

INFLUENCE OF INTELLECTUAL CAPITAL AND INDIVIDUAL ABSORPTIVE CAPACITY ON INNOVATION PERFORMANCE

INFLUÊNCIA DO CAPITAL INTELECTUAL E DA CAPACIDADE DE ABSORÇÃO INDIVIDUAL NO DESEMPENHO DA INOVAÇÃO

Submission: 17/12/2021

Accept: 17/03/2022

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ABSTRACT

Purpose: The objective of this research was to identify the existence of a relationship between intellectual capital, individual absorptive capacity and the innovation performance of the Federal Institute of Santa Catarina's technical-administrative civil servants.

Methodology: Self-administered questionnaires were used as a data collection instrument, applied to the institution's technical-administrative staff, resulting in a sample of 314 respondents. In the data analysis, structural equation modeling was used. The final quantitative analysis structure resulted in 28 variables, distributed among the constructs proposed by the research.

Relevance: the relevance of the study lies in the fact that individuals play a role in the creation, transfer and absorption of knowledge, thus factors at the individual level represent an antecedent for performance; therefore, at the time when the codification of knowledge occurs or expands, through assimilation, acquisition, transformation and application, a direct contribution to increasing organizational effectiveness also occurs.

Results: The results showed that human capital, structural capital and relational capital influence the individual absorptive capacity, from the perspective of the institution's technical-administrative staff, with the most relevant relationship being that of human capital.

Originality/Theoretical contribution: The responses indicated that the innovation performance – analyzed based on the creation and implementation of ideas – is influenced by the individual absorptive capacity. Therefore, through the results obtained, contributions to management were proposed that could contribute to the influence between the constructs, and consequently, to the individual and organizational performance.

Keywords: Intellectual capital. Individual absorptive capacity. Innovation performance. Educational institution. Structural Equation Modeling.

RESUMO

Objetivo: O objetivo desta pesquisa foi identificar a existência de uma relação entre capital intelectual, capacidade de absorção individual e o desempenho em inovação dos servidores técnico-administrativos do Instituto Federal de Santa Catarina.

Metodologia: Utilizou-se como instrumento de coleta de dados questionários autoaplicáveis, aplicados ao corpo técnico-administrativo da instituição, resultando em uma amostra de 314 respondentes. Na análise dos dados, foi utilizada a modelagem de equações estruturais. A estrutura final de análise quantitativa resultou em 28 variáveis, distribuídas entre os construtos propostos pela pesquisa.

Relevância: a relevância do estudo reside no fato de os indivíduos desempenharem um papel na criação, transferência e absorção do conhecimento, portanto, fatores no nível individual representam um antecedente para o desempenho; portanto, no momento em que a codificação do conhecimento ocorre ou se expande, por meio da assimilação, aquisição, transformação e aplicação, ocorre também uma contribuição direta para o aumento da eficácia organizacional.

Resultados: Os resultados mostraram que capital humano, capital estrutural e capital relacional influenciam a capacidade de absorção individual, na perspectiva do corpo técnico-administrativo da instituição, sendo a relação mais relevante a do capital humano.

Originalidade/Contribuição teórica: As respostas indicaram que o desempenho da inovação – analisado a partir da criação e implementação de ideias – é influenciado pela capacidade de absorção individual. Portanto, por meio dos resultados obtidos, foram propostas contribuições para a gestão que possam contribuir para a influência entre os construtos e, conseqüentemente, para o desempenho individual e organizacional.

Palavras-chave: Capital intelectual. Capacidade de absorção individual. Desempenho de inovação. Instituição de Ensino Superior. Modelagem de Equações Estruturais.

1 INTRODUCTION

Institutions must be able to identify opportunities and capture external knowledge that represent an element that generates intelligence by enabling the adaptation and optimization of activities carried out in the organizational framework (Yildiz, Murtic, Zander & Richnér, 2019). Thus, for both the individual's common life and the economic, social and cultural policies of nations, groups of countries and even borderless realities are influenced by the forms of access, production, distribution and application of knowledge. There is an almost deterministic belief in knowledge as an economic input of relevant strategic importance for the competitiveness of individuals, companies, business corporations and for developed countries (Soares, Lima, Mazon, Scafuto & Agostineto, 2019; Lima, Serra, Soares & Lima, 2020; Leite, Padilha & Binotto, 2021; Perdoná & Soares, 2021).

According to Engelman et al. (2017), the intangible internal resources are linked to the process of knowledge creation, that is, intellectual capital, as well as absorptive capacity. Stewart (1998) conceptualizes intellectual capital as the sum of knowledge of all members of a company, generating organizational competitive advantage, whose character and sustainability are influenced by the absorptive capacity (Sedoglavich, Akoorie & Pavlovich, 2015).

For Yildiz et al. (2019), the user's absorption capacity, besides expanding pre-existing stocks of resources, also creates new resources. The authors further report that exploring newly acquired knowledge in the everyday tasks helps organizational members set up routines that perform tasks with newly acquired knowledge and create new knowledge. Nevertheless, the users' ability to apply knowledge can be increased by sharing activities across departments, teams and the organization. Therefore, Lowik, Kraaijenbrink and Groen (2016) define absorptive capacity as individual activities of recognition, assimilation, transformation and application of new external knowledge.



In this way, assimilation activities allow the knowledge recognized and acquired at the individual level to be adapted to the organizational context, making it understandable and transferable to other members of the organization, with the last phase – application at the individual level – comprising the internalization of the new knowledge in daily work activities (Yildiz et al., 2019).

In this connection, Lane, Koka and Pathak (2006) corroborate by stating that organizational processes and routines are essential to absorptive capacity, given that these elements make it possible to share, communicate and transfer knowledge. Thus, in addition to the role of knowledge-intensive teams in the development of innovation, their ability to acquire new external knowledge stands out as an essential competence, trying to ensure a continuous flow of ideas to enable the teams' learning processes (Lowik; Kraaijenbrink & Groen, 2016). Such learning from external knowledge can, according to Sung and Choi (2012) increase the team's creativity as well as its performance (Bresman, 2010). While a few years ago, the IC debate was about the starting of the knowledge economy, the search for increasing economic value. Today the knowledge economy represents a consolidated concept, and a new paradigm is emerging based on an economy in which sustainability and worth represent the core values. Organizations are employing new business models to create value that also embraces a sustainable perspective (Edvinsson et al, 2021).

Thus, given the framework described, a question that grounds this research arises: What is the relationship between intellectual capital, individual absorptive capacity and the innovation performance of the technical-administrative civil servants of the Federal Institute of Santa Catarina? The objective is to review the relationship between intellectual capital, individual absorptive capacity and the innovation performance of the technical-administrative civil servants of the Federal Institute of Santa Catarina.

The present study's covers a public institution, which technological advances demand innovative tools and, consequently, improvement in the knowledge of public servants (Hilgers; Ihl, 2010). It should be noted, however, that although the transfer of knowledge is rare in these organizations, since their agents often associate knowledge with power and the opportunity for promotion, self-storing, the intellectual capital management can help to disseminate knowledge, in addition to improving officials' performance, reducing rework and increasing productivity (Catto & Maccari, 2021).

In the literature, studies have been conducted on absorptive capacity; however, these are biased in relation to antecedents and consequences at the macro level, which obscures the role of individual factors. (Yildiz, et al, 2019). Individuals play a crucial role in knowledge creation, transfer, and absorption, which suggests that factors at the individual level represent a critical antecedent to performance (Yildiz et al., 2019). From the moment knowledge codification occurs or is expanded, through assimilation, acquisition, transformation and application, there is also a direct contribution to the increase of organizational effectiveness as a dynamic capacity, capable of producing and sustaining competitive advantages (Bolisani & Bratianu, 2018).

With view at identifying the existence of a relationship between intellectual capital and individual absorptive capacity, as well as its relationship with the innovation performance of the civil servants of the Federal Institute of Santa Catarina, it is necessary to outline the hypotheses, based on the literature that has tangentially addressed the subject and, consequently, develop the conceptual analysis model of this research. The constructs analyzed need to consider the context. Several innovation studies point out differences in turbulent x non turbulent environments concerning ACAP and Innovation, once there is the contextual particularity of the research environment, that is a Public University. The literature review is presented below.



2 LITERATURE REVIEW

For Flores, García and Adame (2017), intellectual capital integrates the tacit and explicit knowledge of the organization's members, such as their skills, talents, network of collaborators, external links, recognition by society, processes, innovation capacity, record of patents, among others.

The affinity between intellectual capital (IC) efficiency and different dimensions of business performance, exist a positive connection of IC with companies' financial and economic performance, whereas it is non-significant with market valuation (Bhattacharjee and Akter, 2021).

Jenoveva (2016) reports, therefore, that the organization that aims to improve its absorptive capacity needs to invest in the development of its employees' absorptive capacity, through activities such as qualification and training, thus aggregating different individual absorptive capacities. Also, for the author, since the organization's absorptive capacities concern their employees, the latter level of education, experience and training positively influences the level of companies' absorptive capacity. In this connection, the company's absorptive capacity is a human capital resource, which is developed through the individual absorptive capacity of the organization's employees (Tian & Soo, 2018).

In relation to structural capital, Engelman, Fracasso, Schmidt & Carneiro (2017) highlight it as the processes and procedures formed by the intellectual input of the company's employees. Therefore, organizations must develop the necessary structures to share the knowledge of their employees, allowing its use within the company (Sjödin & Frishammar, 2015).

With regard to relational capital, Engelman, et al (2017) report that it refers to the interaction between individuals and seeks to improve the exchange of information and the sharing of ideas, enhancing existing knowledge, besides allowing new knowledge to spread in the organization. The companies must make decisions in line with their dynamic capabilities as a way to reach better business performance (Barbosa, et al, 2021) and the dynamic capabilities help to develop innovation capability (Froehlich & Bitencourt, 2019).

Therefore, relational capital can influence the sources of knowledge, which are the antecedents of absorptive capacity and which are related to the variety and complementarity of the knowledge accessed. Thus, the absorptive capacity develops as the relationship with customers, partners and even competitors grows, due to access to further sources of knowledge (Silva, 2018).

Thus, the following hypotheses concerning the relationship between intellectual capital and individual absorptive capacity are hereby listed, to be tested in this study:

H1 – The individual intellectual capital of the technical-administrative staff of the Federal Institute of Santa Catarina is related to their absorptive capacity.

H1a – Human capital, from the perspective of the technical-administrative civil servants of the Federal Institute of Santa Catarina, is related to their absorptive capacity.

H1b – Structural capital, from the perspective of the technical-administrative civil servants of the Federal Institute of Santa Catarina, is related to their absorptive capacity.

H1c – Relational capital, from the perspective of the technical-administrative civil servants of the Federal Institute of Santa Catarina, is related to their absorptive capacity.

On the other hand, when it comes to the relationship between individual absorptive capacity and innovation performance, the construction of hypotheses comes from the whole range of seminal authors to contemporary authors. For Cohen and Levinthal (1990) and Zahra and George (2002), for example, absorptive capacity is an important antecedent for innovative performance. We ought to mention, though, the individual aspect in this process as highlighted by Cohen and Levinthal (1990), in which they report that to improve their performance in work-related tasks, individuals increasingly depend on their knowledge capabilities to continually innovate.



Zahra and George (2002) further consider absorptive capacity as a driver of competitive advantage based on strategic flexibility, innovation and performance. Also according to these authors – who propose the segregation of the potential and realized construct - despite the importance of the potential absorptive capacity, the realized absorptive capacity is considered the main source of performance improvements. Bolisani and Bratianu, (2018) highlight the ability of employees to transform and apply creative ideas, so that these are translated into better performance at work.

On the other hand, Lowik, Kraaijenbrink and Groen (2017) investigated, in their study, the diversity of prior knowledge, the diversity of networks and cognitive styles in relation to the individual absorptive capacity and innovation performance of employees and managers of a medium-sized Dutch company.

Intellectual resource is recognised as a key success factor in an increasingly competitive, knowledge-based economy. The intellectual resources have a significant positive impact on new product performance. Furthermore, the results reveal that innovation capability indirectly mediates the effect of intellectual resources on new product performance (Yousefi et al, 2021).

One of the authors' conclusions is that individual absorptive capacity activities mediate between individual characteristics - such as knowledge diversity, network diversity and cognitive style - and individual innovation performance. It should be noted that the structural measurement model - to test the hypothesis that individual absorptive capacity mediates between individual characteristics and individual innovation performance - showed a significant positive effect of individual absorptive capacity on the individual innovation performance (Lowik; Kraaijenbrink & Groen, 2017).

Given the above, hypotheses H2a and H2b are proposed, which seek to verify the existence of a relationship between individual absorptive capacity and innovation performance, whether in the creation of ideas or in the implementation of ideas.

H2 – The individual absorptive capacity of the Federal Institute of Santa Catarina civil servants is related to their innovation performance.

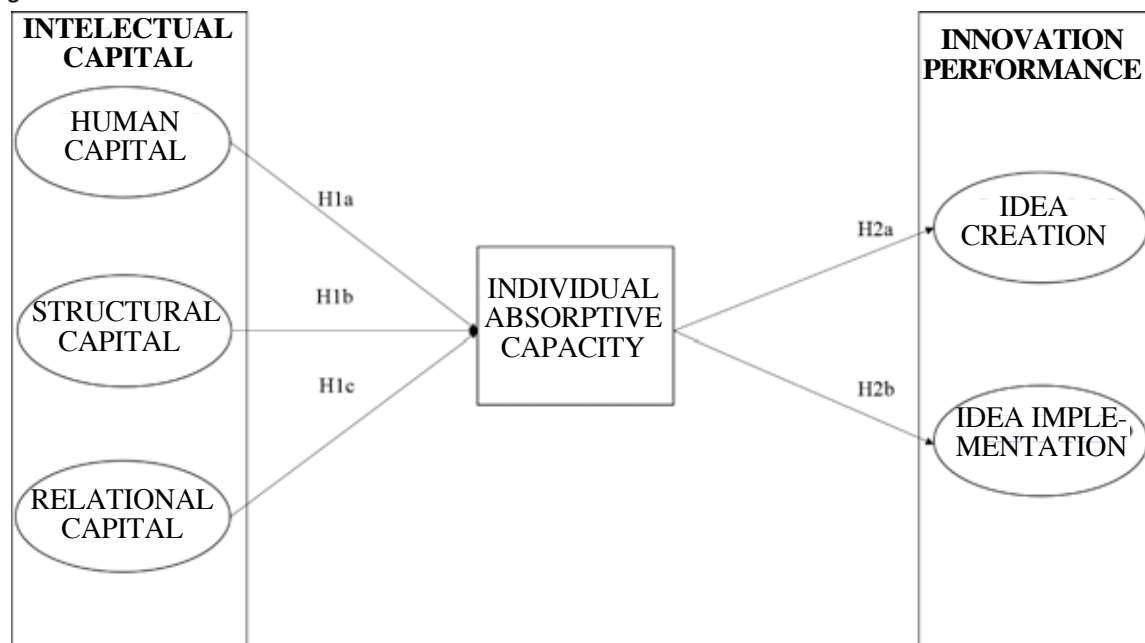
H2a - The individual absorptive capacity of the Federal Institute of Santa Catarina civil servants is related to their creation of ideas.

H2b - The individual absorptive capacity of the Federal Institute of Santa Catarina civil servants is related to their implementation of ideas.

Thus, having outlined the study hypotheses, based on the constructs concerning the study topic, the theoretical model of the research was structured, as shown in Figure 1:



Figure 1. Theoretical research model



Source: Prepared by the authors (2020).

Thus, this article seeks to identify the relationship between the dimensions of intellectual capital and individual absorptive capacity, as well as its relationship with the elements - creation and implementation of ideas - concerning the performance of individual innovation. Finally, the hypotheses proposed for this research will be verified from the quantitative data, which details regarding the sample and applied collection, treatment and analysis techniques, are presented in the next section.

3 METHODOLOGY

The research employs a quantitative, conclusive, descriptive approach, using data collection via survey through the Google Forms tool and analysis via descriptive statistics and the Partial Least Squares structural equation modeling technique. Quantitative because, according to Saunders, Lewis and Thornhill (2016), in this type of research, data collection uses standardized methods and generates numerical data, which can be analyzed through charts and statistical techniques. For the authors, the quantitative approach enables the formulation of hypotheses, which can be tested (contributing to theory development) or examined in future research. The research is conclusive as it seeks to test specific hypotheses and examine relationships. Descriptive as it seeks to describe characteristics of a given phenomenon, seeking to establish relationships between existing variables, such as trust and perceived influence.

Data were collected in a survey. For the elaboration of the collection instrument, initially, models that addressed the research topic and that had already been empirically tested were searched in the literature.

In order to be able to measure the degree of intellectual capital of each respondent, we chose to use Gracioli, et al. (2012) research instrument applied in connection with Brazilian companies. Nevertheless, the dimensions that make up the aforementioned instrument meet the proposal of this study. Because the object of this study is different, as well as its respondent public, there was a need to adapt the localization of some questions.

Regarding the absorptive capacity construct, we chose to use the Lowik, Kraaijenbrink and Groen (2016) model, in which the individual absorptive capacity is conceptualized as a multidimensional construct, which consists of individual activities of recognition, assimilation, transformation and application of new external knowledge. As with the intellectual capital instrument, localization was necessary for the context in which the research was applied.

To carry out the analysis of innovation performance, the research instrument by Lowik, Kraaijenbrink and Groen (2017) was used. The questionnaire used by the authors was based on the measure for the innovation performance of individuals on the number of ideas generated in the last 12 months (ideas creation) and the number of innovation and improvement projects in which the civil servants were actively involved in the last 12 months (ideas implementation), according to the study by Ng and Feldman (2010). Lowik, Kraaijenbrink and Groen (2017) report in their research that the construct presented good reliability and validity.

Subsequently, the initial instrument underwent a pre-test. At first, a group of experts revised the initial questionnaire and provided feedback on the instrument's understanding, consistency and adequacy of the sequence of items, which led to some specific modifications. After updating the instrument, in order to reduce the possibility of non-random errors, the preliminary questionnaire model was administered in a test group consisting of five respondents (with a similar profile to the present study, but who were not sample participants), in order to review and improve the instrument's content regarding validity and integrity. Based on respondents' comments, minor adjustments were made to the wording of the questionnaire to improve understanding.

For each statement in the questionnaire, an opinion from the respondent was expected, based on a Likert type scale. The Likert scale used in this survey ranged from 1 to 7 (from "totally disagree" to "totally agree") because, according to Hair, Hult, Ringle & Sarstedt, (2017), the greater the number of points used, the greater the precision obtained regarding the intensity with which the respondent agrees or disagrees with the statement.

Data collection was carried out between September 2, 2019 and October 4, 2019, obtaining a total of 314 responses. From the results gathered, the data were organized, synthesized and presented, allowing their interpretation within the framework of the objectives outlined.

This data processing is called descriptive statistics, which techniques used in this research were relative frequency, standard deviation and arithmetic mean, with view at characterizing the research sample.

The collected data were entered into Excel spreadsheets and were reviewed using descriptive statistics and the partial least square structural equation modeling technique, with the support of the SmartPLS software, version 3®.

The next section presents and discusses the results, based on the primary data collected and assessed, as well as comparing the findings with the literature on the subject.

4 PRESENTATION AND DISCUSSION OF RESULTS

After exporting the collected primary data to the SmartPLS3® software, and carrying out its configurations, a report of the preliminary data obtained was generated. The evaluation of the measurement model was started through its convergent validity, reliability and discriminant validity, as recommended by Hair, et al, (2017). However, it is noteworthy, that the assessment sequence occurred in accordance with the recommendation by Bido and Silva (2019), namely: 1) convergent validity; 2) discriminant validity; 3) reliability; since one of the presuppositions for the reliability assessment is that its convergent and discriminant validity are adequate.



Thus, after making the necessary adjustments to validate the measurement model in terms of its convergent validity, discriminant validity, as well as attesting to its reliability, collinearity was reviewed using the Variance Inflation Factor (VIF). According to Hair et al. (2017), failure to comply with this assumption may make inferences based on the model erroneous or unreliable.

First, the crossed factor loads were evaluated according to Chin's (1998) criterion, which proved to be adequate, as shown in Table 1:

Table 1 - Crossed factor loads

	Human Capital	Structural Capital	Relational Capital	Individual Absorptive Capacity	Innovation Performance - Creating Ideas	Innovation Performance - Implementing Ideas
AP1	0.552	0.521	0.425	0.718	0.412	0.361
AP2	0.525	0.503	0.452	0.782	0.524	0.511
AP3	0.556	0.515	0.446	0.782	0.584	0.411
ASS1	0.509	0.445	0.423	0.666	0.392	0.348
ASS2	0.554	0.536	0.474	0.770	0.546	0.453
ASS3	0.492	0.445	0.416	0.667	0.417	0.342
CE1	0.417	0.770	0.528	0.456	0.309	0.503
CE2	0.628	0.823	0.492	0.675	0.487	0.444
CE4	0.238	0.535	0.465	0.286	0.207	0.278
CH2	0.821	0.511	0.437	0.614	0.435	0.395
CH3	0.726	0.543	0.489	0.510	0.346	0.379
CH5	0.660	0.396	0.372	0.494	0.356	0.277
CH6	0.690	0.416	0.399	0.456	0.331	0.468
CH7	0.755	0.483	0.386	0.573	0.290	0.364
CI1	0.427	0.467	0.475	0.624	0.910	0.589
CI2	0.459	0.460	0.475	0.636	0.929	0.574
CI3	0.437	0.465	0.397	0.647	0.936	0.576
CI4	0.449	0.449	0.428	0.652	0.913	0.552
CR1	0.464	0.481	0.791	0.512	0.357	0.326
CR2	0.498	0.493	0.851	0.563	0.454	0.414
CR3	0.349	0.562	0.606	0.385	0.229	0.498
CR4	0.285	0.395	0.578	0.426	0.303	0.405
II1	0.492	0.533	0.531	0.573	0.570	0.941
II2	0.479	0.554	0.532	0.591	0.568	0.968
II3	0.491	0.561	0.545	0.611	0.607	0.969
II4	0.494	0.550	0.538	0.615	0.630	0.949
REC1	0.640	0.580	0.527	0.752	0.470	0.451
REC2	0.533	0.481	0.478	0.697	0.437	0.425
REC3	0.477	0.428	0.526	0.698	0.555	0.435
REC4	0.466	0.489	0.548	0.695	0.571	0.435
TR1	0.447	0.473	0.461	0.602	0.365	0.470
TR2	0.495	0.499	0.469	0.599	0.436	0.554
TR3	0.499	0.565	0.547	0.775	0.599	0.568
TR4	0.492	0.492	0.410	0.716	0.531	0.401

Source: Prepared by the authors (2020).



Subsequently, the discriminant validity was evaluated according to the Fornell–Larcker criterion. Table 2 presents the values of the correlations between latent variables and square roots of the AVE values on the main diagonal (highlighted).

Table 2 - Correlation values between latent variables and square roots of AVE values

	Human Capital	Structural Capital	Relational Capital	Individual Absorptive Capacity	Innovation Performance - Creating Ideas	Innovation Performance - Implementing Ideas
Human Capital	0.732					
Structural Capital	0.643	0.720				
Relational Capital	0.567	0.666	0.716			
Individual Absorptive Capacity	0.728	0.703	0.666	0.711		
Innovation Performance - Creating Ideas	0.481	0.499	0.481	0.694	0.922	
Innovation Performance - Implementing Ideas	0.511	0.575	0.561	0.625	0.621	0.957

Source: Prepared by the authors (2020).

The data in Table 2 show that all correlation values between the VL are smaller than the square roots of their AVE; therefore, the Fornell–Larcker criterion was met.

Finally, the values of internal consistency were evaluated using Cronbach’s alpha and composite reliability. Table 3 shows these values, together with the values related to AVE:

Table 3 - Values related to the model internal consistency

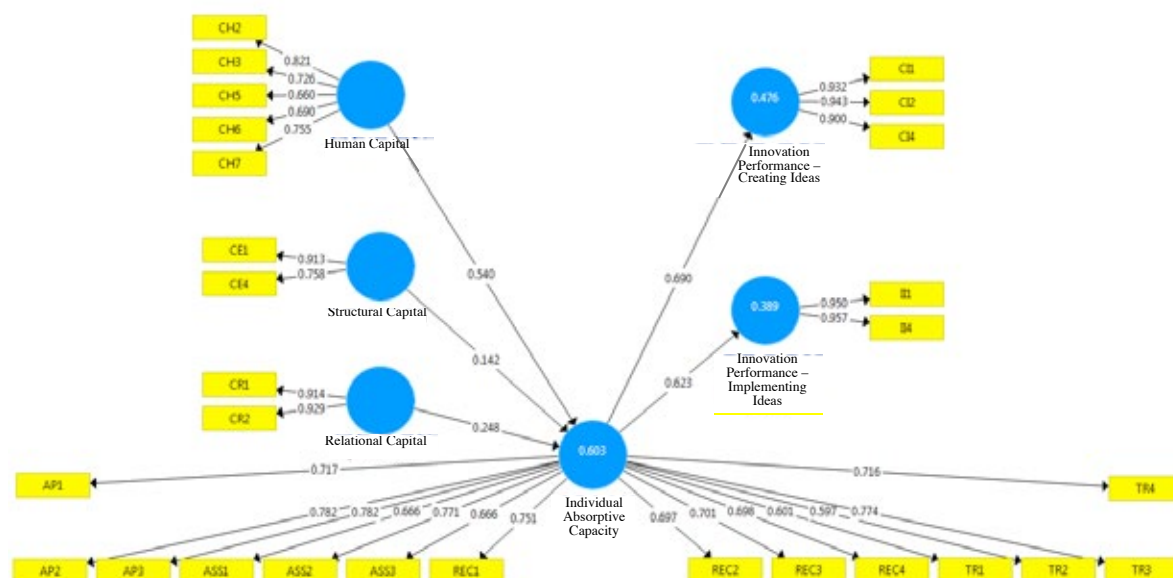
	Cronbach's Alpha	Composite Reliability	AVE
Human Capital	0.782	0.852	0.536
Structural Capital	0.597	0.825	0.704
Relational Capital	0.823	0.918	0.849
Individual Absorptive Capacity	0.924	0.934	0.505
Innovation Performance - Creating Ideas	0.941	0.958	0.850
Innovation Performance – Implementing Ideas	0.969	0.978	0.916

Source: Prepared by the authors (2020).

Figure 2 shows the final model after removing predictors, to adapt the model to the parameters indicated in the literature.



Figure 2. Theoretical research model



Source: Prepared by the authors (2020).

Subsequently to the analysis of collinearity, the Pearson determination coefficients (R^2) and if their relationships are significant were assessed, according to the Student t test and the p value. To that effect, the function of the SmartPLS3®, Bootstrapping with a significance level of 5% was used.

Table 4 - R^2 of endogenous VL

	R^2
Individual Absorptive Capacity	0.603
Innovation Performance - Creating Ideas	0.476
Innovation Performance – Implementing Ideas	0.389

Source: Prepared by the authors (2020).

We observed that the endogenous VL have R^2 above 26%; therefore, according to the Cohen classification (1988), they all have a large effect on the model. The constructs explain 39% of ideas implementation. Hence, other aspects like organizational creativity, intra-entrepreneurial orientation, technological capability, reconfiguration capability and even innovation process are critical in terms of creating innovation performance. Is recommended that authors should also discuss this in the text – otherwise, can create a narrative where is just enough to increase knowledge level and this will create innovation. Is an important part, however there are other factors involved in this dynamic.

Table 5 - Significance of the structural relationship

	Student T test	p value
Human Capital→Individual Absorptive Capacity	12.156	0.000
Structural Capital→Individual Absorptive Capacity	3.263	0.001
Capital Relacional→Individual Absorptive Capacity	5.338	0.000
Individual Absorptive Capacity→Innovation Performance - Creating Ideas	19.629	0.000
Individual Absorptive Capacity→Innovation Performance – Implementing Ideas	18.379	0.000

Source: Prepared by the authors (2020).

According to the data presented in Table 12, the values of the relationships between the VL are above the reference value of 1.96, considering the adopted significance level of 5% (Hair Junior, et al., 2017).

As for p values, they correspond, according to Hair Junior et al. (2017) to the probability of erroneously rejecting a true null hypothesis. It is noteworthy that, to achieve the results of p values, the function of SmartPLS3®, Bootstrapping was used with a significance level of 5%. According to the aforementioned authors, when assuming a significance level of 5%, the p value must be less than 0.05 in order to conclude that the relationship under consideration is significant at 5% level.

Next, the following indicators of the model's fit quality were investigated: Relevance or Predictive Validity (Q^2) and Effect size (f^2), which values are shown in Table 6.

Table 6 - Model fit quality

VL	Q^2	f^2
Human Capital	-	0.313
Structural Capital	-	0.176
Relational Capital	-	0.435
Individual Absorptive Capacity	0.280	0.413
Innovation Performance - Creating Ideas	0.383	0.618
Innovation Performance – Implementing Ideas	0.337	0.543

Source: Prepared by the authors (2020).

Finally, after making the adjustments and analysis related to the model, in the next subsection we concentrated in reviewing the research hypotheses in light of the statistical results, comparing them with the theoretical reference.

4.1 Hypothesis Analysis

After running the PLS-SEM algorithm, estimates were obtained for the path coefficients, which represent the hypothetical relationships between the constructs (Hair, et al. 2017). It is noteworthy that all the coefficients demonstrated in this investigation have a positive value.

Table 7 - Hypothesis results

	Structural path coefficient	Student's t test	Results
Human Capital→Individual Absorptive Capacity	0.540	12.156	Supported
Structural Capital→Individual Absorptive Capacity	0.142	3.263	Supported
Relational Capital→Individual Absorptive Capacity	0.248	5.338	Supported
Individual Absorptive Capacity→Innovation Performance - Creating Ideas	0.690	19.629	Supported
Individual Absorptive Capacity→Innovation Performance – Implementing Ideas	0.623	18.379	Supported

Source: Prepared by the authors (2020).



Thus, from the data obtained in the survey, the hypotheses of this study were reviewed, as detailed below:

H1 – Intellectual capital, from the perspective of the Federal Institute of Santa Catarina’s technical-administrative civil servants is related to its absorptive capacity.

This hypothesis was supported through the proven relationships of its dimensions - human capital, structural capital and relational capital - with the absorptive capacity, which is discussed below.

H1a – Human capital, from the perspective of the technical-administrative civil servants of the Federal Institute of Santa Catarina, is related to its absorptive capacity.

As in the research by Engelman et al (2017) and Nazarpoori (2017), this study identified the existence of a relationship between human capital and absorptive capacity, albeit, from an individual perspective, not an organizational one, as in the aforementioned works.

As a result, it is appropriate to rescue Cohen and Levinthal’s (1990) concept of absorptive capacity, which is consistent with the findings by Sjödin and Frishammar (2015, p. 477) about the organizational absorptive capacity being dependent on the “capacity of its members to recognize valuable external knowledge in the environment, integrate it with existing organizational capabilities, and encourage its use within the organization.”

With regard to human capital, although Stewart (1998) reports that such capital is neither generated nor used in routine activities and therefore knowledge, changes and innovations fail to be developed, we should emphasize that, in connection with public institutions, technology advances have required innovative tools and improved civil servants knowledge (Hilgers & Ihl, 2010; Costa, Itelvino & Monken, 2021).

From this argumentation, hypothesis H1a can be explained, in the case of the present study, by the remarkable concentration of respondents with specialization (54.1%) and holding Master’s degree (25.5%), which denotes the qualification of the technical-administrative institution’s civil servants.

Therefore, starting from the assumption that human capital is related to the knowledge, experiences and qualification of the individuals that make up organizations (Engelman, et al, 2017), and that their ability to recognize the value and connect with external knowledge depends on a sufficient number of qualified individuals (Cohen; Levinthal, 1990), the existence of a relationship between human capital was attested, from the perspective of the IFSC’s technical-administrative civil servants, with their individual absorptive capacity.

H1b – Structural capital, from the perspective of the Federal Institute of Santa Catarina technical-administrative civil servants, is related to its absorptive capacity.

Regarding the influence of structural capital and absorptive capacity, the results of this research converge with the studies by Engelman et al (2017), Nazarpoori (2017) and Silva (2018). Although these studies have evaluated this relationship in an organizational rather than an individual way, the comparison is possible, considering that structural capital is supported by human capital (Edvinsson; Malone, 1998).

Nevertheless, Fernandez-Jardón, and Silva (2020) state that structural capital refers to the processes and procedures formed by the intellectual input of the company’s employees. These authors emphasize that this transformation of knowledge occurs through continuous improvement, creativity and experience sharing thus obtaining greater agility in the distribution of knowledge, reducing re-work, increasing collective knowledge, minimizing waiting time and expanding productivity.



According to Yildiz et al. (2019), even though the organization has people and capabilities, it is necessary to integrate, share and enrich information, for the creation and assimilation of useful knowledge which is adequate to the activity performed. In addition, it should be noted that, according to Sjödin and Frishammar (2015), as knowledge within organizations is held by individuals, it is essential that they develop the necessary structures for sharing knowledge, allowing its use within the company.

H1c – Relational capital, from the perspective of the Federal Institute of Santa Catarina’s technical-administrative civil servants is related to their absorptive capacity.

The aforementioned assumption was also supported. It is worth mentioning that in the studies by Engelman et al (2017) - only for the transformation dimension - Nazarpoori (2017) - only with regard to the realized absorptive capacity, the relationship had also been verified albeit from the organizational perspective. Furthermore, it is noteworthy that as this research did not consider the dimensions of absorptive capacity in the theoretical model, the attested relationship was broadly evaluated.

Nahapiet and Ghoshal (1998), when approaching relational capital, conceptualize it as the knowledge incorporated, available and used by individuals in their interactions with other individuals and their interrelationship networks. For Engelman et al. (2017), the aforementioned capital is related to the interaction between individuals and seeks to improve the exchange of information and the sharing of ideas, enhancing existing knowledge, in addition to allowing new knowledge to disseminate throughout the organization.

H2 - The individual absorptive capacity of the Federal Institute of Santa Catarina’s civil servants is related to their innovation performance.

This hypothesis gained empirical support, converging with the finding by Cohen and Levinthal (1990) on the fact that individuals increasingly depend on their knowledge capabilities to continually innovate, aiming to improve performance in important work-related tasks. Nevertheless, Zahra and George (2002) also consider absorptive capacity an important antecedent to innovative performance.

In addition to these authors, it is worth mentioning other more recent works, which also investigated the relationship between absorptive capacity and innovation performance, such as: Soares and Mazon (2016), Khan, Xuehe, Atlas, Khan, Pitafi, & Sallem. (2017), Lowik, Kraaijenbrink and Groen (2017) and Blanco, Lozada and Arias (2018). It should be noted that only the work of Lowik, Kraaijenbrink and Groen (2017) evaluated the constructs from an individual perspective.

We emphasize that the improvements implemented cannot necessarily be considered innovation.

H2a - The individual absorptive capacity of the Federal Institute of Santa Catarina’s civil servants is related to their creation of ideas.

As in the study by Lowik, Kraaijenbrink and Groen (2017), this hypothesis was supported. As already mentioned, innovation performance was studied from the perspective of innovative behavior. This behavior Lane, Koka and Pathak (2006), requires individuals to be creative in their decision making, aiming to anticipate the expected problems and solve them as soon as they occur.

Lowik, Kraaijenbrink and Groen (2017) state that knowledge diversity can increase innovation and creativity, as new ideas and insights emerge from the combinations of existing knowledge. Nevertheless, according to Lowik, Kraaijenbrink and Groen (2016), the lack of a supportive climate can be one of the organizational barriers that discourage employees to exchange and integrate their knowledge. Therefore, it can be assumed that at the IFSC there is a support management style that



stimulates and promotes the generation of ideas, encouraging its technical-administrative civil servants to express them.

The result of this hypothesis may be linked to the cognitive style of the respondents, diversity of prior knowledge and external networks (entities external to the institution), as verified in the research by Lowik, Kraaijenbrink and Groen (2017).

H2b - The individual absorptive capacity of the Federal Institute of Santa Catarina's civil servants is related to their implementation of ideas.

The existence of a relationship between the individual absorptive capacity of the IFSC technical-administrative civil servants and the implementation of their ideas was also verified by the research. As detected in hypothesis H2a, the creation of ideas permeates the dimensions of recognition, assimilation and transformation, and thus, application activities result in the implementation of ideas generated by these individuals or by others (Zahra; George, 2002).

In this perspective, the contribution of senior management is also highlighted, as a facilitator of the implementation of ideas, through the acquisition and maintenance of necessary resources for innovation projects and improvements (Lowik; Kraaijenbrink; Groen, 2016), especially when they need to be convinced to allocate scarce resources necessary for effective integration of absorptive capacity (Zahra; George, 2002; Todorova; Durisin, 2007; Moreira, Chim-Miki & Oliveira, 2020).

It is worth mentioning that, in many situations, organizations pay more attention to the search for new ideas and knowledge, but do not devote attention and resources to facilitating the use and application of knowledge (Tian & Soo, 2018). However, the research result showed that the performance of individual innovation, based on the absorptive capacity of the IFSC's technical-administrative civil servants, occurs both in the dimensions of creating ideas and in their implementation.

In addition, it can be assumed that the IFSC management has been working to reduce the risk perceived by the civil servants to explore new ideas and apply new knowledge at work (Newman; Donohue; Eva, 2017), with initiatives such as the IFSC Innovation Award, which, as already mentioned, encourages the replication of ideas developed or already carried out by the civil servants.

To advance in the theoretical implications, ACAP in organizational perspective is supported by Potential ACAP and Realized ACAP. This is also valid on an individual level, according to our survey results. However, further studies must be developed to validate this finding. The theme absorptive capacity (ACAP) understood by Zhara and George (2002) as a dynamic capacity, relevant to the creation and use of knowledge, thus, the study expanded the explanations in terms of the relationship with learning and knowledge creation.

In the managerial perspective the increasing human capital level will impact innovation performance. If managers intend to increase the intellectual capital of an organization, there are a set of practices that can be adopted: Promote effective communication; Invest in the search for new knowledge; Invest in training program and/or Structure the processes, for example.

5 FINAL CONSIDERATIONS

The current context of the knowledge-based economy has demanded innovative tools, both from public and private institutions, and also knowledge improvement from their collaborators. From the data collected through questionnaires, it was found that there is a relationship between intellectual capital (human capital, structural capital and relational capital) with individual absorptive capacity, as well as identifying its influence on the innovation performance of IFSC's tech-



nical-administrative civil servants, both through the creation of ideas and in their implementation.

The aforementioned verification of the relationship between the constructs occurred in the data analysis stage, in which structural equation modeling (SEM) and the partial least squares (PLS) estimation method were applied, in order to validate the theoretical model research, as well as evaluating its hypotheses.

First, it should be noted that the relationship of each of the dimensions of intellectual capital, defined by the research, with the construct of individual absorptive capacity was assessed. Thus, with regard to human capital, it was found that there is a relationship between this dimension and the individual absorptive capacity. Based on this, it is suggested that the IFSC continue to encourage actions to qualify and improve its technical-administrative civil servants, such as training courses. In addition, the IFSC must recognize its civil servants as agents of external knowledge integration, through their recognition and application in the institution.

Structural capital and relational capital, on the other hand, despite demonstrating a relationship with individual absorptive capacity, their influence was not as significant when compared to human capital. Given this result, it is suggested that the institution invest in the formalization of data processes and systems, as ways to retain and transfer knowledge over time and activities. However, with regard to relational capital, the relationship with target audiences, partners and other educational institutions must be improved and further strengthened, to encourage the exchange of information and the sharing of ideas, enhancing existing knowledge and allowing that new knowledge flow through the IFSC.

It is also highlighted that, through the results achieved, it was possible to verify that the individual absorptive capacity interferes in the innovation performance of the IFSC technical-administrative civil servants, either through the creation of ideas or through their implementation. Thus, it is believed that actions such as the IFSC Innovation Award are of paramount importance, especially in stimulating and disseminating ideas, which can be replicated in the search for solutions for the institution and for society.

It is noteworthy, however, that although the results presented meet the objectives proposed by this research, some limitations ought to be considered. First, when analyzing the relationships of the constructs from an individual perspective, limitations were detected in the literature for comparing the results found, since most studies address relationships from an organizational point of view. And, although there is a connection between the spectra, certain adaptations, especially with regard to some questions addressed in the questionnaire, may have biased the results. Absorptive Capacity is measured on an individual level and idea creation and implementation are referring to individual efforts or collective efforts - innovation usually is accomplished in a collective effort.

It was also found that the questions about relational capital did not address issues about the relationship between civil servants, but only with external agents. Furthermore, the results found refer to the reality of the IFSC technical-administrative civil servants; thus, they cannot be generalized to other institutions. It should also be noted that this research is cross-sectional; hence, its conclusions reflect the perception of the time when it was applied.

Finally, in order to reduce some of the limitations raised and encourage new studies, suggestions for possible directions are listed: carry out longitudinal studies in view of the complexity of the topic; assess the relationship between the constructs, considering the dimension of the individual absorptive capacity; and assess the relationship of each dimension of the intellectual capital with innovation performance, in the form of ideas creation and implementation; concerning theoretical implications, it is important to expand the explanations interns of relationship ACAP with learning and knowledge creation.



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APPENDIX: SCALE / INDICATORS

Cod.	Scale / Indicators
REC1	I am always actively looking for new knowledge for my work
REC2	I intentionally seek knowledge in many places to come up with new ideas
REC3	I am good at distinguishing between good implementation opportunities and not so good implementation opportunities
REC4	I easily identify which new knowledge is most valuable at IFSC
ASS1	I often share my new knowledge with colleagues to establish a common understanding.
ASS2	I translate new knowledge in such a way that my colleagues understand what I mean
ASS3	I communicate newly acquired knowledge that may be of interest to our industry/IFSC
TR1	I often meet with colleagues to come up with good ideas
TR2	I attend meetings with people from different sectors/departments to get new ideas
TR3	I develop new ideas from the knowledge that is available at IFSC
TR4	I can turn existing knowledge into new ideas
AP1	I often apply newly acquired knowledge to my work
AP2	I apply new knowledge to create new products, services or working methods
AP3	I always consider how I can apply new knowledge to improve my work
CI1	I suggest to the IFSC innovations and improvements regarding the creation of new products or services
CI2	I suggest to the IFSC innovations and improvements relating to the improvement of existing products or services
CI3	I suggest to the IFSC innovations and improvements concerning the creation of new working methods
CI4	I suggest IFSC improve existing work processes
II1	I actively participate in the implementation of innovation or improvement projects to create new products or services for the IFSC
II2	I actively participate in the implementation of innovation or improvement projects to improve existing products or services at the IFSC
II3	I actively participate in the implementation of innovation or improvement projects to create new working methods for the IFSC
II4	I actively participate in the implementation of innovation or improvement projects to improve existing work processes at the IFSC
CH1	I participate in IFSC decisions
CH2	I am creative and take initiative in my work at IFSC
CH3	I am committed to the IFSC
CH4	I am qualified by the IFSC to develop my functions
CH5	I have the ability to innovate in my tasks
CH6	I often develop teamwork
CH7	I cooperate and share knowledge with co-workers
CE1	My suggestions are implemented by the IFSC when relevant
CE2	I seek new knowledge to implement at IFSC
CE3	I have an adequate number of equipment to carry out my work
CE4	The execution of my work is facilitated by manuals and systems provided by the IFSC
CR1	I am able to identify the needs of the IFSC target audience
CR2	I seek to work considering the needs of the IFSC target audience
CR3	My efforts are recognized and rewarded by the IFSC
CR4	I have positive relationships with partners and “competitors” (other educational institutions) for convenient exchange of information

Source: Adapted from Gracioli et al. (2012); Lowik, Kraaijenbrink e Groen (2017) e Pospichil et al. (2018)



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3. Development of theoretical propositions (theoretical work)	√	√	√	
4. Theoretical foundation / Literature review	√	√		
5. Definition of methodological procedures		√		√
6. Data collection	√			
7. Statistical analysis	√	√		
8. Analysis and interpretation of data	√	√	√	
9. Critical revision of the manuscript		√	√	√
10. Manuscript writing	√	√		
11. Other (please specify)				

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Conflict of Interest

The authors have stated that there is no conflict of interest.

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