that are favorable to innovation related transfer of learning. Article 3 also aimed to assess the instructional design quality of the training activities to identify skills taught by training that are necessary to carry out process improvement activities. Through document analysis, hypotheses about the program were extracted from the construction of logical models associated with training evaluation models. The evaluated innovation program was described and then, the potential impact of training on innovation was assessed enabling the identification of effects of the program and the training on the training participants behavior at work (innovation skills).

Hypotheses were raised about the expected results of an innovation program in the public sector, planned relationships between its components were described, training instructional quality was evaluated accordingly to instructional design and training effectiveness theories recommendations and criteria, and expected training participant's work performance objectives were extracted. Results suggest that the set of training activities

evaluated in Article 3 can potentially develop knowledge, skills and attitudes compatible with objectives of its associated organizational innovation program as described in the logical model presented. Then, it was possible to extract from the analyzed documents a set of behaviors that apprentices can apply at work after the completion of training activities, qualitatively showing that there is a potential for training contribution to results of the innovation program in the public sector and leaving the base to construction and investigation of validity evidence of the Training Contribution to Organizational Innovation in The Public Sector (TCOIPS) scale presented in Article 4.

The study reported on Article 3 has practical contributions, as follows: the construction of the program theory for the organizational innovation program assessed that allows to summarize it, enhance systemic comprehension about the program, and guide improvements on components, subcomponents, or its relationships for others application cycles of the program; and the evaluation of the training pedagogical didactic material based on instructional design theoretical approach with proposals for improvements on the lesson plan, teaching strategies, reaction evaluation, and learning evaluation so that the training can enhance its contribution to the innovation program results. As limitations, Article 3 used only documentary data without triangulating the information collected with data from other different data sources, hindering the analysis of different points of view about the expected innovation program results and the contribution of training to them; also, the lack of systematic data about the evaluation of reactions and learning in the data collected made it difficult to pair all expected immediate results from the program; and, in spite of the temporal coverage of the documentary data collected, the transversal methodological approach used combined with the lack of data about organizational performance indicators prevented the gathering of information on the long term program results, hindering more robust analysis about training contribution to innovation on the organizational level and if the expected effects are permanent or decay quickly.

The fourth article of this thesis, presented in Article 4, used a mixed approach, and aimed to report the development, psychometric and discriminant validity evidence, and reliability of the Training Contribution to Organizational Innovation in Public Sector (TCOIPS) scale. This study was carried out with a qualitative phase of instrument development and investigation of content and semantic validity evidence followed by a quantitative phase to investigate evidence of psychometric validity of the TCOIPS scale, which could be used to obtain relevant data on the topic at the individual analysis level. TCOIPS measures how much the innovation training contributed to the participants to promote process improvements based on the development of soft and hard innovation skills.

Results in Article 4 suggest that the training assessed in this thesis research had a medium to high contribution on work processes improvement on the organizational internal environment based on the development and positive transfer to work of specific innovation job-related skills. These conclusions were made possible because TCOIPS scale was specifically built to evaluate how much training contributed to organizational innovation transmitting necessary skills for work process improvement. As reported in Article 3, this training contribution was expected as an essential part of the innovation program described in the logic model (see Figure 1 in Article 3) and it is characterized by the development of work-related innovation skills that are described in the instrument in Article 4. This set of skills are closely related to the innovation program theory as the expected innovation results described require, together with other program components, the application of specific innovation-oriented behaviors at work that, by its turn, represent the training impact on individual level. In this way, Article 3 shows that the instructional design quality of the assessed training was adequate to the program objectives and had potential to contribute to the achievement of results expected by the program stakeholders.

Study 4 jointly applied measures of training contribution to organizational innovation in the public sector (TCOIPS) and training transfer (IMPACT), correlated constructs present in the logical model of Study 3. This application together with the results of the discriminant validity analysis carried out in Study 4 contributed to reveal that these two constructs are conceptually and methodologically distinct (the TCOIPS and IMPACT scales measure correlated but distinct constructs). This finding has the practical implications that both scales should be used in new research on the topic.

As limitations for the study on Article 4, it is worth mentioning that the innovation program documentary data and the didactic material represents the reality from the first two years of the program application cycles (2019 and 2020) and could be outdated in relation to the current applications, since the program itself is not static and passes through rounds of continuous improvement. The sample of cases obtained with the survey application was non-randomly selected, at the risk of not representing all the population perception about the phenomena studied and affecting results generalization to the universe of training participants. Sample size was in the limit regarding application of more robust statistical analysis to investigate variables relationships, which suggests the need of amplify the scale application in larger samples to confirm the factorial structure found, to investigate moderating effect of training impact and to carry on multilevel research to investigate the relationship of the variables measured by TCOIPS scale with innovation results in group and organization levels of analysis. Due to the possible relevance of contextual variables mentioned in the logical model presented in Article 3, it is worth mentioning that another limitation of the study presented in Article 4 is not having constructed a measure to assess externalities that may affect the contribution of training to organizational innovation in the public sector.

Regarding the research agenda, to advance knowledge about which are the different possible training contribution to innovation outcomes and how this contribution occurs in

different levels of analysis, it is suggested to perform multilevel assessment of training impact on organizational innovation results at the individual, group and organizational levels, applying TCOIPS auto perception scale associated with IMPACT scale, Psychosocial support scale and evaluating its relationship with objective data. It is also suggested carrying out studies that compare different in-depth public sector case studies with similar innovation program to analyze the impact of different contexts in the relationship.

It is suggested a wide application of TCOIPS in public sector organizations and measuring outcomes of other innovation training in different organizational contexts, comparing results with those found in this research, either in public or private organizations. The transcultural adaptation of TCOIPS scale is also recommended to allow comparing results found in Brazil with those of other countries, and to allow the application of TCOIPS scale in other contexts. Another suggestion is to apply the scale in a longitudinal approach, with pre- and at least two post-tests regarding the training application time affecting the generalization of results to the universe of training participants. As a training needs assessment, with change of instructions, the scale can be used before the implementation of an innovation program, aiming to assessing the mastery or perception of skills deficit and proposing appropriate interventions, such as offering educational actions to fill the identified gaps. It is desirable to analyze TCOIPS scale predictive validity in longitudinal and multilevel research.

Another recommendation is to investigate factors such as innovative climate, motivation to learn, and motivation to transfer to identify if and how these factors impact the contribution of training to organizational innovation outcomes in the short, medium and long term. Finally, it is suggested that innovation training using different instructional design didactic strategies are compared longitudinally, to identify if these strategies interfere on innovation outcomes in the public sector.

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.

As a research agenda, it is suggested to pair information from different data sources (e.g., program stakeholders, documentary, training participants) to enrich and strengthen the understanding of an innovation program needs, components, internal relationships and external factors that could affect the contribution of training to organizational innovation results in the public sector; to use logical models integrated with training evaluation models in future research on the contribution of training to innovation in other organizational contexts; to use organizational innovation theory associated with instructional design theory to link the description of organizational innovation needs to training needs, learning objectives and expected innovation results after training; to evaluate and compare innovation programs in different organizational contexts using mixed methods that allow investigating its components relationships and their prediction in a multilevel analysis; to apply longitudinal methods to investigate the contribution of training to the long-term expected innovation results in the public sector and other organizational contexts; and, to investigate the mediating effect of the training contribution to innovation (TCOIPS scale) in the relationship between organizational support and training transfer, expanding the knowledge about the phenomena involved.

This thesis demonstrates how the success of an organizational innovation program in the public sector can depend on the contribution of training activities linked to different types

of organizational support (e.g., material, psychosocial). The logical model built in Article 3 presents barriers and facilitators to innovation that were found in the context studied. Thus, before applying the instruments of impact and contribution of training to organizational innovation in the public sector, managers and researchers are recommended to use the evaluation model presented in Article 1 (logical model integrated with TD&E evaluation models) to build context assessment instruments (support and barriers) that may affect the effectiveness of the program and training.

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APPENDIX

Appendix A

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
29	Bauernschuster, S., Falck, O., Heblich, S., 2009. Training and Innovation. *Journal of Human Capital*	0.944	2009	97	87
30	Gallego, J., Rubalcaba, L., Hipp, C., 2013. Services and organisational innovation: the right mix for value creation. *Management Decision*	2.723	2013	55	85
31	Ferraz, I. N., de Melo Santos, N., 2016. The relationship between service innovation and performance: a bibliometric analysis and research agenda proposal. *RAI Revista de Administração e Inovação*	0	2016	21	81
32	Neirotti, P., Paolucci, E., 2013. Why do firms train? Empirical evidence on the relationship between training and technological and organizational change: Relationship between training and technological and organizational change. *International Journal of Training and Development*	2.400	2013	49	79
33	Esendemir, N., Zehir, C., 2017. Innovation and Performance: The Mediating Effect of Organizational Learning and Technological Capability. *International Journal of Research in Business and Social Science*	0	2017	4	74

Source: By the author.

Appendix B
Instructional Design Quality Assessment Scripts

Figure E1

*Self-instructional online course assessment script**

1	CONTEÚDO DA APRENDIZAGEM (Lacerenza)	SIM	NÃO
1.1	Interpessoal		
1.2	Intrapessoal		
1.3	Liderança		
1.4	Negócios		
2	**TIPO DE APRENDIZAGEM (Lacerenza)**	**SIM**	**NÃO**
2.1	Afetivo		
2.2	Cognitivo		
2.3	Baseado em Habilidades		
3	**MÉTODO DE TREINAMENTO (Lacerenza)**	**SIM**	**NÃO**
3.1	Informação		
3.2	Demonstração		
3.3	Prática		
4	INFORMAÇÕES GERAIS	SIM	NÃO
4.1	O curso informa quais materiais didáticos serão colocados à disposição do treinando?		
4.2	Há informação sobre ferramentas necessárias para realizar aquilo que está descrito nos objetivos educacionais (quando essencial sua especificação)? Quais ferramentas?		

4.3	O curso informa como usar cada recurso instrucional disponibilizado?		
5	**OBJETIVOS INSTRUCIONAIS**	**SIM**	**NÃO**
5.1	Os objetivos de desempenho no trabalho que são esperados do treinando ao final do curso foram apresentados previamente ao acesso aos módulos?		
5.2	Os objetivos estão descritos em termos de desempenhos observáveis?		
5.3	Há precisão na escolha do verbo de ação quanto à descrição do comportamento esperado?		
5.4	O objetivos dos módulos são compatíveis com a complexidade do desempenho esperado descrito no objetivo geral?		
6	**ESTRATÉGIAS INSTRUCIONAIS**	**SIM**	**NÃO**
6.1	Existe um programa do curso?		
6.2	Esse programa está disponível ao aluno desde o início do curso?		
6.3	A carga horária sugerida com relação ao volume de conteúdos apresentados é adequada?		
6.4	As estratégias adotadas estão adequadas às características da clientela (escolaridade, cargo)?		
6.5	As estratégias estão adequadas à natureza dos objetivos instrucionais (afetivo, cognitivo, psicomotor)?		
6.6	Há diversificação das estratégias de ensino-aprendizagem utilizadas ao longo do curso?		
6.7	Os recursos de apoio à aprendizagem são fidedignos às situações reais de trabalho?		
7	**CONTEÚDO**	**SIM**	**NÃO**
7.1	Os conteúdos se referem à situação real de trabalho?		
7.2	Os conteúdos são adequados à complexidade do desempenho esperado descrito no objetivo geral?		
7.3	Os textos simulam um diálogo com o treinando?		

8	EXERCÍCIOS E INTERAÇÕES	SIM	NÃO
8.1	Há diversificação das interações utilizadas ao longo do curso?		
8.2	Os exercícios estão compatíveis com o nível de complexidade dos objetivos instrucionais (Taxonomias de Bloom e Simpson)?		
8.3	Os exercícios de aprendizagem simulam a situação real de trabalho?		
9	**AVALIAÇÃO**	**SIM**	**NÃO**
9.1	Existe avaliação de aprendizagem		
9.2	As avaliações de aprendizagem são compatíveis com os objetivos instrucionais?		
9.3	Há variedade nas formas de avaliações de aprendizagem?		
9.4	Há feedback sobre o resultado das avaliações?		
9.5	O feedback sobre o resultado das avaliações é proveniente de múltiplas fontes?		
9.6	É exigida um score/nota final mínima para a conclusão do curso?		
10	**QUALIDADE DO MATERIAL DIDÁTICO**	**SIM**	**NÃO**
10.1	O material estimula, favorece e oportuniza a aprendizagem prevista nos objetivos instrucionais?		
10.2	O material estimula discussões no ambiente de trabalho sobre o tema em estudo?		
11	**CONCLUSÃO**	**SIM**	**NÃO**
11.1	**O curso tem potencial para desenvolver as competências descritas nos objetivos?**		
11.2	**Quais comportamentos os aprendizes poderiam aplicar no trabalho após a realização do treinamento?**		

* For each script item there is also an additional space in the right side of the script for the evaluators to input comments that would be necessary either to explain the item assessment or to detail any information that is relevant for the evaluation context and results.

Figure E2

*Tutored face-to-face course assessment script**

1	CONTEÚDO DA APRENDIZAGEM (Lacerenza)	SIM	NÃO
1.1	Interpessoal		
1.2	Intrapessoal		
1.3	Liderança		
1.4	Negócios		
2	**TIPO DE APRENDIZAGEM (Lacerenza)**	**SIM**	**NÃO**
2.1	Afetivo		
2.2	Cognitivo		
2.3	Baseado em Habilidades		
3	**MÉTODO DE TREINAMENTO (Lacerenza)**	**SIM**	**NÃO**
3.1	Informação		
3.2	Demonstração		
3.3	Prática		
5	**OBJETIVOS INSTRUCIONAIS**	**SIM**	**NÃO**
5.1	Os objetivos de desempenho no trabalho que são esperados do treinando ao final do curso são apresentados no início do curso?		
5.2	Os objetivos estão descritos em termos de desempenhos observáveis?		
5.3	Há precisão na escolha do verbo de ação quanto à descrição do comportamento esperado?		

5.4	O objetivos dos módulos (caso seja aplicável) são compatíveis com a complexidade do desempenho esperado descrito no objetivo geral?		
6	**ESTRATÉGIAS INSTRUCIONAIS**	**SIM**	**NÃO**
6.1	Existe um programa do curso?		
6.2	Esse programa é apresentado ao aluno no início do curso?		
6.3	O programa apresentado no início do curso é relembrado ao aluno durante o curso com demonstração do caminho percorrido e as etapas seguintes?		
6.4	Existe um plano de aula detalhado e com clareza na descrição das atividades a serem executadas/coordenadas pelo instrutor?		
6.5	A carga horária sugerida com relação ao volume de conteúdos apresentados é adequada?		
6.6	As estratégias adotadas estão adequadas às características da clientela (escolaridade, cargo)?		
6.7	As estratégias estão adequadas à natureza dos objetivos instrucionais (afetivo, cognitivo, psicomotor)?		
6.8	Há diversificação das estratégias de ensino-aprendizagem utilizadas ao longo do curso?		
6.9	Os recursos de apoio à aprendizagem são fidedignos às situações reais de trabalho?		
7	**CONTEÚDO**	**SIM**	**NÃO**
7.1	Os conteúdos se referem à situação real de trabalho?		
7.2	Os conteúdos são adequados à complexidade do desempenho esperado descrito no objetivo geral?		
7.3	Os textos simulam um diálogo com o treinando?		
8	**EXERCÍCIOS E INTERAÇÕES**	**SIM**	**NÃO**
8.1	Há diversificação das interações utilizadas ao longo do curso?		
8.2	Os exercícios estão compatíveis com o nível de complexidade dos objetivos instrucionais (Taxonomias de Bloom e Simpson)?		

8.3	Os exercícios de aprendizagem simulam a situação real de trabalho?		
9	**AVALIAÇÃO**	**SIM**	**NÃO**
9.1	Existe avaliação de aprendizagem		
9.2	As avaliações de aprendizagem são compatíveis com os objetivos instrucionais?		
9.3	Há variedade nas formas de avaliações de aprendizagem?		
9.4	Há feedback sobre o resultado das avaliações?		
9.5	O feedback sobre o resultado das avaliações é proveniente de múltiplas fontes?		
9.6	É exigida um score/nota final mínima para a conclusão do curso?		
9.7	A avaliação de aprendizagem contempla conhecimento, habilidades e atitudes?		
10	**QUALIDADE DO MATERIAL DIDÁTICO**	**SIM**	**NÃO**
10.1	O material estimula, favorece e oportuniza a aprendizagem prevista nos objetivos instrucionais?		
10.2	O material estimula discussões no ambiente de trabalho sobre o tema em estudo?		
11	**CONCLUSÃO**	**SIM**	**NÃO**
11.1	**O curso tem potencial para desenvolver as competências descritas nos objetivos?**		
11.2	**Quais comportamentos os aprendizes poderiam aplicar no trabalho após a realização do treinamento?**		

* For each script item there is also an additional space in the right side of the script for the evaluators to input comments that would be necessary either to explain the item assessment or to detail any information that is relevant for the evaluation context and results.

Appendix C

Summary of training instructional quality assessment results

Nível de complexidade no programa de inovação	Atividade planejada	Desenho instrucional	Pode desenvolver CHAs específicos?	Comportamentos	Observações complementares
Amarelo (Nível 1)	Curso *e-learning* de curta duração sobre conceitos, explanações e exemplos sobre melhoria de processos.	Auto instrucional, método baseado em informação e focado em aprendizagem cognitiva de conhecimento sobre conteúdo de negócios, sem exercícios e com avaliação de aprendizagem ao final de cada módulo com feedback de única fonte.	Parcialmente	1. Descrever o programa primeira escolha, suas ferramentas e etapas, para os pares e superiores; 2. Definir etapas do roteiro de melhoria contínua DMAIC; 3. Listar os benefícios de aplicação da metodologia Lean Seis Sigma	O curso tem potencial para desenvolver conhecimento específico sobre o programa de inovação e suas metodologias a serem empregadas, compatível com os objetivos descritos no material instrucional. Não tem potencial para desenvolver habilidades e nem atitudes relacionadas a esse conhecimento. Porém, o objetivo instrucional não prevê isso.
Amarelo (Nível 1)	Curso presencial de média duração sobre aplicação de metodologia de inovação organizacional em processos de trabalho	Treinamento tutorado, com método misto baseado em informação, demonstração e prática, com diversificação de estratégias instrucionais focadas em aprendizagem cognitiva e baseada em habilidades sobre conteúdo de negócios, com diversificação de exercícios e sem avaliação formal de aprendizagem.	Sim	1. Praticar as técnicas da metodologia Lean Seis Sigma; 2. Identificar princípios e padrões do processo produtivo. 3. Aplicar o método de análise e solução de problemas; 4. Analisar situações reais de erros e desperdícios no processo produtivo; 5. Identificar oportunidades de melhoria nos ambientes de trabalho, priorizando e implementando melhorias em processos organizacionais.	O curso tem potencial para desenvolver CHAs relativos aos seus objetivos instrucionais, pois seu material didático explana o conceito e a dinâmica do programa de inovação, conceitos subjacentes, metodologia a ser aplicada pelo treinando e ferramentas necessárias, além de aplicar o conhecimento durante o treinamento. Os treinandos passam pela experiência simulada do que será aplicado no local de trabalho.
Azul (Nível 2)	Curso *e-learning* de curta duração sobre conceitos, explanações e exemplos da construção de um mapa de fluxo de valor (MFV)	Auto instrucional, método baseado em informação e focado em aprendizagem cognitiva de conhecimento sobre conteúdo de negócios, sem exercícios e com avaliação de aprendizagem ao final de cada módulo com feedback de única fonte.	Parcialmente	1. Identificar as etapas necessárias utilizadas para realização do mapeamento do fluxo de valor; 2. Identificar os símbolos utilizados para realização do mapeamento do fluxo de valor;	O curso tem potencial para desenvolver conhecimento específico sobre identificação das etapas necessárias e simbologias do Mapeamento do Fluxo de Valor - MFV, compatível com os objetivos descritos no material. Não tem potencial para desenvolver habilidades e atitudes relacionadas a esse conhecimento. Porém, o objetivo instrucional não prevê isso.
Azul (Nível 2)	Curso presencial de média duração sobre aplicação da ferramenta MFV e liderança de equipes.	Treinamento tutorado, com método misto baseado em informação, demonstração e prática, com diversificação de estratégias instrucionais focadas em aprendizagem afetiva, cognitiva e baseada em habilidades sobre conteúdo de negócios, interpessoal, intrapessoal e liderança que se referem à situação real de trabalho, com diversificação de exercícios e sem avaliação formal de aprendizagem.	Sim	1. Elaborar fluxo de valor MFV; 2. Coordenar equipes de time Kaizen; 3. Aplicar melhoria de processo; 4. Aplicar os princípios da liderança Lean nas suas rotinas com a equipe de melhoria; 5. Conduzir as equipes de melhoria (kaizen) do projeto primeira escolha, aplicando os princípios da liderança lean; 6. Compreender o conceito de Mindset; 7. Identificar os dois tipos de mindset; 8. Caracterizar os dois tipos de mindset; 9. Desenhar o Mapa de Fluxo de Valor - MFV; 10. Propor metas de solução de problemas que será trabalhado na etapa Selo Azul; 11. Compreender a importância da aplicação do MFV nas unidades, visando a melhoria da eficiência dos processos e do desenvolvimento das equipes de solução de problemas.	Os objetivos de desempenho esperados do egresso após a participação no curso precisam ser melhor descritos para apoiar o potencial de desenvolvimento dos CHAs nele previstos.

Appendix D

Questionnaires of content validation by judges

Figure D1

Instrument for TCOIPS scale items content validation by judges using CVC method

FORMULÁRIO DE VALIDAÇÃO DE CONTEÚDO POR JUÍZES DE QUESTIONÁRIO EM PESQUISA CIENTÍFICA ACADÊMICA OBJETIVO DA PESQUISA: Avaliar a contribuição de um treinamento estratégico sobre os resultados de um programa de inovação em processos no setor público.				
PLANEJAMENTO DA MELHORIA DE DESEMPENHO DE UM PROCESSO PRODUTIVO	**1) CLAREZA DA LINGUAGEM**	**2) PERTINÊNCIA PRÁTICA**	**3) RELEVÂNCIA TEÓRICA**	**OBERVAÇÕES**
Definição do processo produtivo a ser trabalhado em um projeto de melhoria contínua com o uso de ferramentas de desenho de processo.				
Identificação de quem fará parte da equipe em um projeto de melhoria contínua de processos.				
Especificação de qual indicador será usado para mensuração e controle da efetividade de melhorias de processo.				
Diagnóstico de erros e desperdícios no processo produtivo como oportunidades de melhoria no ambiente de trabalho.				
Definição das causas que geram mais impacto nos resultados finais do processo produtivo (causas prioritárias ou raiz) a partir da aplicação de ferramentas como o Diagrama de Ishikawa.				
Demonstração da variabilidade do processo produtivo com base no comportamento dos seus indicadores.				
GERAÇÃO DE SOLUÇÕES PARA MELHORIA DO DESEMPENHO DE UM PROCESSO PRODUTIVO	**1) CLAREZA DA LINGUAGEM**	**2) PERTINÊNCIA PRÁTICA**	**3) RELEVÂNCIA TEÓRICA**	**OBERVAÇÕES**
Compartilhamento, com os colegas de trabalho, das experiências bem-sucedidas de redução de perdas e desperdícios em processos.				
Criação de valor para o cliente ao propor soluções inovadoras em processos produtivos.				
Proposição de metas de solução de problemas (contramedidas) por meio da análise de fluxo de valor de um processo produtivo.				
Detalhamento de um plano de trabalho para implementação de melhorias de processo com o uso de ferramentas como 5W2H.				
IMPLEMENTAÇÃO DE SOLUÇÕES PARA MELHORIA DO DESEMPENHO DE UM PROCESSO PRODUTIVO	**1) CLAREZA DA LINGUAGEM**	**2) PERTINÊNCIA PRÁTICA**	**3) RELEVÂNCIA TEÓRICA**	**OBERVAÇÕES**
Implementação de melhorias em processos produtivos a partir da aplicação de técnicas de definição, mensuração e análise de processos.				
Melhoria do desempenho de um processo produtivo no ambiente de trabalho após otimização do seu fluxo de valor.				
Proposição de mudanças em estratégias de melhoria de processos visando a criação de valor para o cliente, a partir do monitoramento da sua efetividade.				
LIDERANÇA DE EQUIPES PARA CULTURA DE MELHORIA CONTÍNUA	**1) CLAREZA DA LINGUAGEM**	**2) PERTINÊNCIA PRÁTICA**	**3) RELEVÂNCIA TEÓRICA**	**OBERVAÇÕES**
Construção do relatório A3 contendo a descrição de todas as etapas do processo de aplicação de melhoria contínua.				
Condução dos colegas de trabalho para o atingimento de metas de melhoria de um processo produtivo no ambiente de trabalho.				
Fortalecimento da cultura de melhoria contínua a partir da comunicação participativa, ativa e colaborativa com os colegas de trabalho.				
Mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a melhoria contínua de processos nos Correios.				
Reconhecimento social do alcance de resultados obtidos pelos colegas de trabalho com a aplicação de métodos e técnicas de melhoria contínua de processos.				
NOME DO AVALIADOR (JUIZ) DE CONTEÚDO:				
DATA DA AVALIAÇÃO:				

Figure D2

Instrument for TCOIPS scale content categories validation by judges

FORMULÁRIO DE VALIDAÇÃO DE CATEGORIAS DE CONTEÚDO POR JUÍZES DE QUESTIONÁRIO EM PESQUISA CIENTÍFICA ACADÊMICA	
INSTRUÇÕES PARA PREENCHIMENTO:	
OBJETIVO DA PESQUISA: Avaliar a contribuição de um treinamento estratégico sobre os resultados de um programa de inovação em processos no setor público. 1. Leia atentamente cada afirmativa nos itens abaixo e, segundo sua opinião e a descrição a seguir, **escolha na lista suspensa em cada espaço disponível na coluna C a categoria de conteúdo** a que ele pertence e registre o número correspondente à categoria escolhida. 2. Caso julgue necessário, por favor, utilize o espaço disponível na coluna D para inserir sugestões de melhorias para as afirmativas de cada item.	

CATEGORIAS DE CONTEÚDO DAS HABILIDADES DESENVOLVIDAS PELO TREINAMENTO PRIMEIRA ESCOLHA:		DEFINIÇOES DO CONJUNTO DE HABILIDADES:
(1)	Planejamento da melhoria de processos	Refere-se ao conjunto de habilidades de definição dos componentes essenciais de um projeto de melhoria contínua (processo, equipe, indicador), mensuração e análise do estado atual do processo produtivo que será melhorado.
(2)	Geração de soluções inovadoras	Refere-se ao conjunto de habilidades de cocriação de soluções inovadoras para melhoria do desempenho de um processo produtivo, a partir da utilização de conhecimentos sobre melhoria contínua e o estado atual do processo produtivo que será melhorado.
(3)	Implementação de soluções inovadoras	Refere-se ao conjunto de habilidades de execução de soluções inovadoras para melhoria do desempenho de um processo produtivo e o controle da sua efetividade visando sua estabilização no ambiente de trabalho.
(4)	Liderança de equipes para cultura de melhoria contínua	Refere-se ao conjunto de habilidades de mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a implementação de soluções inovadoras pela melhoria contínua de processos
		OBSERVAÇÕES SOBRE APRIMORAMENTO DAS DEFINIÇÕES DO CONJUNTO DE HABILIDADES:

QUESTIONÁRIO

HABILIDADES DESENVOLVIDAS PELO TREINAMENTO PRIMEIRA ESCOLHA	CATEGORIAS DE CONTEÚDO DAS HABILIDADES DESENVOLVIDAS PELO TREINAMENTO PRIMEIRA ESCOLHA	OBSERVAÇÕES SOBRE APRIMORAMENTO DOS ITENS
Construção do relatório A3 contendo a descrição de todas as etapas do processo de aplicação de melhoria contínua.		
Melhoria do desempenho de um processo produtivo no ambiente de trabalho após otimização do seu fluxo de valor.		
Mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a melhoria contínua de processos nos Correios.		
Diagnóstico de erros e desperdícios no processo produtivo como oportunidades de melhoria no ambiente de trabalho.		
Condução dos colegas de trabalho para o atingimento de metas de melhoria de um processo produtivo no ambiente de trabalho.		
Demonstração da variabilidade do processo produtivo com base no comportamento dos seus indicadores.		
Compartilhamento, com os colegas de trabalho, das experiências bem-sucedidas de redução de perdas e desperdícios em processos.		
Fortalecimento da cultura de melhoria contínua a partir da comunicação participativa, ativa e colaborativa com os colegas de trabalho.		
Proposição de metas de solução de problemas (contramedidas) por meio da análise de fluxo de valor de um processo produtivo.		
Detalhamento de um plano de trabalho para implementação de melhorias de processo com o uso de ferramentas como 5W2H.		
Reconhecimento social do alcance de resultados obtidos pelos colegas de trabalho com a aplicação de métodos e técnicas de melhoria contínua de processos.		
Identificação de quem fará parte da equipe em um projeto de melhoria contínua de processos.		
Proposição de mudanças em estratégias de melhoria de processos visando a criação de valor para o cliente, a partir do monitoramento da sua efetividade.		
Implementação de melhorias em processos produtivos a partir da aplicação de técnicas de definição, mensuração e análise de processos.		
Definição das causas que geram mais impacto nos resultados finais do processo produtivo (causas prioritárias ou raiz) a partir da aplicação de ferramentas como o Diagrama de Ishikawa.		
Criação de valor para o cliente ao propor soluções inovadoras em processos produtivos.		
Especificação de qual indicador será usado para mensuração e controle da efetividade de melhorias de processo.		
Definição do processo produtivo a ser trabalhado em um projeto de melhoria contínua com o uso de ferramentas de desenho de processo.		

NOME DO(A) AVALIADOR(A) DE CONTEÚDO:	
DATA DA AVALIAÇÃO:	

Appendix E

Content categories definitions

Content categories of skill sets developed by training	*Variable*	*Items*	*Preliminary definitions of skill sets*	*Judges' comments and suggestions*	*Is there a need to change?*	*Adjusted skill set definitions after validation by judges*
1	Planejamento da melhoria de processos	PLAN	1 a 5	Refere-se ao conjunto de habilidades de definição dos componentes essenciais de um projeto de melhoria contínua (processo, equipe, indicador), mensuração e análise do estado atual do processo produtivo que será melhorado.	Sugestão de texto: Refere-se ao conjunto de habilidades relacionadas com a definição/escopo de um projeto de melhoria contínua (processo, equipe, indicador), mensuração e análise do estado atual do processo produtivo que será melhorado.	Sim	Refere-se ao conjunto de habilidades relacionadas com a definição e o escopo de um projeto de melhoria contínua (processo, equipe, indicador), mensuração e análise do estado atual do processo de trabalho que será melhorado.
2	Geração de soluções inovadoras	IDEA	7, 9	Refere-se ao conjunto de habilidades de cocriação de soluções inovadoras para melhoria do desempenho de um processo produtivo, a partir da utilização de conhecimentos sobre melhoria contínua e o estado atual do processo produtivo que será melhorado.	Por que só cocriação? Não pode ser criação e/ou implementação de soluções inovadoras?	Sim	Refere-se ao conjunto de habilidades de criação e cocriação de soluções inovadoras para melhoria do desempenho de um processo de trabalho, a partir da utilização de conhecimentos sobre seu estado atual e melhoria contínua de processos.
3	Implementação de soluções inovadoras	IMPLE	10, 11 e 14	Refere-se ao conjunto de habilidades de execução de soluções inovadoras para melhoria do desempenho de um processo produtivo e o controle da sua efetividade visando sua estabilização no ambiente de trabalho.	Obs: Senti falta de uma categoria envolvendo a Avaliação de soluções inovadoras, pois entendo que esta é fundamental. O controle você dispõe juntamente com a implementação, mas e a retroalimentação dos projetos/processos por meio do monitoramento e avaliação?	Sim	Refere-se ao conjunto de habilidades de organização para implementação e conseguinte execução de soluções inovadoras para melhoria do desempenho de um processo de trabalho.

4	Estabilização dos resultados atingidos com soluções inovadoras	ESTAB	6, 8, 12, 13	(nova categoria)	(proposta de nova categoria a partir do comentário do juiz na categoria 3)	Sim	Refere-se ao conjunto de habilidades de controle, monitoramento e avaliação da efetividade dos resultados de soluções inovadoras em processos de trabalho, visando sua estabilização no ambiente organizacional.
5	Liderança de equipes para cultura de melhoria contínua	LIDER	15 a 18	Refere-se ao conjunto de habilidades de mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a implementação de soluções inovadoras pela melhoria contínua de processos.	Sugestão de texto: Refere-se ao conjunto de habilidades de mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a implementação e difusão de soluções inovadoras para melhoria contínua dos processos.	Sim	Refere-se ao conjunto de habilidades de mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a implementação e difusão de soluções inovadoras para melhoria contínua dos processos.

Appendix F

Content validity coefficient results

Item	*CVC*				*Theoretical dimension*			
	LC	*PP*	*TR*	*CVCt*	*PLAN*	*IDEA*	*IMPLE*	*LIDER*
1. Definição do processo produtivo a ser trabalhado em um projeto de melhoria contínua com o uso de ferramentas de desenho de processo.	0,77	0,83	0,80	0,80	6	1	0	0
2. Identificação de quem fará parte da equipe em um projeto de melhoria contínua de processos.	0,83	0,90	0,73	0,82	6	0	0	1
3. Especificação de qual indicador será usado para mensuração e controle da efetividade de melhorias de processo.	0,70	0,87	0,80	0,79	5	0	2	0
4. Diagnóstico de erros e desperdícios no processo produtivo como oportunidades de melhoria no ambiente de trabalho.	0,83	0,93	0,83	0,87	5	0	0	2
5. Definição das causas que geram mais impacto nos resultados finais do processo produtivo (causas prioritárias ou raiz) a partir da aplicação de ferramentas como o Diagrama de Ishikawa.	0,83	0,97	0,87	0,89	4	2	1	0
6. Demonstração da variabilidade do processo produtivo com base no comportamento dos seus indicadores.	0,80	0,93	0,83	0,86	2	0	5	0
7. Compartilhamento, com os colegas de trabalho, das experiências bem-sucedidas de redução de perdas e desperdícios em processos.	0,83	0,87	0,80	0,83	0	1	1	5
8. Criação de valor para o cliente ao propor soluções inovadoras em processos produtivos.	0,93	0,93	0,83	0,90	1	3	3	0
9. Proposição de metas de solução de problemas (contramedidas) por meio da análise de fluxo de valor de um processo produtivo.	0,90	0,93	0,73	0,86	1	6	0	0
10. Detalhamento de um plano de trabalho para implementação de melhorias	0,87	0,87	0,83	0,86	5	1	1	0

de processo com o uso de ferramentas como 5W2H.								
11. Implementação de melhorias em processos produtivos a partir da aplicação de técnicas de definição, mensuração e análise de processos.	0,87	0,93	0,87	0,89	0	1	6	0
12. Melhoria do desempenho de um processo produtivo no ambiente de trabalho após otimização do seu fluxo de valor.	0,87	0,90	0,80	0,86	0	3	3	0
13. Proposição de mudanças em estratégias de melhoria de processos visando a criação de valor para o cliente, a partir do monitoramento da sua efetividade.	0,80	0,96	0,84	0,87	0	6	1	0
14. Construção do relatório A3 contendo a descrição de todas as etapas do processo de aplicação de melhoria contínua.	0,87	0,90	0,87	0,88	3	2	2	0
15. Condução dos colegas de trabalho para o atingimento de metas de melhoria de um processo produtivo no ambiente de trabalho.	0,80	0,87	0,83	0,83	0	0	0	7
16. Fortalecimento da cultura de melhoria contínua a partir da comunicação participativa, ativa e colaborativa com os colegas de trabalho.	0,97	0,90	0,80	0,89	0	0	0	7
17. Mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a melhoria contínua de processos no(a) _____.[9]	0,87	0,90	0,77	0,84	0	0	0	7
18. Reconhecimento social do alcance de resultados obtidos pelos colegas de trabalho com a aplicação de métodos e técnicas de melhoria contínua de processos.	0,80	0,88	0,84	0,84	0	0	0	7
CVC TOTAL	0.84	0.90	0.82	0.85				

Note: LC, language clarity; PP, practical pertinence; TR, theoretical relevance; PLAN, process improvement planning; IDEA, innovative solutions generation; IMPLE, innovative solutions implementation; LIDER, team leadership for a culture of continuous improvement

[9] This space refers to the name of the organization studied, which was suppressed of this thesis text.

Appendix G

Research instrument used in the survey applied on study 4

IMPACTO DO TREINAMENTO _____ NO TRABALHO DO EGRESSO

Prezado (a) participante,

Você está sendo convidado(a) a participar, como voluntário(a), de uma pesquisa sobre o impacto do treinamento _____ no trabalho dos egressos e os efeitos organizacionais da participação em um programa de inovação em processos. Esta pesquisa é parte do projeto de tese do doutorando Sérgio Ricardo de Castro Gonçalves, orientado pela profa. Dra. Gardênia da Silva Abbad.

A avaliação da efetividade do treinamento _____ é uma parceria de pesquisa entre o grupo de Pesquisa Impacto, do Programa de Pós-Graduação em Administração da Universidade de Brasília, e a Universidade Corporativa _____.

A sua participação consiste em responder os itens contidos no questionário **Impacto do Treinamento _____ no Trabalho do Egresso**, após a aceitação do termo de consentimento livre e esclarecido. O tempo necessário para o preenchimento deste questionário foi estimado em 15 minutos.

As suas respostas individuais serão mantidas em sigilo e os resultados serão analisados e apresentados de modo agrupado sob a forma de relatórios técnicos e científicos que possibilitarão o aprimoramento de treinamentos sobre melhoria de processos. A qualquer momento você poderá desistir de participar da pesquisa, sem qualquer implicação ou prejuízo a si próprio.

Consentimento

Tendo em vista o exposto, eu, de forma livre e esclarecida, manifesto meu consentimento em participar desta atividade.

( ) Sim

( ) Não

Bloco 1 – Contribuição de Treinamento para Inovação Organizacional no Setor Público – TCOIPS

Assinale qual(is) treinamento(s) você concluiu dentro do Programa _____:

( ) Faixa Amarela (ou Selo Amarelo)
( ) Faixa Azul (ou Selo Azul)

Instruções:

A seguir, você encontrará uma lista de desempenhos esperados no trabalho, após sua participação no(s) curso(s) do Programa _____. Para responder às questões desse bloco,

assinale na escala a seguir o número que melhor expressa sua opinião sobre **em que medida o(s) treinamento(s) _____ contribuiu(íram) para a melhoria de processos no seu ambiente de trabalho**, nos aspectos descritos em cada item.

0	1	2	3	4
NENHUMA CONTRIBUIÇÃO	POUCA CONTRIBUIÇÃO	MÉDIA CONTRIBUIÇÃO	MUITA CONTRIBUIÇÃO	ENORME CONTRIBUIÇÃO

N	ITEM
1	Definição do processo produtivo a ser trabalhado em um projeto de melhoria contínua com o uso de ferramentas de desenho de processo.
2	Identificação de quem fará parte da equipe em um projeto de melhoria contínua de processos.
3	Especificação de qual indicador será usado para mensuração e controle da efetividade de melhorias de processo.
4	Diagnóstico de erros e desperdícios no processo produtivo como oportunidades de melhoria no ambiente de trabalho.
5	Definição das causas que geram maior impacto nos resultados finais do processo produtivo (causas prioritárias ou raiz) a partir da aplicação de ferramentas como o Diagrama de Ishikawa.
6	Demonstração da variabilidade do processo produtivo com base no comportamento dos seus indicadores.
7	Compartilhamento, com os colegas de trabalho, das experiências bem-sucedidas de redução de perdas e desperdícios em processos.
8	Criação de valor para o cliente ao propor soluções inovadoras em processos produtivos.
9	Proposição de metas de solução de problemas (contramedidas) por meio da análise de fluxo de valor de um processo produtivo.
10	Detalhamento de um plano de trabalho para implementação de melhorias de processo com o uso de ferramentas como 5W2H.
11	Implementação de melhorias em processos produtivos a partir da aplicação de técnicas de definição, mensuração e análise de processos.
12	Melhoria do desempenho de um processo produtivo no ambiente de trabalho após otimização do seu fluxo de valor.
13	Proposição de mudanças em estratégias de melhoria de processos visando a criação de valor para o cliente, a partir do monitoramento da sua efetividade.
14	Construção do relatório A3 contendo a descrição de todas as etapas do processo de aplicação de melhoria contínua.
15	Condução dos colegas de trabalho para o atingimento de metas de melhoria de um processo produtivo no ambiente de trabalho.
16	Fortalecimento da cultura de melhoria contínua a partir da comunicação participativa, ativa e colaborativa com os colegas de trabalho.
17	Mobilização dos colegas de trabalho para a manutenção dos resultados alcançados com a melhoria contínua de processos na empresa.
18	Reconhecimento social do alcance de resultados obtidos pelos colegas de trabalho com a aplicação de métodos e técnicas de melhoria contínua de processos.

Antes de realizar o treinamento _____, você possuía os conhecimentos e habilidades necessários e suficientes para realizar atividades de melhoria contínua em processos produtivos?
( ) Sim
( ) Não

Bloco 2 – Impacto em amplitude do treinamento no desempenho dos egressos - IMPACT.

Instruções:

Para responder as questões deste bloco, analise cuidadosamente cada item e marque o ponto da escala que melhor descreve a sua percepção quanto ao impacto do(s) treinamento(s) _____ no seu trabalho.

0	1	2	3	4
DISCORDO TOTALMENTE	DISCORDO POUCO	NEM CONCORDO NEM DISCORDO	CONCORDO MUITO	CONCORDO TOTALMENTE

N	Item
1	Utilizo, com frequência, em meu trabalho atual, o que foi ensinado no(s) treinamento(s) _____.
2	Aproveito as oportunidades que tenho para colocar em prática o que me foi ensinado no(s) treinamento(s) _____.
3	As habilidades que adquiridas no(s) treinamento(s) _____ a fizeram com que eu cometesse menos erros em meu trabalho e em atividades relacionadas ao conteúdo do programa.
4	Recordo-me bem dos conteúdos ensinados no(s) treinamento(s) _____.
5	Quando aplico o que aprendi no(s) treinamento(s) _____, executo meu trabalho com maior rapidez.
6	A qualidade do meu trabalho melhorou nas atividades diretamente relacionadas ao conteúdo do(s) treinamento(s) _____.
7	A qualidade do meu trabalho melhorou mesmo naquelas atividades que não pareciam estar relacionadas ao conteúdo do(s) treinamento(s) _____.
8	Minha participação no(s) treinamento(s) _____ serviu para aumentar minha motivação para o trabalho.
9	Minha participação no(s) treinamento(s) _____ aumentou minha autoconfiança (agora tenho mais confiança na minha capacidade de executar meu trabalho com sucesso).
10	Após minha participação no(s) treinamento(s) _____, tenho sugerido, com maior frequência, mudanças nas rotinas de trabalho.
11	O(s) treinamento(s) _____ me tornou(ram) mais receptivo(a) a mudanças no trabalho.
12	O(s) treinamento(s) _____ beneficiou(aram) meus colegas de trabalho, que aprenderam comigo novas habilidades.

Bloco 3 - Suporte psicossocial à transferência de treinamento para o trabalho do egresso

Instruções:
Para responder às questões deste bloco, analise cuidadosamente cada afirmativa e **avalie o apoio que você vem recebendo dos colegas e chefias para aplicar no trabalho** aquilo que você aprendeu no(s) treinamento(s) _____.

0	1	2	3	4
DISCORDO TOTALMENTE	DISCORDO POUCO	NEM CONCORDO NEM DISCORDO	CONCORDO MUITO	CONCORDO TOTALMENTE

N	Item
1	Tenho recebido elogios quando aplico corretamente no trabalho as novas habilidades que aprendi no(s) treinamento(s) _____.
2	Meus colegas mais experientes apoiam as tentativas que faço de usar no trabalho o que aprendi no(s) treinamento(s) _____.
3	Tenho sido encorajado pelo meu gestor imediato a aplicar, no meu trabalho, o que aprendi no(s) treinamento(s) _____.
4	Meu gestor imediato tem criado oportunidades para que eu aplique no trabalho as habilidades aprendidas no(s) treinamento(s) _____.
5	As metas de trabalho estabelecidas pelo meu gestor encorajam-me a aplicar no trabalho o que aprendi no(s) treinamento(s) _____.
6	Tenho tido oportunidades de usar no meu trabalho as habilidades que aprendi no(s) treinamento(s) _____.

Bloco 4 – Efeitos organizacionais da participação em um Programa de Inovação em Processos (EOPIP)

Questionário sobre os Efeitos Organizacionais de um Programa de Inovação em Processos

A seguir, você encontrará um conjunto de perguntas relacionadas aos efeitos esperados do programa _____. Por favor, responda cada questão refletindo sobre os resultados obtidos na unidade organizacional que recebeu uma aplicação do Programa _____ no ambiente de trabalho com sua **participação em um ciclo completo (treinamento, aplicação e reconhecimento)**.

1. Diga, dentre as opções a seguir, em qual tipo de processo produtivo _____ você aplicou os conhecimentos, habilidades e atitudes aprendidos no treinamento do Programa _____:

   ( ) Processos da área fim (operação ou vendas)

( ) Processos da área meio (todas as demais áreas de suporte às áreas fim)

2. Na sua opinião, a etapa de **aplicação** do programa _____ o estimulou a esforçar-se para concluir a implementação de soluções inovadoras que criam valor para o cliente do processo?
   ( ) Sim
   ( ) Não

3. Na sua opinião, a etapa de **reconhecimento** do programa _____ (premiação, divulgação dos resultados da equipe, registro profissional) o estimulou a esforçar-se para concluir a implementação de soluções inovadoras que criam valor para o cliente do processo?
   ( ) Sim
   ( ) Não

4. Cite melhorias de processo implementadas na empresa em decorrência da aplicação do Programa _____. (questão não obrigatória)
   _____
   _____

5. As melhorias de processo implantadas durante a sua participação no Programa _____ permanecem em uso na empresa?
   ( ) Sim
   ( ) Não

6. Cite até dois fatores **facilitadores** da implantação de melhorias de processo durante o período de aplicação do Programa _____ na empresa. (questão não obrigatória)
   _____
   _____

7. Cite até duas **barreiras** (restrições) que impediram a implantação de melhorias de processo criadas durante a aplicação do Programa _____. (questão não obrigatória)
   _____
   _____

Bloco 5 – Dados sociodemográficos e profissionais

Dados sociodemográficos e profissionais

Instruções:

Escolha a resposta que representa a sua situação atual e complemente os dados solicitados.

1. **O último nível de escolaridade concluído por você:**
   ( ) Ensino médio
   ( ) Graduação
   ( ) Pós-graduação
   ( ) Mestrado

( ) Doutorado

2. **Sexo:**
   ( ) Feminino
   ( ) Masculino

3. **Sua faixa etária:**
   ( ) De 18 a 22 anos
   ( ) De 23 a 27 anos
   ( ) De 28 a 32 anos
   ( ) De 33 a 37 anos
   ( ) De 38 a 42 anos
   ( ) De 43 a 47 anos
   ( ) De 48 a 52 anos
   ( ) De 53 a 57 anos
   ( ) De 58 a 62 anos
   ( ) Acima de 63 anos

4. Qual é o seu tempo de serviço _____, em anos?
   [____]

5. **Você possui função gratificada?**
   ( ) Sim
   ( ) Não

6. **Você trabalha em qual estado brasileiro?**

   (lista com todas as siglas de estados brasileiros para livre escolha de uma opção)

8. Em qual ano você participou do Programa _____?
   ( ) 2018
   ( ) 2019

9. Qual foi o papel mais abrangente que você desempenhou no Programa _____?
   ( ) Coordenador do Programa _____.
   ( ) Especialista _____ (Multiplicador do treinamento e líder de equipe)
   ( ) Agente de melhoria de processos (Time Kaizen)