IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN:2278-487X, p-ISSN: 2319-7668. Volume 25, Issue 9. Ser. 1 (September. 2023), PP 23-35
www.iosrjournals.org

Modeling Of Individual Absorptive Capacity As Predictor Of Frugal Innovation In Graduation Students

Denise Adriana Johann[1], Luis Felipe Dias Lopes[2],
Sirlene Aparecida Takeda Bresciani [3], Claudete Correa dos Santos [4],
Rogeane Morais Ribeiro [5], Valéria Wisniewski Padilha [6],
Claúdia Aline de Souza Ramser[7]

[1]*(Postgraduate Program in Administration / Federal University of Santa Maria, Brazil*
[2]*(Department of Administrative Sciences / Postgraduate Program in Administration / Federal University of Santa Maria, Brazil)*
[3]*(Doctor in Administration / Federal University of Santa Maria, Brazil)*
[4]*(Master in Administration / Federal University of Santa Maria, Brazil)*
[5]*(Doctor in Administration / University Vale of Itajaí-Univali, Brazil)*
[6]*(Doctor in Administration/University Vale of Itajaí-Univali, Brazil)*
[7]*(Postgraduate Program in Administration / Federal University of Santa Maria, Brazil*

Abstract:
Background*: This study aims to assess the individual capacity of absorbing frugal innovations from Brazilian undergraduate students. Even with the advance in the search for innovation, especially those of low cost and that fill gaps in society that have not yet been addressed, this is a topic that is little debated in undergraduate courses, as it is a place of perfect conditions, where students have the capacity absorption of knowledge to generate new resources. development and growth of the nation.*
Materials and Methods: *The Structural Equation Modeling (SEM) technique was used, with a population of 462 students from different undergraduate courses.*
Results: *The results demonstrate that the Individual Absorption Capacity dimensions impact the Frugal Innovation dimensions. The analyzed students explored open innovation, sustainable innovation, product innovation and cost innovation. Reliability was confirmed on the CAI-IF scales to measure the dimensions of individual absorptive capacity in frugal innovation.*
Key Word*: Individual absorptive capacity; Dimensions of frugal innovation; Graduate student; Structural equation modeling.*

Date of Submission: 26-08-2023 Date of Acceptance: 06-09-2023

I Introduction

It is known that knowledge transfer significantly reduces Research and Development (R&D) costs, contributing to new strategies and competitive advantage. Therefore, companies seek to establish partnerships with institutions that generate and disseminate scientific and technological knowledge. In this sense, the university has a lot to contribute, promoting access to new sources of knowledge for innovation with research (Murtic et al., 2018)

Knowledge absorption (CA) was introduced by Cohen and Leninthal (1990) as a three-dimensional model, later Zahra and George (2002) reconceptualized the absorption capacity and introduced the transformation dimension, and distinguished the potential absorption capacity (PAC), which comprises the dimensions of acquisition and assimilation of new knowledge and the (RAC) comprising the dimensions of transformation and exploitation of new knowledge.

In this sense, the ability to absorb knowledge is an interactive process between knowledge and learning. Flatten et al. (2011) mention that few CA studies were applied to the individual context, the relationships of individuals with the CA dimensions. Prexl et al. (2020), in their research, concluded that the individual has a central role in the innovation and absorption of new knowledge, influencing directly and positively the processes and structure of an organization. According to Prexl et al. (2020), individual exploitation is considered important in combining knowledge to create new goods, services, processes, or organizational forms. Thus, graduate students are active in the dimension of exploitation of individual absorptive capacity.

Innovation plays a relevant role in developing new products and processes, whether through scientific and technological knowledge or their R&D relationships (Almulhim, 2021). Therefore, the frugal type of innovation has been the subject of numerous studies in different contexts (Albert, 2019; Hossain, 2018; Zeschky et al., 2011). However, there is still a lack of research that seeks to understand and investigate frugal innovation in the context of knowledge management, its sharing, and transfer (Ananthram 7 Chan, 2019; Bencsik et al., 2016; Fischer et al., 2020; Almulhim, 2021). In this context, only one study was found, by Dost et al. (2019), who examined the impact of knowledge sources on frugal innovation through a study of SME's in Saudi Arabia.

For Cadeddu et al. (2019) and Mortazavi et al. (2020), several sources of knowledge can facilitate or introduce Frugal Innovation. In this way, the authors highlight entrepreneurial universities as sources of knowledge capable of contributing to the development of economic products, with an increase in the organization's productivity. Therefore, this research offers the possibility of understanding the dynamics of knowledge absorption in its four dimensions based on theory (Zahra & George, 2002) in the academic environment. Since the acquisition, assimilation, transformation, and exploitation capacity present in postgraduate students involved in research and science development may be aligned with the development of frugal products, services, or processes.

As already reported by the Organization for Economic Cooperation and Development (OECD, 2018), scientific and technological knowledge, driven by investment flows in technology industries, R&D (Research and Development), and human capital, has been projecting a new meaning to the contemporary concept of productivity. Thus, this research contributes to existing theories, albeit embryonic, regarding the capacity to absorb knowledge at the individual level in frugal innovation.

In this sense, the main objective of this study is to examine the effects of individual absorptive capacities of knowledge on Frugal Innovation, investigating how these knowledge capacities impact Frugal Innovation, and finally, understand if the absorptive capacity of individuals somehow affects Frugal Innovation.

II. Theoretical Review

Considering the need to sustain the themes addressed in this research, in this theoretical framework section, we sought to describe and support the topics of individual absorptive capacity and its dimensions: capacity for acquisition, assimilation, transformation, and exploitation, in addition to frugal innovation and its dimensions: open, cost, sustainable, and product innovation, briefly presenting research concepts and instruments.

II.1. Individual Absorptive Capacity (CAI) and its dimensions

Many studies address absorption capacity at different levels: individual (Cohen & Levinthan, 1990), intraorganizational (Szulanski, 1996), organizational (Cohen & Levinthan, 1990; Schmidit, 2010), learning dyad (Lane & Lubatkin; 1998), intra-district (Camisón & Forés, 2011), and inter-alliance (Lee, Liang & Liu, 2010). The absorptive capacity can be addressed at the organizational level, but also at the individual level, which authors call it cumulative, where the individual's memory of knowledge is associated with the learning process (Cohen & Levinthan, 1990; Fernandez-de-Lucio; Vergajurado & Gutierrez-Gracia, 2008). In this sense, the absorptive capacity of organizations interconnects the skills and knowledge of individuals included in it. Thus, for individuals to develop their individual absorptive capacity (CAI), investment in human capital development is necessary, thus increasing their absorptive capacity (Cohen & Levinthan, 1990; Kim & Maubougne, 1998). Under this perspective, Wang, Feng, and Liu (2015) developed the foundation of individual absorptive capacity for identification, assimilation, and transformation of knowledge, and also of the behavior of individuals, thus enabling a better understanding of the performance of individuals.

The individual level of absorptive capacity can recognize, assimilate, explore, and transform external knowledge. Individual absorptive capacities are fundamental to knowledge management, as well as the role that individuals play in absorbing external knowledge (Volberba, Foss & Lyles, 2010). Other studies that defend the absorptive capacity at the individual level to be related to the organizational scope were carried out by the authors Eduardo et al. (2016) and Fuchs, Rosseto, and Carvalho (2016). These corroborate with Cohen and Levinthal (1990) regarding the understanding and interpretation of the knowledge acquired from the external environment dependent on the assimilation of each individual inserted in the organization.

In their studies, Cohen and Levinthal (1990) and Vega-Jurado et al. (2008), used, in addition to absorptive capacity, another construct aimed at the academic context, the scientific absorptive capacity, which can, from the perspective of the organization's capacity, absorb knowledge created and absorbed in Higher Education Institutions (HEI), Science and Technology Institutes (STI) and, scientific congresses. For the authors, universities can leverage their intellectual capital through absorptive capacity, creating, and sharing knowledge, a necessary condition for the success and superior performance of HEI's.

Studies carried out in the last decade have been carried out focusing on the individual absorptive capacity, thus contributing for the subject to develop quickly. Authors confirm that individual characteristics are directly related to organizational absorptive capacity and point out that the qualification of individuals affects the process of acquiring, assimilating, exploring, and applying knowledge. Therefore, they conclude that the knowledge acquired from the external environment depends on the assimilation of each individual inserted in the organization (Cohen & Levinthan, 1990; Silva et al., 2016; Silva Teixeira et al., 2016; Fuchs, Rosseto & Carvalho, 2016).

Frugal Innovation (IF) and its dimensions

For Silva, Etiel (2018), little attention is still directed to examining the innovation efforts of local firms in developing countries. Thus, in his study, he aims to investigate the association between certain organizational capabilities that help develop frugal innovation. Thus, it defends that the value proposition of frugal innovation manifests more for less, based on the interaction of the following concepts: cost innovation, sustainable innovation, open innovation, and product innovation.

In the model proposed by Silva and Etiel (2018), validated in the organizational context, organizational capabilities (production; technological; human capital, and; marketing) are exogenous constructs, while frugal innovation is an endogenous construct. Thus, the IF scale is composed of items measured by the authors Abulrub and Lee (2012) – *Open Innovation*; Chen, Lai and Wen (2006), and Chen (2008) – *Sustainable Innovation*, Afonso et al. (2008) – *Cost Innovation* and *Product Innovation* with the authors Gunday et al. (2011).

Seeking validation in the university context, from the perspective of undergraduate students, the authors Bresciani et al. (2020) carried out a study to analyze the influence of entrepreneurial intention on the dimensions of frugal innovation, using the instrument validated by Silva, Etiel (2018). For the frugal innovation scale, the dimensions *Open Innovation* (OI) by Abulrub and Lee (2012) were applied; *Sustainable Innovation* (SI) by Chen (2008); *Cost Innovation* (CI) by Afonso et al. (2008), and *Product Innovation* (PI) by Gunday et al. (2011). The instrument was applied with a 5-point Likert scale, ranging from totally disagree to totally agree.

Product Innovation

The Oslo Manual (OECD, 2018) proposes as the main innovation concept a new or improved product or process, or even a combination of them, but which present characteristics or attributes that differ significantly from previous products or processes produced by the organization and which has been made available to potential users. Thus, product and service innovation ―includes significant improvements in technical specifications, components and materials, embedded *software*, ease of use, or other functional characteristics‖ (OECD, 2018, p. 56).

Gunday et al. (2011, p. 663) point out that product innovation is a difficult process, driven by technological advancement, changes in customer needs, shortening of product life cycles, and increased global competition. In this sense, they explain that companies achieve a competitive differential and increase their market share, according to the level of importance they attribute to innovation. In this way, the authors validated the scale of product innovation, covering analyses of the last three years to demonstrate what the company has implemented in product innovation. Regarding the products, the items point to increased quality, reduced manufacturing costs, ease of use, novelties with the use of material components, technical specifications, and functionality that are totally different from current ones (GUNDAY et al., 2011).

Open Innovation

Chesbrougoh and Appleyard (2007) point out that companies have experimented with new business models, mainly in the technology sector and in drug development, using collective creativity within a community of innovators as a means of expanding the creation of organizational value. With this, open innovation becomes a balance of traditional business strategy principles. Previously, in the traditional model, projects remained structured on the company's scientific and technological basis. There was the so-called entry process in the R&D department, with output to the market. On the other hand, in the open model, during the process, several inputs and outputs are considered, with sources of knowledge both internal and external to the company.

In this sense, open innovation is considered a strategy that balances the powerful value creation forces that can be found in creative individuals, innovation communities, and collaborative initiatives with the need to capture value to sustain the continued participation and support of these initiatives (Cchesbrougoh & Appleyard, 2007, p. 76). On the other hand, West et al. (2014, p. 806) point out that open innovation is a distributed innovation process, based on purposefully managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms according to the organization's business model.

From the concepts of open innovation, the scale proposed by Alburub and Lee (2012) presents items that measure the cooperation between external partners such as universities, research institutes, and companies, which checks the needs of customers and also internal and external technologies, in the sale or purchase of intellectual property, patents, copyrights, or trademarks.

Cost Innovation

Williamson (2010, p. 348) points out that the new generation of organizations from emerging markets has increasingly competed with established companies, offering personalized, varied, and high-tech products and services to mass consumers at drastically low prices. Thus, it points out that business models based on differentiation and focus are threatened by organizations that use cost innovation to offer products to consumers with greater utility and lower prices. Therefore, it describes that cost innovation has three important factors, namely: i) offering customers high technology at low cost; ii) present low-cost varieties to customers, and; iii) move niche products to the mass market. Thus, cost innovation may require managers to analyze their cost structures in search of new ways to do more with less.

According to the concept of cost innovation, the scale developed and validated by Afonso et al. (2008), called *target cost*, offers items that range from the minimum achievable sales price and the profit margin required to determine the allowable cost of a new product. Silva and Itiel (2018, p. 99) point out that the main objective when using this scale is to ensure that products that are not profitable are not introduced in the market and that it makes it possible to achieve an ideal compensation between cost, functionality, and quality.

Sustainable Innovation

Boons et al. (2013) state that there is no consensus on the concept of sustainable innovation. Thus, the literature has presented different terms. Among them, the most used are: sustainable innovation, eco-innovation, cleaner technologies, and recently, a term focused on the social aspect with initiatives aimed at the base of the pyramid, as proposed by Prahalad and Hart (2008). In this sense, supported by Carrillo-Hermosilla, Del Río, and Könnölä (2010), Boons et al. (2013) defend the concept of sustainable innovation as an innovation that improves sustainability performance, encompassing ecological, economic, and social criteria.

According to Bos-Browers (2010), innovation contributes to the profitability and competitive permanence of an organization. Therefore, it is considered a driving for of economic growth of a country. Furthermore, the author points out that non-economic arguments focus on better corporate social and environmental performance.

With that, he affirms that sustainable innovation consists of improving technological processes and reducing production costs. Thus, sustainable innovation can be defined as the renewal or improvement of products, services, or processes that provide improved economic performance and an improved environmental and social performance, both in the short and long term. As discussed in the literature on the subject, the sustainable innovation scale by Chen, Lai, and Wen (2006) and Chen (2008) is proposed to analyze organizational innovations related to environmental demand, related to the use of less polluting materials, reduced consumption of energy, reduced defects and replacements, and also recycling, reuse, and decomposition of materials.

Elaboration of research hypotheses

According to Barros (2008, p. 306), [...] a well-constructed hypothesis offers a bridge, even if provisional, between Theory and Method and research procedures, in addition to helping to delimit the theme in question, bringing a problematizing feature to it. In this way, presented the studies that support this research, the following hypotheses were elaborated:

H_1: There is a statistically significant relationship between Absorptive Capacity and Frugal Innovation.

Based on the above, hypothesis 1 can be broken down into other sixteen hypotheses, relating to each dimension of Frugal Innovation (Open Innovation, Sustainable Innovation, Cost Innovation, and Product Innovation) with the Absorptive Capacity (Acquisition, Assimilation, Transformation, and Exploitation).

H_{1a}: Knowledge Acquisition Capacity is related to Cost Innovation;
H_{1b}: Knowledge Acquisition Capacity is related to Sustainable Innovation;
H_{1c}: Knowledge Acquisition Capacity is related to Product Innovation;
H_{1d}: Knowledge Acquisition Capacity is related to Open Innovation;
H_{1e}: Knowledge Assimilation Capacity is related to Cost Innovation;
H_{1f}: Knowledge Assimilation Capacity is related to Sustainable Innovation;
H_{1g}: Knowledge Assimilation Capability is related to Product Innovation;
H_{1h}: Knowledge Assimilation Capacity is related to Open Innovation;
H_{1i}: Knowledge Transformation Capacity is related to Cost Innovation;
H_{1j}: Knowledge Transformation Capacity is related to Sustainable Innovation;
H_{1k}: Knowledge Transformation Capacity is related to Product Innovation;
H_{1l}: Knowledge Transformation Capacity is related to Open Innovation;
H_{1m}: Knowledge Exploitation Capacity is related to Cost Innovation;
H_{1n}: Knowledge Exploitation Capacity is related to Sustainable Innovation;
H_{1o}: Knowledge Exploitation Capability is related to Product Innovation.
H_{1p}: Knowledge Exploitation Capacity is related to Open Innovation.

III. Methodology

For the research, a quantitative approach was chosen, with a descriptive objective. Cervi (2009, p. 128) states that firstly only what is known is quantified. In this sense, quantitative technic is considered that social phenomena can be explained from their representation in numbers, used in analyses that allow generalizations, indication of causal relationships and, as a consequence, for validation or rejection of theories. Given this, Gil (1999, p. 46) explains that descriptive research has as its primary objective the description of the characteristics of a given population or phenomenon or, then, the establishment of relationships between variables‖.

As for the method, a Survey was used. According to Freitas et al. (2000), this type of survey is useful to identify and describe characteristics of a certain target population, information, and conclusions, based on data collection with a pre-defined instrument, usually a questionnaire. Thus, in this study, for the descriptive analysis of the data, the SPSS version 26 *software* was initially used, which sought to understand the profile of the students who participated in the research.

This research is registered on Plataforma Brasil with the Certificate of Presentation for Ethical Appreciation (CAAE) n. 12457019.1.0000.5346, consisting in the application of a questionnaire with three sections, the first being objective questions about the sociodemographic data of the participants. The second section, one dimension from the Individual Absorptive Capacity Scale (CAI) and the third, four dimensions from the Frugal Innovation Scale, both with a five-point *Likert* Scale, ranging from strongly disagree to strongly agree options.

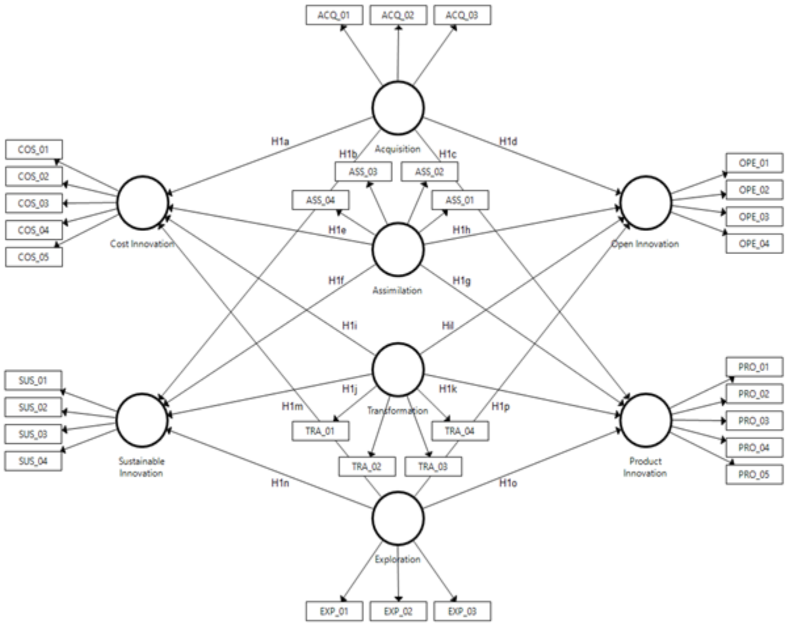
The sample consisted of 462 postgraduate students. For the individual absorptive capacity questionnaire, the instrument by Silva et al. (2016), and the Frugal Innovation scale validated in the Brazilian context by Silva and Etiel (2018), and Bresciani et al. (2020), consisting of four reflective dimensions, with items measured by the authors Alburub and Lee (2012) – Open Innovation (OI), consisting of four items; Chen, Lai, and Wen (2006) – Sustainable Innovation (SI), consisting of four items; Afonso et al. (2008) – Cost Innovation (CI), consisting of five items, and Product Innovation (PI) with the authors Gunday et al. (2011), consisting of five items.

For the analysis of the hypotheses, the technique of structural equation modeling (SEM) was used. According to Hair et al. *(*2014), the Equation Modeling technique is conceptualized for combining elements of multiple regression (examining dependency relationships) and factor analysis (representing constructs not directly observed), thus estimating simultaneous dependency relationships.

Path diagram analysis and its relationships between latent variables and their respective variables observed, and hypotheses proposed in the research are shown in Figure 1 and diagram 1.

Os escores propostos pelos autores foram adaptados para um escore padronizado (Ssi), conforme mostrado na Tabela 1. In Figure 1, it is observed that the measurement model formed by four exogenous and independent variables (acquisition capacity, assimilation capacity, transformation capacity, and exploitation capacity) that connect four endogenous and dependent variables (open innovation, sustainable innovation, product innovation, and cost innovation), with a total of 16 hypotheses and 32 questions (indicators). In this sense, Table 1 presents the path diagram that aims to describe the structural equations.

Figure 1. CAI–IF Dimensional Path Model



Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

Table I. Initial path diagram for the model (diagram 1)

Dimensions Endogenous	=	Dimensions Exogenous	+	Error
COS	=	β_1 ACQ + β_2 ASS + β_3 TRA + β_4 EXP	+	ε_{COS}
SUS	=	β_5 ACQ + β_6 ASS + β_7 TRA + β_8 EXP	+	ε_{SUS}
PRO	=	β_9 ACQ + β_{10} ASS + β_{11} TRA + β_{12} EXP	+	ε_{PRO}
OPE	=	β_{13} ACQ + β_{14} ASS + β_{15} TRA + β_{16} EXP	+	ε_{OPE}

Source: Research data based on Hair, Gabriel, and Patel (2014).

IV.Presentation and discussion of results

The first stage for validation, known as Measurement Model Assessment, seeks to ensure the reliability of the model, through the assessment of Cronbach's Alpha (α); Composite Reliability (ρ_c); *Average Variance* Extracted – AVE; Cross-loadings; Fornell-Larcker Criterion and Heterotrait-Monotrait *Ratio* (*HTMT*) criterion confirmed by the Bootstrapping *method.*

In the second stage, known as Structural Model Assessment through Collinearity Assessment (VIF); Coefficient of determination (R^2) confirmed by the bootstrapping method for 5,000 subsamples; effect size (f^2) confirmed by the bootstrapping method; confirmation of hypotheses by Student's t-test determined by the bootstrapping method and finally, predictive relevance (Q^2) confirmed by the blindfolding method. Composite reliability analysis refers to the number of questions about each variable. The questions must have the ability to explain the variable. To achieve this answer, it is necessary if they are sufficient to calculate *Cronbach's Alpha*, the composite reliability, and the Average Variance Extracted (AVE).

The convergent validity test, on the other hand, seeks the values of factor loadings, convergent validity, reliability, and discriminant validity of reflective measurement models (Ringle et al., 2014). As noted by Ringle et al. (2014), based on the sample data and the allocation of variables observed in their respective latent variables, in this study, the analysis was satisfactory, the values of all factor loadings, according to the parameter (values > 0.70). Then, convergent validity, and reliability (internal consistency and composite reliability) tests were performed. The results met the requirements for obtaining values greater than 0.50 for AVE and values greater than 0.70 for internal consistency (*Cronbach's* α) and composite reliability (Hair et al., 2005). Then, it is started the analysis of the measurement model. Table 2 demonstrates the results found.

Table II. Internal consistency and convergent validity

Dimensions	Cronbach's alpha	Reliability Composite	Average Variance Extracted
Acquisition (ACQ)	0.696	0.821	0.605
Assimilation (ASS)	0.851	0.877	0.642
Exploitation (EXP)	0.840	0.903	0.757
Transformation (TRA)	0.868	0.910	0.716
Open Innovation (OPE)	0.844	0.895	0.681
Sustainable Innovation (SUS)	0.939	0.956	0.846
Product Innovation (PRO)	0.951	0.962	0.837
Cost Innovation (COS)	0.925	0.943	0.769

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

For Chin (1998) and Hair et al. (2005), the item reliability analysis is related to the quality of items (questions), confirming the correlation of the items. Thus, the value greater than or equal to 0.70. In this sense, Chin (1998) points out that if the question does not reach item reliability, it should be removed from the questionnaire, which he calls debugging. Thus, it can be observed in Table 3 the discriminant validity, that all observed variables (OV's) met the criterion of crossed-loadings, that is, the factor loadings of the observed variables (OV's) with the original latent variable (LV) are greater than the factor loadings with the other LV's of the EIE-EIF scales.

Table III. Cross-loadings

Indicators	Dimensions							
	ACQ	ASS	EXP	TRA	OPE	SUS	PRO	COS
ACQ_01	0,764	0.283	0.343	0.367	0.156	0.142	0.084	0.095
ACQ_02	0.751	0.550	0.216	0.275	0.057	0.076	0.028	0.033
ACQ_03	0.817	0.553	0.215	0.299	0.103	0.128	0.121	0.095
ASS_01	0.448	0.854	0.363	0.512	0.055	0.040	0.072	0.040
ASS_02	0.502	0.869	0.281	0.364	0.064	0.048	0.037	0.023

ASS_03	0.404	0.731	0.228	0.359	0.040	-0.020	0.013	-0.028
ASS_04	0.474	0.741	0.260	0.380	0.058	-0.010	-0.022	-0.008
EXP_01	0.329	0.341	0.869	0.574	0.230	0.188	0.180	0.167
EXP_02	0.299	0.341	0.891	0.567	0.252	0.164	0.169	0.153
EXP_03	0.275	0.288	0.851	0.520	0.239	0.179	0.176	0.214
TRA_01	0.351	0.421	0.467	0.817	0.188	0.153	0.163	0.152
TRA_02	0.397	0.489	0.512	0.867	0.181	0.167	0.158	0.159
TRA_03	0.280	0.343	0.548	0.855	0.215	0.155	0.149	0.145
TRA_04	0.375	0.485	0.621	0.846	0.223	0.152	0.155	0.143
OPE_01	0.164	0.073	0.233	0.187	0.842	0.555	0.532	0.512
OPE_02	0.121	0.078	0.242	0.226	0.843	0.573	0.615	0.636
OPE_03	0.127	0.026	0.228	0.218	0.851	0.537	0.623	0.639
OPE_04	0.078	0.051	0.208	0.150	0.763	0.577	0.551	0.561
SUS_01	0.150	0.025	0.195	0.158	0.641	0.934	0.699	0.698
SUS_02	0.169	0.048	0.191	0.178	0.630	0.937	0.698	0.703
SUS_03	0.134	0.049	0.172	0.187	0.637	0.885	0.749	0.710
SUS_04	0.133	0.025	0.190	0.159	0.577	0.921	0.703	0.735
PRO_02	0.092	0.038	0.140	0.165	0.655	0.707	0.911	0.807
PRO_03	0.148	0.058	0.208	0.180	0.628	0.739	0.914	0.754
PRO_04	0.083	0.062	0.197	0.155	0.655	0.695	0.922	0.774
PRO_05	0.076	0.052	0.197	0.180	0.641	0.694	0.924	0.761
COS_01	0.112	0.014	0.175	0.143	0.579	0.715	0.676	0.854
COS_02	0.087	0.036	0.214	0.165	0.583	0.617	0.643	0.854
COS_03	0.078	0.008	0.182	0.173	0.668	0.689	0.775	0.909
COS_04	0.084	0.036	0.159	0.149	0.649	0.696	0.823	0.894
COS_05	0.110	0.028	0.164	0.141	0.646	0.676	0.840	0.874

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

The next tests carried out in the first step of evaluating the measurement of the model are the Fornell and Larcker and the HTMT Test (Heterotrait-Monotrait Ratio). According to Fornell and Larcker (1981), this analysis compares the correlations between the VL's (r_{ij} for i □ j), in this sense, the model points out that they must be smaller than the square root of the average variance extracted in order to ensure that a dimension is independent of the other. It can be seen in Table 4 that the values of the main diagonal are higher than the others $\left(\sqrt{AVE's} > r_{ij}\right)$, so the discriminant validity is established at the construction level of the Fornell and Larcker criterion.

Table IV. Fornell-Larker and Heterotrait-Monotrait Ratio criteria

Dimensions	$\sqrt{AVE}$	Pearson Correlation Matrix							
		AQUI	ASS	EXP	ABE	SUS	PRO	CUS	TRA
AQU	0.778	1.000	0.557	0.346	0.151	0.160	0.113	0.107	0.414
ASS	0.801		1.000	0.371	0.069	0.040	0.054	0.028	0.514
EXP	0.870			1.000	0.276	0.204	0.201	0.206	0.636
ABE	0.825				1.000	0.675	0.704	0.712	0.239
SUS	0.920					1.000	0.773	0.773	0.185
PRO	0.915						1.000	0.852	0.184
CUS	0.877							1.000	0.177
TRA	0.846								1.000
		Upper Limit $(HTMT)_{97.5\%}$							
ASS		0.837							
EXP		0.536	0.503						
ABE		0.298	0.187	0.430					
SUS		0.306	0.124	0.336	0.817				
PRO		0.238	0.132	0.331	0.835	0.860			
CUS		0.236	0.118	0.331	0.861	0.871	0.841		
TRA		0.622	0.652	0.803	0.379	0.306	0.301	0.297	

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

Table 4 shows the HTMT criterion, demonstrating that the results meet the requirement of the criterion, that is, the upper limits, determined by the bootstrapping method, obtained values less than 1.00. The model then processed results in a path diagram, that is, the definition of each indicator (VO) and the type of relationship with each dimension (VL), which served as the basis for constructing the measurement model as shown in Table 4.

After evaluating the measurement model, the model can be called reliable and valid. The next step sought to evaluate the structural model and prove its hypotheses. In this sense, Hair et al. (2017) state that the evaluation of the structural model is performed by collinearity analysis (Variance Inflation Factor - VIF); significance level of R^2; effect size f^2; evaluation of the significance and relevance of the betas of the structural model (Student's t-test); and finally, by assessing predictive relevance Q^2. Thus, in Table 5, the VIF indicates whether there is a potential collinearity problem in the model if the values are greater than 5 (Hair et al., 2017).

Table V. Multicollinearity analysis- VIF values for the dimensions of the CAI-IF model

Dimensions	VIF			
	Open	Sustainable	Product	Cost
Acquisition	1.513	1.513	1.513	1.513
Assimilation	1.687	1.687	1.687	1.687
Exploitation	1.702	1.702	1.702	1.702
Transformation	1.993	1.993	1.993	1.993

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

It is observed in the model that all *VIF* values are less than 5. Given the assumptions, there are no strong relationships between dimensions, so there are no collinearity problems. Table 6 shows the significance of the coefficient of determination (R^2) that explains in degrees the influence of the independent variable on a dependent variable, accompanied by the effect size values (f^2) obtained by the bootstrapping *method*.

Table VI. Explanation coefficient R^2 and f^2 effects for the measurement model

Exogenous Dimensions	Endogenous Dimensions (Innovation) - f^2 (p-value)			
	Open	Sustainable	Product	Cost
Acquisition	0.007 (0.382)	0.016 (0.248)	0.004 (0.631)	0.005 (0.527)
Assimilation	0.011 (0.179)	0.015 (0.233)	0.006 (0.539)	0.011 (0.315)
Exploitation	0.027 (0.106)	0.012 (0.317)	0.012 (0.318)	0.015 (0.242)
Transformation	0.010 (0.295)	0.007 (0.384)	0.007 (0.390)	0.007 (0.405)
R^2 (p-value)	0.095 (0.001)	0.067 (0.006)	0.052 (0.016)	0.057 (0.007)

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

The coefficient of determination (R^2) comprises values between 0 and 1. In this sense, Cohen (1988) and adapted by Lopes et al. (2020) describes the relationships as strong ($R^2 > 0.19$), moderate ($0.075 < R^2 \leq 0.19$) and weak ($0.02 \leq R^2 \leq 0.075$) evaluating the portion of the variability of predictor dimensions (endogenous). Thus, the open, sustainable, product, and cost dimensions of frugal innovation (endogenous variables) do not present significant results. Only open innovation has a moderate relationship on the dimensions of individual absorptive capacity (exogenous variable) with R^2 of 0.095, while the exogenous variables sustainable innovation, product innovation, and cost innovation showed weak relationships on the endogenous variables. The respective R^2 are 0.067, 0.052, and 0.057. Thus, in the proposed model, open innovation is the variable most explained by the dimensions of individual absorptive capacity. Thus, open innovation is explained by the model at 0.09%. At the same time, sustainable innovation is explained at 0.07%, cost innovation with 0.06% and, product innovation explained at 0.05%.

As for the estimates of the regression coefficients and the correlations in their proper ways, the regression betas show us their significance, that is, the quantity in degrees of freedom. Some relationships had non-significant betas. That is, there was no relationship between the dimensions, they are: acquisition with open innovation, with cost innovation and with innovation, and with product innovation. Thus, the analyses showed that the assimilation dimension was not related to product innovation, whereas the transformation dimension was not related to cost innovation, sustainable innovation, and product innovation.

As for the f^2 values that assess the usefulness of each dimension for the adjustment of the model, which according to Cohen (1988) and adapted by Lopes et al. (2020) these values are classified as $f^2 > 0.225$ (large effect), $0.075 < f^2 \leq 0.225$ (medium effect); and $0.02 \leq f^2 \leq 0.075$ (small effect). After the model was adjusted, the quality of fit of the model was evaluated through the analysis of the coefficients, interpreted as the betas (b's) of the regression with the f^2 results described in Table 6, influencing the confirmation of the hypotheses proposed in the model, where the ratio of the dimensions AQUI and OI (0.007), between AQUI and OS (0.016), between AQUI and OP (0.004), and AQUI and OC (0.005), thus indicating a small effect on the relationship of the acquisition dimension with the dimensions of frugal innovation.

The dimensions between ASS and OI (0.011), between ASS and OS (0.015, between AS and OP (0.006), and between ASS and OC (0.011) indicate a small effect on the relationship of the assimilation dimension with the dimensions of frugal innovation. The exploitation dimension also has a small effect on all dimensions of frugal innovation: EXP and OI (0.027), EXP and OS (0.012), EXP and OP (0.012), and EXP and OC (0.015), and finally, the transformation dimension also presents the other dimensions of individual absorptive capacity a small effect on all dimensions of frugal innovation: TRA and OI (0.010), TRA and OS (0.007), TRA and OP (0.007), and TRA and OC (0.007). According to notes of Cohen (2013), it can be inferred that the model generally presents a small f² (effect size).

After evaluating the quality of fit of the model, the path coefficients are interpreted, these coefficients using the t-test to assess the relationships between the dimensions of the model. According to Hair et al. (2014), the path coefficients represent the hypothetical relationships between the dimensions of the structural model (exogenous variables $\rightarrow$ endogenous variables), proving or not the proposed hypotheses. Table 7 shows the validation of the structural coefficients and their respective hypotheses.

Table VII. Validation of structural coefficients and their respective hypotheses

Exogenous Dim.	□	Endogenous Dim.	□'s	S. D.	Stat. T (|□ / S. D.|)	p-value	Status
Acquisition	□	Cost Innovation	0.081	0.057	1.414	0.157	Rejects
	□	Sustainable Innovation	0.151	0.064	2.367	0.018	Accepts
	□	Product Innovation	0.071	0.062	1.146	0.252	Rejects
	□	Open Innovation	0.096	0.055	1.757	0.079	Rejects
Assimilation	□	Cost Innovation	-0.133	0.069	1.942	0.052	Accepts
	□	Sustainable Innovation	-0.153	0.073	2.112	0.035	Accepts
	□	Product Innovation	-0.097	0.072	1.347	0.178	Rejects
	□	Open Innovation	-0.131	0.055	2.366	0.018	Accepts
Transformation	□	Cost Innovation	0.113	0.064	1.756	0.079	Rejects
	□	Sustainable Innovation	0.115	0.065	1.769	0.077	Rejects
	□	Product Innovation	0.117	0.064	1.822	0.068	Rejects
	□	Open Innovation	0.136	0.065	2.100	0.036	Accepts
Exploitation	□	Cost Innovation	0.155	0.063	2.473	0.013	Accepts
	□	Sustainable Innovation	0.135	0.064	2.119	0.034	Accepts
	□	Product Innovation	0.139	0.064	2.161	0.031	Accepts
	□	Open Innovation	0.205	0.060	3.428	0.001	Accepts

Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

The result shows that of the sixteen hypotheses, 09 were accepted ($p < 0.05$), and 07 were rejected ($p > 0.05$). The analyses confirmed the direct and positive relationship between the exogenous variable exploitation with all the endogenous dimensions of frugal innovation H_{1m}: Knowledge Exploitation Capacity is a predictor of Cost Innovation; H_{1n}: Knowledge Exploitation Capacity is a predictor of Sustainable Innovation; H_{1o}: Knowledge Exploitation Capacity is a predictor of Product Innovation; H_{1p}: Knowledge Exploitation Capacity is a predictor of Open Innovation.

The exogenous acquisition variable is only a predictor of sustainable innovation (H_{1b}: Knowledge Acquisition Capacity is related to Sustainable Innovation). The other hypotheses relating the exogenous variable acquisition to open innovation, product innovation, and cost innovation were rejected. The exogenous variable assimilation is not just a predictor of product innovation (H_{1g}: Knowledge Assimilation Capacity is related to Product Innovation) where the hypothesis was rejected. The other hypotheses of the exogenous assimilation variable were accepted (H_{1e}: Knowledge Assimilation Capacity is related to Cost Innovation; H_{1f}: Knowledge Assimilation Capacity is related to Sustainable Innovation and H_{1h}: Knowledge Assimilation Capacity is related to Open Innovation).

Regarding the exogenous variable transformation is only a predictor of open innovation (H_{1l}: The Knowledge Transformation Capacity is related to Open Innovation), the other hypotheses of the exogenous variable transformation with cost innovation, sustainable innovation, and product innovation were rejected (H_{1i}: Knowledge Transformation Capacity is related to Cost Innovation; H_{1j}: Knowledge Transformation Capacity is related to Sustainable Innovation and H_{1k}: Knowledge Transformation Capacity is related to Product Innovation).

Next, the Stone-Geisser indicator (Q^2) calculation by the blindfolding method is presented, aiming to assess the accuracy of the fit model. Hair et al. (2016) use it as an evaluation criterion, indicating that Q^2 values must be greater than zero. Values of 0.02, 0.15, and 0.35 indicate, respectively, the predictive relevance: small, medium, and large (Table 8).

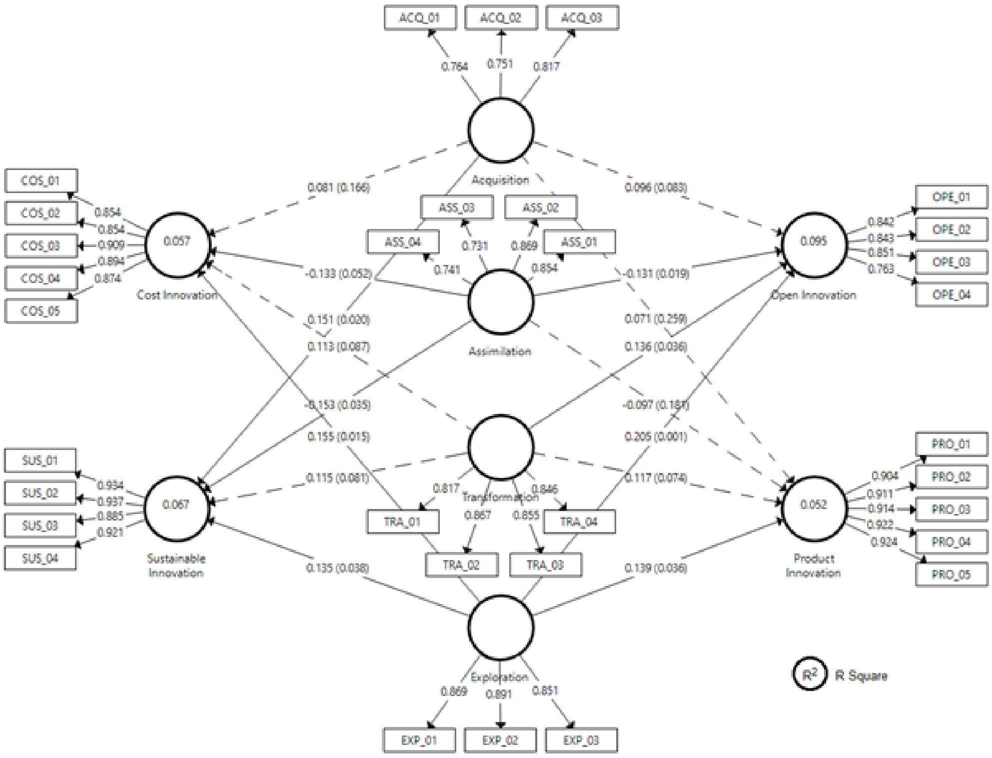
Table VIII. Predictive validity of the CAI-IF model

Predictive Dimensions	SOS	SSE	$Q^2 = 1 - \frac{SOS}{SSE}$
Open Innovation	1,852.00	1,741.73	0.060
Sustainable Innovation	1,852.00	1,757.49	0.051
Product Innovation	2,315.00	2,221.98	0.040
Cost Innovation	2,315.00	2,220.51	0.041

SOS = Sum of Observed Squares; SSE = Sum of Squared Estimate of Errors
Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

It is observed that all results indicate the accuracy of the model and point to all dimensions with little predictive relevance, that is, dimensions ranging from 0.041 to 0.60, that is, OI ($Q^2 = 0.060$), SI ($Q^2 = 0.051$), PI ($Q^2 = 0.040$) and OC ($Q^2 = 0.041$). Thus, once the model evaluation steps are completed, as proposed by Hair et al. (2014), we move on to the final considerations, pointing out the main findings of this research. Figure 3 and Table 9 (diagram 2) present the final results of the path model.

Figure 3. CAI-IF dimension path model



Source: SmartPLS® software v. 3.3.3 (Ringle, Wende & Becker 2015).

Table IX. Path diagram for the final CAI-IF model (diagram 2)

Endogenous Dimensions	**=**	**Exogenous Dimensions**	**+**	**Error**
COS	=	- 0.133 ASS + 0.155 EXP	+	ε_{COS}
SUS	=	0.151 ACQ - 0.153 ASS + 0.135 EXP	+	ε_{SUS}
PRO	=	0.139 EXP	+	ε_{PRO}
OPE	=	- 0.131 ASS + 0.136 TRA + 0.205 EXP	+	ε_{ABE}

Source: Research data based on Hair, Gabriel, and Patel (2014).

V. Conclusion

In this study, the objective was to explore the association between the dimensions of the CAI and IF constructs in postgraduate students. It was identified, through correlation analysis, that Open Innovation is the dimension most explained by the dimensions of the CAI, with the highest number of associations. The analysis of least-squares equations showed that the exploitation dimension of the CAI has the strongest and most significant links with all the dimensions of Frugal Innovation, accepting all the hypotheses proposed in the model regarding the association between the EXP dimensions with OI, OS, OP, and OC.

In practice, globalization, according to Zahra and George (2002) and Nooteboom et al. (2007), is one of the main drivers of open innovation (OI). Thus, organizations with external partners are more active in generating innovation. Thus, in the present study, students' capacity for assimilation, transformation, and exploitation can influence the development in search of open innovation in 0.09%, being the strongest link found in this study.

Corroborating with other studies, it is possible to state that postgraduate students incorporate the acquired knowledge, assimilating and transforming it in the application in products, services, or processes that are related to open and sustainable innovation, in terms of product and cost, where the greatest connection with open innovation was observed, with a $t_{cal.}$ = 3.428, with 0.205 degrees.

For an overview of solid (significant) and dotted (insignificant) paths, the exploitation dimension forms a solid path, that is, significant with the four dimensions of frugal innovation (open, sustainable, product, and cost innovation), as presented in figure 3. It is noteworthy that the exploitation dimension encompasses skills in effectively using knowledge to create something new, as pointed out by the authors Flatten et al. (2011), Zahra and George (2002), and Yildiz et al. (2019). It is also corroborated by authors who stress that exploitation depends on the use and implementation of knowledge, for example, thus creating essential competencies to intensify knowledge (Cohen; Levinthal, 1990; Lane et al., 2006; Prexl, 2020).

Individual attempts to assimilate external knowledge allow for exploitation, but these efforts require the openness, commitment, and motivation to recognize the value of knowledge to transfer it to the knowledge base and transform it into internal processes or explore it into new products (Hafkesbrink; SCchroll, 2014; Salter et al., 2015; Prexl, 2020). In this sense, the transformation dimension forms a solid and significant path with open innovation. In contrast, the assimilation dimension forms a solid and significant path with open innovation and cost innovation, corroborating the findings of the studies by Prexl et al. (2020) when they conclude that individual attempts to assimilate external knowledge allow for exploitation. On the other hand, the acquisition dimension forms a solid and significant path only with sustainable innovation.

Thus, it is concluded that postgraduate students can explore knowledge directly and positively linked to frugal innovation, that is, with its dimensions: open, sustainable, product, and cost innovation. Thus, in this population analyzed, knowledge exploitation is present in the daily practices of students, that is, exploring in their research, in the management of organizations in which they are owners or collaborators, or even in the classroom, playing the role of a teacher. This ability can lead to the creation of frugal products, or the improvement of a product, service, system, or process, with frugal characteristics.

Still, the CAI-IF model has shown to have good psychometric properties with postgraduate students. However, a study with individuals of different nationalities, ages, and backgrounds is important to confirm the generalization of the CAI-IF scales. Thus, the limitation was to apply it to a sample of postgraduate students. Thus, it is suggested to evaluate the performance of the CAI-IF model in samples with populations of different nationalities, ages, and professional training.

Acknowledgments

This study was funded by the following Brazilian research agencies: National Council for Scientific and Technological Development (CNPq), Coordination for the Improvement of Higher Education Personnel (CAPES) and Research Support Foundation of the State of RS (FAPERGS).

References

[1]. Afonso, P.; Nunes, M.; Paisana, A.; Braga, A. (2008). The Influence Of Time-To-MarketAnd Target Costing In The New Product Development Success, International Journal Of Production Economics, 115, 559-568. Https://Doi.Org/10.1016/J.Ijpe.2008.07.003.

[2]. Albert, M. (2019). Sustainable Frugal Innovation-The Connection Between Frugal Innovation And Sustainability, Journal Of Cleaner Production, 237, 117747. Https://Doi.Org/10.1016/J.Jclepro.2019.117747.

[3]. Alburub, A. G., & Lee, J. (2012). Open Innovation Management: Challenges And Prospects, Procedia–Social And Behavioral Sciences, 41, 130-138. Https://Doi.Org/10.1016/J.Sbspro.2012.04.017.

[4]. Almulhim, A. F. (2021). The Role Of Internal And External Sources Of Knowledge On Frugal Innovation: Moderating Role Of Innovation Capabilities. International Journal Of Innovation Science,13(3). 341-363. Https://Doi.Org/10.1108/IJIS-09-2020-0130.

[5]. Ananthram, S., & Chan, C. (2021). Institutions And Frugal Innovation: The Case Of Jugaad. Asia Pacific Journal Of Management, 38, 1031-1060.

[6]. Barros, J. D. A. (2008). A Elaboração Textual De Hipóteses – Uma Contribuição Ao Seu Esclarecimento No Ensino De Metodologia. Revista Educação Em Questão, 33(19). Available In: Https://Periodicos.Ufrn.Br/Educacaoemquestao/Article/View/3938/3205.

[7]. Bencsik, A., Machova, R., & Tóth, Z. (2016). Cheap And Clever–Symbiosis Of Frugal Innovation And Knowledge Management. Problems And Perspectives In Management, 14(1). 85-93. Http://Dx.Doi.Org/10.21511/Ppm.14(1).2016.10.

[8]. Boons, F., Montalvo, C., Quist, J., & Wagner, M. (2013). Sustainable Innovation, Business Models And Economic Performance: An Overview. Journal Of Cleaner Production, 45, 1-8. Https://Doi.Org/10.1016/J.Jclepro.2012.08.013.

[9]. Bos-Brouwers, H. E. J. (2010). Corporate Sustainability And Innovation In Smes: Evidence Of Themes And Activities In Practice. Business Strategy And The Environment, 19(7). 417-435. Https://Doi.Org/10.1002/Bse.652.

[10]. Bresciani, S. A. T., Lopes, L. F., Johann, D. A., Moura, G., Almeida, D., & Teixeira, C. E. (2020). Modeling Entrepreneurial Intent As A Predictor Of Frugal Innovation InUniversity Students, Revista De Administração Da UFSM, 13(3). 643-663. Https://Doi.Org/10.5902/19834659 43879.
[11]. Cadeddu, S.B.M., Donovan, J. D., Topple, C., De Waal, G.A., & Masli, E., K. (2019). Frugal Innovation And The New Product Development Process: Insights From Indonesia, Taylor & Francis: London, UK.
[12]. Camisón, C., & Forés, B. (2010). Knowledge Absorptive Capacity: New Insights For Its Conceptualization And Measurement, Journal Of Business Research, 63(7). 707-715. Https://Doi.Org/10.1016/J.Jbusres.2009.04.022.
[13]. Carrillo-Hermosilla, J., Del Río, P., & Könnölä, T. (2010). Diversity Of Eco-Innovations: Reflections From Selected Case Studies. Journal Of Cleaner Production, 18(10-11), 1073-1083. Https://Doi.Org/10.1016/J.Jclepro.2010.02.014.
[14]. Cervi, E. U. (2009). Métodos Quantitativos Nas Ciências Sociais: Uma Abordagem Alternativa AoFetichismo Dos Números E Ao Debate Com Qualitativistas, In Jussara Ayres Bourguignon, Pesquisa Social: Reflexões Teóricas E Metodológicas. Ponta Grossa: Todapalavra.
[15]. Chen, Y. S. (2008). The Driver Of Green Innovation And Green Image – Green Core Competence, Journal Of Business Ethics, 81(3), 531-543. Https://Doi.Org/10.1007/S10551-007-9522.
[16]. Chen, Y. S., Lai, S. B., & Wen, S. T. (2006). The Influence Of Green Innovation Performance OnCorporate Advantage In Taiwan, Journal Of Business Ethics, 67, 331-339. Https://Doi.Org/10.1007/S10551-006-9025-5.
[17]. Chesbrough, H. W., & Appleyard, M. M. (2007). Open Innovation And Strategy, California Management Review, 50(1), 57-76. Https://Doi.Org/10.2307/41166416.
[18]. Chin, W. W. (1998). Commentary: Issues And Opinion On Structural Equation Modeling, MIS Quarterly, 22(1), 7-16. Available In: Https://Www.Jstor.Org/Stable/249674.
[19]. Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective On Learning AndInnovation", Administrative Science Quarterly, V. 1, N. 35, P. 128–152. Https://Doi.Org/10.2307/2393553.
[20]. D'Avila, O. S.; Silveira-Martins, E. (2017). Proposição E Validação De Escala Para Mensuração Da Capacidade Dinâmica Produtiva, Revista Eletrônica De Estratégia ENegócios, 10(1), 285-311. Https://Doi.Org/10.19177/Reen.V10e12017285-311.
[21]. Dost, M., Pahi, M. H., Magsi, H. B., & Umrani, W. A. (2019). Effects Of Sources Of Knowledge On Frugal Innovation: Moderating Role Of Environmental Turbulence. Journal Of Knowledge Management, 23(7), 1245-1259. Https://Doi.Org/10.1108/JKM-01-2019-0035.
[22]. Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A Measure Of Absorptive Capacity: Scale Development And Validation, European ManagementJournal, 29, 98-116. Https://Doi.Org/10.1016/J.Emj.2010.11.002.
[23]. Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models With Unobservable Variables And Measurement Error, Journal Of Marketing Research, 18(1), 39-50. Https://Doi.Org/10.1177/002224378101800104.
[24]. Freitas, H., Oliveira, M., Saccol, A. Z., & Moscarola, J. (2000). O Método De Pesquisa Survey, Revista De Administração Da Universidade De São Paulo, 35(3), 105-112. Available In: Http://Www.Clam.Org.Br/Bibliotecadigital/Uploads/Publicacoes/1138_1861_Freitashenriquerausp.Pdf.
[25]. Fuchs J. P. S., Rosseto, C. R., Carvalho, & C. E. (2016). A Influência Da Capacidade Absortiva Realizada No Desempenho Da PME Vitivinícola, Revista Desenvolvimento EmQuestão, 14(37), 1449167. Https://Doi.Org/10.21527/2237-6453.2016.37.144-167.
[26]. Gil, A. (1999). Métodos E Técnicas De Pesquisa Social, São Paulo: Atlas.
[27]. Gunday, G., U, G., Kilic, K., & Alpkan, L. (2011). Effects Of Innovation Types OnFirm Performance, International Journal Of Production Economics, 133, 662-676. Https://Doi.Org/10.1016/J.Ijpe.2011.05.014.
[28]. Hafkesbrink, J., & Schroll, M. (2014). Ambidextrous Organizational And Individual Competencies In Open Innovation: The Dawn Of A New Research Agenda. Journal Of Innovation Management, 2(1), 9-46. Https://Doi.Org/10.24840/2183-0606_002.001_0004.
[29]. Hair, F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2005). Análise Multivariada De Dados, 5 Ed., Bookman, Porto Alegre
[30]. Hair, F., Hult, J. G. T. M., Ringle, C. M., & Sarstedt, M. (2014). Partial Least Squaresstructural Equation Modeling (PLS-SEM), Sage, Thousand Oaks.
[31]. Hair, F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). A Primer On Partial LeastSquares Structural Equation Modeling (PLS-SEM), 2 Nd Ed, Sages, Thousand Oaks.
[32]. Hossain, M. (2018). Frugal Innovation: A Review And Research Agenda, Journal Of Cleaner Production, 182, 926-936. Https://Doi.Org/10.1016/J.Jclepro.2018.02.091.
[33]. Kim, W. C., & Maubourgne, R. (1998), Procedural Justice, Strategic Decision, And The Knowledge Economy, Strategic Management Journal, V. 19, N. 4, P. 323-338. Https://Doi.Org/10.1002/(SICI)1097-0266(199804)19:4%3C323::AID-SMJ976%3E3.0.CO;2-F.
[34]. Lane, P. J., Koka, B. R., & Pathak, S. (2006). The Reification Of Absorptive Capacity: A Critical Review And Rejuvenation Of The Construct, Academy Of Management Review. 31(4), 833-863. Https://Doi.Org/10.5465/Amr.2006.22527456.
[35]. Lane; P. J., & Lubatkin, M. (1998). Relative Absorptive Capacity And Interorganizational, Strategic Management Journal. 19(5) 461-477. Https://Doi.Org/10.1002/(SICI)1097-0266(199805)19:5%3C461::AID-SMJ953%3E3.0.CO;2-L.
[36]. Lee, S. C., Liang, H., & LIU, C. Y. (2010). The Effects Of Absorptive Capacity, KnowledgeSourcing Strategy, And Alliance Forms On Firm Performance, The Service IndustriesJournal, 30, 2421-2440. Https://Doi.Org/10.1080/02642060802635551.
[37]. Lopes, L. F. D., Chaves, B. M., Fabrício, A., Porto, A., Machado De Almeida, D., Obregon, S. L., ... & Flores Costa, V. M. (2020). Analysis Of Well-Being And Anxiety Among University Students. International Journal Of Environmental Research And Public Health, 17(11), 3874. Https://Doi.Org/10.3390/Ijerph17113874.
[38]. Mortazavi, S., Laine, I., Quarshie, A., Väätänen, J., & Gupta, S. (2020). Multinational Enterprise And Inclusive Innovation At The Bottom Of The Pyramid: A Systematic Literature Review. International Business And Emerging Economy Firms: Volume I: Universal Issues And The Chinese Perspective, 19-47. Https://Doi.Org/10.1007/978-3-030-24482-8_2.
[39]. Murtic, S., Oljaca, R., Koleska, I., Karic,& I., Todorovic, V. (2018). Response Of Cherry Tomato Seedlings To Liquid Fertiliser Application Under Water Stress, Horticultural Science, 45(1), 22-28. Https://Doi.Org/10.17221/17/2017-HORTSCI.
[40]. Oecd / Eurostat, Oslo Manual 2018: Guidelines For Collecting, Reporting And UsingData On Innovation, 4th Edition, The Measurement Of Scientific, Technological And Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg.
[41]. Prahalad, C. K., & Hart, S. L. (2008). The Fortune At The Bottom Of The Pyramid, EstratégiasE Negócios, Florianópolis, 1(2), 1-23. Available In: Https://Ssrn.Com/Abstract=914518.
[42]. Prexl, K. M., Hubert, M., Hubert, M., & Gonera, A. (2020). Exploring The Individual:An Empirical Investigation Of Interrelationships Between Dimensions Of Absorptive Capacity, International Journal Of Innovation Management, 24(5), 2050077. Https://Doi.Org/10.1142/S1363919620500772.
[43]. Ringle, C. M., Silva, D., Bido, D. S. (2014). Modelagem De Equações Estruturais Com Utilização Do Smartpls, Remark – Revista Brasileira De Marketing, 13(2), 54-71. Https://Doi.Org/10.5585/Remark.V13i2.2717.
[44]. Ringle, C. M; Wende, S., & Becker, J. M. (2015). Smartpls 3, Gmbh: Smartpls. Https://Www.Smartpls.Com.

[45]. Salter, A., Ter Wal, A. L., Criscuolo, P., & Alexy, O. (2015). Open For Ideation: Individual-Level Openness And Idea Generation In R&D. Journal Of Product Innovation Management, 32(4), 488-504. Https://Doi.Org/10.1111/Jpim.12214.

[46]. Schmidt, T. (2010). Absorptive Capacity—One Size Fits All? A Firm-Level Analysis Of Absorptive Capacity For Different Kinds Of Knowledge. Managerial And Decision Economics, 31(1), 1-18. Https://Doi.Org/10.1002/Mde.1423.

[47]. Silva, E. R., D'Arrigo, F. P., Furlan, J., Ganzer, P. P., Olea, P. M., Larantis, F., Dorion, E. C. H., Nodari, C. H., Radelli, A. A. P., & Prodavon, C.C. (2016). Capacidade Absortiva Individual: Uma Perspectiva ComAlunos De Administração, Revista Espacios, 37(1). Available In: Https://Www.Revistaespacios.Com/A16v37n01/163701e2.Html.

[48]. Silva Teixeira, A. L., Rosa, A. C., Ruffoni, J., & Rapini, M. S. (2016). Dimensões Da Capacidade De Absorção, Qualificação Da Mão De Obra, P&D E Desempenho Inovativo. Revista Brasileira De Inovação. 15(1), 139-164. Https://Doi.Org/10.20396/Rbi.V15i1.8649123.

[49]. Szulanski, G. (1996). Exploring Internal Stickiness: Impediments To The Transfer Of Best Practice Within The Firm. Strategic Management Journal, 17(S2), 27-43. Https://Doi.Org/10.1002/Smj.4250171105.

[50]. Vega-Jurado, J., Gutiérrez-Gracia, A., & Fernández-De-Lucio, I. (2008). Analyzing The Determinants Of Firm's Absorptive Capacity: Beyond R&D. R&D Management, 38(4), 392-405. Https://Doi.Org/10.1111/J.1467-9310.2008.00525.X.

[51]. Volberda, H. W., Foss, N. J., & Lyles, M. A. (2010). Perspective-Absorbing The Concept Of Absorptive Capacity: How To Realize Its Potential In The Organization Field. Organization Science, 21(4), 931-951. Https://Doi.Org/10.1287/Orsc.1090.0503.

[52]. Wang, W., Feng, Y., & Liu, L. (2015). The Effect Of Organizational Levers And The Mediating Role Of Individual Absorptive Capacity In Information System Innovation, In: System Sciences (HICSS). 2015 48th Hawaii International Conference. 3780-3789.

[53]. West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. (2014). Open Innovation: The Next Decade, Research Policy, 43, 805-811. Https://Doi.Org/10.1016/J.Respol.2014.03.001.

[54]. Williamson, P. J. (2010). Cost Innovation: Preparing For A 'Value-For-Money'revolution. Long Range Planning, 43(2-3), 343-353. Https://Doi.Org/10.1016/J.Lrp.2009.07.008.

[55]. Yildiz, H. E., Murtic, A., Zander, U., & Richtnér, A. (2019). What Fosters Individual-Level Absorptive Capacity In Mncs? An Extended Motivation–Ability–Opportunity Framework. Management International Review, 59, 93-129. Https://Doi.Org/10.1007/S11575-018-0367-X.

[56]. Zahra, S. A., & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, And Extension. Academy Of Management Review, 27(2), 185-203. Https://Doi.Org/10.5465/Amr.2002.6587995.

[57]. Zeschky, M., Widenmayer, B., & Gassmann, O. (2011). Frugal Innovation In Emerging Markets. Research-Technology Management, 54(4), 38-45. Https://Doi.Org/10.5437/08956308X5404007.