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SOCIOECONOMIC IMPACTS OF UNIVERSITY-INDUSTRY COLLABORATIONS: BRAZILIAN LARGE FIRMS PERSPECTIVE

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INTRODUCTION

The Covid-19 pandemic completely transformed work activities, relationships, and interpersonal communication (inside and outside companies). The social distance imposed by the propagation characteristics of Covid-19 accelerated the digital transformation, in which companies began to relate increasingly with their customers and society by the internet and digital media, using for their communication: electronic address (website, URL – Uniform Resource Locator), E-mail Marketing, Google Ads, Facebook, Instagram, Youtube, Tiktok, Podcasts, and others. For internal communication between corporate employees, remote video calls and information sharing became common, with the high popularization of applications such as Google Meet, Zoom, Dropbox, and Google Drive.

The internet allows real-time trading between people and companies located in any region of the planet (with internet access), making it possible to make a purchase order and financial transactions between very distant locations (requiring only a few clicks on the web and very little time). The ease of purchasing imported products from other countries in the Business-to-Consumer (B2C) model from sites such as Amazon, eBay, Wish, and others, contributes to the acceleration of globalization and points to the growing need for industrial development and modernization in countries emerging countries so that products manufactured in these countries (especially those from some segments such as clothing and electronics) remain competitive with quality and attractive prices for the population of these countries.

Covid-19 has put public health services to the test. Economic systems will soon be put to the test by Covid-19. In order to recover from the effects of the coronavirus, innovation will be a essential way (Chesbrough, 2020).

The health, economic and financial crisis caused by the Covid-19 pandemic has significative harmed emerging countries. In Brazil, for example, the economy was severely affected with many companies closing (some of them with many years of existence in the market), accompanied by unemployment and increasing poverty. The new reality imposed by the pandemic showed the importance of flexibility for companies that needed to adapt quickly to meet the new needs arising from an atypical scenario.

Firms must continuously adapt and evolve to thrive in a dynamic, global environment. Despite the continuous change, firms drive markets by utilizing and strategically managing knowledge. Universities are crucial parts of the scientific and technological ecosystem because they provide an endless supply of data and technical capabilities (Berbegal-Mirabent *et al.*, 2015).

The open innovation paradigm emphasizes the need of a internal and external knowledge management in order to improve a company's internal innovation process, making it significantly faster through the implementation of both internal and external ideas, as well as creating technological advancements (Chesbrough *et al.*, 2006).

In the open innovation dynamics, the university is a significant resource as well as a wonderful supplier of ideas for firms. Furthermore, academic professionals are taught and equipped to assess the technical feasibility of new technology deployment. As a result, the investigation and understanding of the university-industry socioeconomic collaboration consequences is highly important in the open innovation study field (Lima *et al.*, 2021).

Collaboration with universities and partners is the only way for managers to obtain the internal technical expertise they need (Najafi-Tavani *et al.*, 2018). The collaborative innovation allows the firms a special chance to conduct externally focused exploration (Heil and Bornemann, 2017). Managers should expand business partnership with universities because these research organizations have the potential to significantly improve both product and process innovation skills (Najafi-Tavani *et al*., 2018).

The entrepreneurial university promotes the transfer of academic knowledge to companies in an effort to enhance socioeconomic growth (Etzkowitz, 2008). The expansion of entrepreneurial activity in higher education is substantially due to an underlying need for economic development as well as a greater emphasis on social responsibility. Higher education institutions play an important role in the development of human resource capability and efficiency (Alessandrini *et al.*, 2013).

The entrepreneurial university is a significant driver of economic and social regional development because it produces and explores knowledge as a source of entrepreneurship (Urbano and Guerrero, 2013). Faced with the conventional triumvirate of land, labor, and money (traditional sources of richness), scientists and engineers started new businesses, and science and technology became a more vital source of capital (Etzkowitz, 2013).

In the Covid-19 pandemic, the world "stops", and global efforts focused on vaccines development, safe and effective treatments for the Covid-19, and related technologies and equipment. The science, research, and development (R&D) results in innovations to solve global problems (as in the case of the pandemic) became evident, with the participation of universities in the creation of vaccines, as was the case of the University of Oxford in partnership with the AstraZeneca company. Additionally, various scientific studies on Covid-19 have been widely disseminated (both on the internet and the main television channels, radio, and newspapers). A large part of the population began to periodically follow an opinion from scientists, medical, and reports on issues related to the pandemic, public health, and its consequences and impacts, which increased recognition from the society of the value and importance of technoscientific development to solve the biggest problems of the planet.

Although the university and its collaborations with the industry are recognized for promoting socioeconomic development, several authors point out the need to create metrics to assess the socioeconomic impact of these collaborations.

A university that develops and transforms knowledge and discovery into social and economic growth is becoming an increasingly essential global goal. The most frequently used metrics, on the other hand, were developed when research and teaching were the main academic goals (Etzkowitz *et al*., 2018).

Universities lack clear data and methods for tracking and evaluating overall entrepreneurial success (Etzkowitz *et al*., 2018). Existing technology transfer output metrics are widely considered to be not only insufficiently defined, but also inaccurate. The national impact of technology transfer personnel's efforts is not taken into consideration. Rather than relying simply on indicators like the number of patents filed and revenue from licensing agreements, the efficacy of the technology transfer role may be assessed in terms of social community impact, job generation and poverty reduction (Alessandrini *et al.*, 2013).

Academic entrepreneurship demands a thorough evaluation that goes beyond specific metrics such as financial returns on an intellectual property portfolio or individual performance. It is important to consider the wider social and economic benefits such as knowledge dissemination, building of intangible assets in the context of new venture development, and the contribution of employment for social, cultural, and economic reasons (Etzkowitz *et al*., 2018).

Zhou and Etzkowitz (2021) highlight those developing countries often followed an economically unsustainable path, importing highly polluting equipment discarded by developed countries. On the other hand, sustainable development, considering the different environmental-socioeconomic aspects, is safe, with potential benefits for human beings, the environment, and the economy.

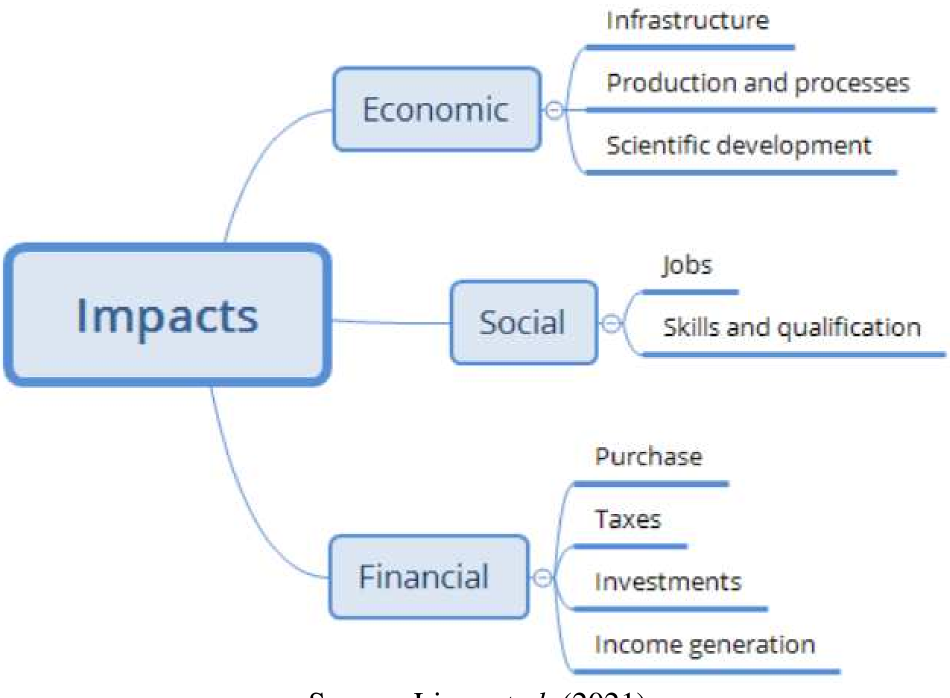
Emerging countries, if they develop the technologies, they need internally, start to reduce their level of dependence on developed countries, at the same time, they become more attractive for participation in international research networks and partnerships with institutions from other countries. The creation of a model for the socioeconomic development of emerging countries makes it possible to take advantage of their potential to create unique competitive differentials. The entrepreneurial university plays a central role in the development of R&D and Innovation with companies that result in socioeconomic impacts.

Consequently, in this research, we investigate the socioeconomic impact of university-industry collaborations on the firm's perspective presenting a multivariate statistical analysis of Brazilian large firms. The article is structured as follows: the second section presents the literature review, the third section describes the research method, and the fourth section refers to results, followed by conclusions, recommendations, and future research possibilities in the last section.

THEORETICAL BACKGROUND

According to Lima *et al.* (2021), the socioeconomic impacts of university-industry collaborations can be categorized into (1) economic: infrastructure, production and processes, and scientific development; (2) social: jobs, skills, and qualification; and (3) financial: purchases, taxes, investments, and income generation, as shown in Figure 1.

Figure 1: Evaluation model for the socioeconomic impact of university–industry collaborations



Source: Lima *et al.* (2021).

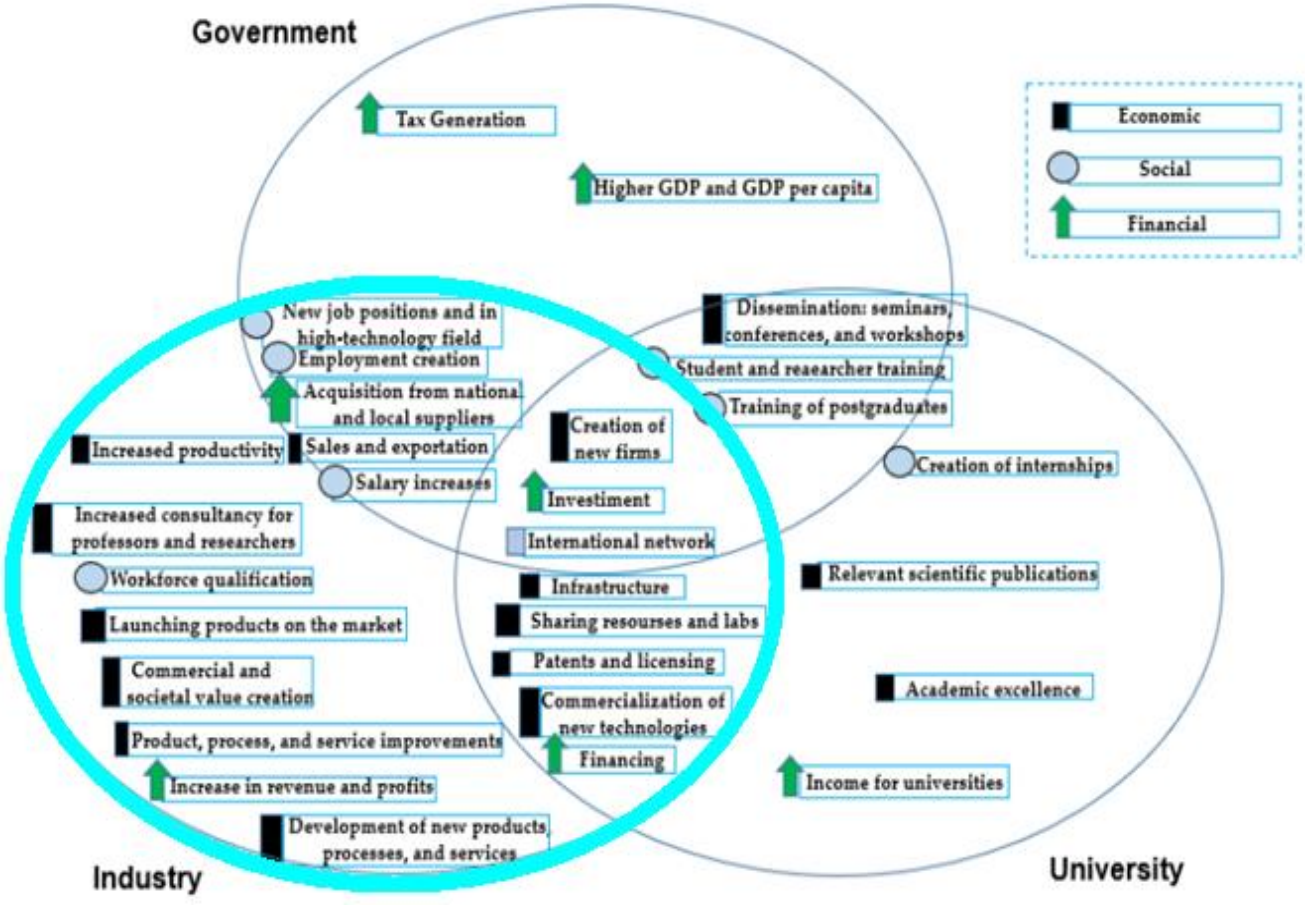
A dynamic arrangement of institutional forces in innovation systems, as well as an interactive (non-linear) model of innovation and a trilateral adjustment of collaboration, are shown by the triple helix. The triple helix model acknowledged that the demarcation lines between university-industry-government became less clear in contrast to the traditional model, in which firms are solely responsible for economic production, universities are solely responsible for knowledge generation and transmission (Etzkowitz, 2008).

According to Zhou and Etzkowitz (2021) create more helices does not help the comprehend the phenomenon. Many studies add more helices to make it more complex, but that is an ineffective method. It may be more efficient to analyze the triple helix upon different perspectives to raise the research level and understanding of global sub-regions reality with build coalitions and resources aggregation. Developing countries have a role to play in constructing relevant knowledge spaces.

We used Lima *et al.* (2021) because the model systematically organizes several high-value socioeconomic impacts for technology management, categorized according to the interest of each actor in the Triple Helix (Government-University-Industry). We analyze large Brazilian firms, for such, we use only the part of the model that refers to the object of study (firms).

Figure 2 illustrates the Socioeconomic Triple Helix Conceptual Model.

Figure 2: Socioeconomic triple helix



Source: Lima *et al.* (2021).

METHOD

Multivariate analysis approaches are popular because they enable organizations to create information, which helps them make better decisions. Multivariate analysis refers to all statistical techniques that analyze multiple measurements on individuals or objects under evaluation at the same time (Hair *et al.*, 2009).

Some multivariate techniques are designed specifically to address multivariate aspects such as factor analysis, which identifies the inherent structure within a set of variables (Hair *et* *al.*, 2009). The factor analysis is used to organize the model's variables (according to their intercorrelations), it also simplifies the model obtained by reducing the number of variables, enabling a more simplified, didactic, and easier to apply model capable of explaining the phenomenon. The factors resulting from the analysis and the final arrangement of the variables provide a detailed understanding of the relationships inserted in the analyzed phenomenon.

The factor analysis is a statistical method that represent the structure or patterns of the variables and they intercorrelations (Hair *et al.*, 2009). Canonical correlation analysis can be seen as a logical extension of multiple regression analysis. Canonical analysis aims to correlate simultaneously numerous metric dependent variables and several metric independent variables. Multiple regression has a single dependent variable, whereas canonical correlation has multiple dependent variables. The underlying principle is to develop a linear combination of each set of variables (independent and dependent) to maximize the correlation between the two sets (Hair *et al.*, 2009).

Scale and Sample

The scale has been developed according to the recommended procedures and steps by DeVellis (2017): (1) determine clearly what is it that you want to measure and generate an item pool; (2) determine the format for measurement and have the initial item pool reviewed by experts; (3) consider the inclusion of validation items and administer items to a development sample; and (4) evaluate the items and optimize scale length.

The scale, developed based on the literature review, was sent to companies that collaborate with universities via e-mail and LinkedIn® to the scale pretest, in which 10 Brazilian firms, that have formalized collaboration projects, answered the questionnaires.

We analyzed the Cronbach Alpha with the SPSS® software. The data obtained is shown in Table 1.

Table 1: Cronbach alpha

Cronbach's Alpha	Cronbach's Alpha based in standardized items	N of items
,931	,932	24

Source: Research data (2021).

According to Almeida *et al.* (2010), Cronbach's Alpha is a statistical tool that measures the reliability of a questionnaire on a scale of 0 to 1. For a reliable questionnaire, 0.7 is the minimum appropriate value. As the value obtained in Cronbach's Alpha (0.931) was much higher than the minimum value (0.7), the questionnaire was accepted to analyze the phenomenon.

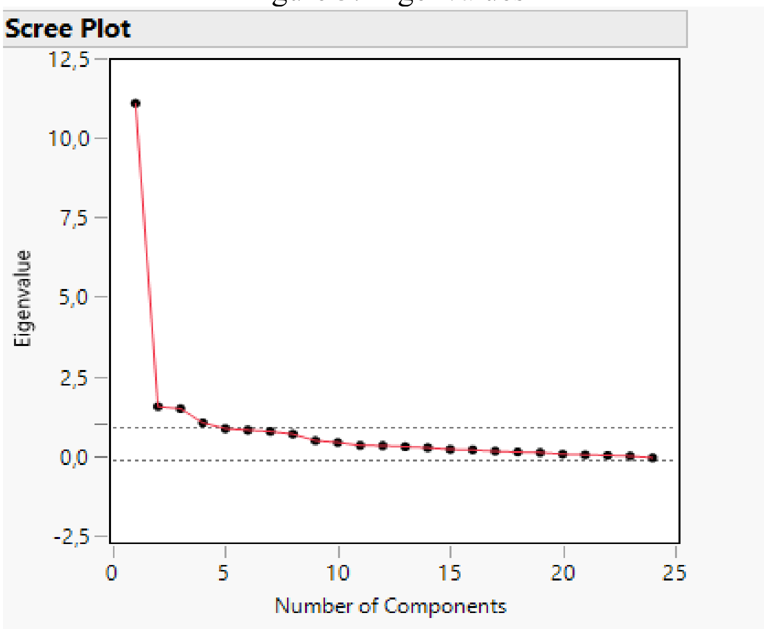
The survey was sent to the ranking of the 1,500 largest companies in Brazil organized by the Institute of Management Foundation (FIA) and Austin Consulting "*Ranking 1500 – Empresas + Estadão*". We collected 210 complete and valid responses from companies that have formalized collaborations with universities.

RESULTS

Most companies (68%) have global operations, 27% national operations, and 6% regional operations. 85% of the companies having more than 500 employees, and 98% of companies have more than 50 employees. 94% of companies are over 14 years old. 74% of companies have formalized collaborations with universities for more than 4 years (Appendix).

The JMP® (SAS) software was used for data processing, in which Factorial Analysis was performed, obtaining the results:

Figure 3: Eigenvalues



Source: Research data (2021).

Table 2: Factors

Eigenvalues

Number	Eigenvalue	Percent	20 40 60 80	Cum Percent
1	11,1986	46,661		46,661
2	1,6675	6,948		53,609
3	1,6014	6,672		60,281
4	1,1579	4,825		65,106
5	0,9727	4,053		69,159
6	0,9279	3,866		73,025
7	0,8865	3,694		76,719
8	0,8048	3,353		80,072
9	0,5962	2,484		82,557
10	0,5368	2,237		84,793
11	0,4456	1,856		86,650
12	0,4372	1,822		88,472
13	0,4064	1,693		90,165
14	0,3741	1,559		91,724
15	0,3219	1,341		93,065
16	0,3085	1,285		94,351
17	0,2672	1,113		95,464
18	0,2402	1,001		96,465
19	0,2210	0,921		97,386
20	0,1727	0,720		98,105
21	0,1506	0,628		98,733
22	0,1331	0,555		99,288
23	0,1126	0,469		99,757
24	0,0584	0,243		100,000

Source: Research data (2021).

To select the number of factors to be extracted, the latent root criterion was used. The latent root criterion considers that only factors that have latent roots or eigenvalues greater than 1 are deemed significant, thus, all factors with latent roots lower than 1 are considered insignificant and are discarded. Using the eigenvalue to establish a cutoff is more reliable when the number of variables is between 20 and 50 (Hair *et al.*, 2009). As the research has 24 variables, this criterion was reliably used .

Four factors were selected for presenting an eigenvalue greater than 1, as shown in Figure 3 and Table 2. In addition, the criterion of percentage of variance was verified, in which a value greater than 65% was obtained. According to Hair *et al.* (2009) in social science studies, solutions that often explain 60% of the total variance (and in some cases even less) can be considered satisfactory.

The orthogonal rotation of factors was put in place using the Varimax method. According to Hair *et al.* (2009) this method has been very successful as an analytical approach to obtain an orthogonal rotation of factors, being more widely accepted than the Quartimax and Equimax method.

Hair *et al.* (2009) state that, considering the practical significance of the analyses, factor loadings in the range from ± 0.3 to ± 0.4 are considered to meet the minimum level for interpretation of the structure. Factor loadings of ± 0.5 or greater are said to be practically significant. In our study, we used 0.545 as factor loadings because it was higher than the minimum value (0.5) described by Hair *et al.* (2009) to practical significance and capable to explain our model. Thus, two variables with factor loadings less than 0.545 were identified. The variables were: "investment in the company's infrastructure" (approx. 0.334) and "external investment" (approx. 0.430), which were removed from the analysis. On the other hand, we identified that the variable "public or private financing for the company" with a factorial load of 0.551 was conceptually able to explain the removed variables in Table 3.

Table 3: Factor loads

Rotated Factor Loading

	Factor 1	Factor 2	Factor 3	Factor 4
Revenue increase	0,847126			
Profit increase	0,819951			
Sales increase	0,754840			
Exportations increase	0,687420			
Commercial and corporate/shareholder value	0,687079			
Public or private financing increase	0,551628			
External investment on the company				
Development of new technologies		0,776531		
Development of new products, processes and services		0,764096		
New technologies commercialization		0,746789		
Release of new products		0,697829		
Products, processes and/or services improvement		0,669169		
Patent licensing		0,576614		
Generation of intellectual property		0,549680		
Purchase of goods and services from local suppliers			0,748000	
Purchase of goods and services from national suppliers			0,732985	
Salary increase of employees who participated in the university collaboration			0,686768	
Employment generation			0,603220	
Creation of new high technology workstations			0,579164	
Creation of new companies			0,545361	
Investments in the company infrastructure				
Network with other institutions (national or international)				0,689468
Professional workforce qualification				0,639652
Resources sharing and/or universities laboratories				0,587159

Source: Research data (2021).

As we already mentioned, factor loadings of 0.7 or higher are considered indicative of a well-defined structure and are the goal of any factor analysis (Hair *et al.,* 2009).

In this study, we identified 7 factor loadings greater than 0.7 referring to the variables that best represent the model. "Increase in revenue" (approx. 0.847), "increase in profit" (approx. 0.819), "increase in sales" (approx. 0.754), "development of new technologies" (approx. 0.776), "development of new products, processes and services" (approx. 0.764), "commercialization of new technologies" (approx. 0.746), "purchase of goods and services from local suppliers" (approx. 0.748), "purchasing goods and services from national suppliers" (approx. 0.732). Additionally, the variable launching new products presented a value very close to 0.7 (approx. 0.697).

Table 4: Commonality

Final Communality Estimates	
Investments in the company infrastructure	0,30194
Resources sharing and/or universities laboratories	0,54533
Products, processes and/or services improvement	0,60937
Development of new technologies	0,76120
New technologies commercialization	0,75365
Development of new products, processes and services	0,75542
Release of new products	0,78631
Creation of new companies	0,46103
Generation of intellectual property	0,61547
Patent licensing	0,56555
Sales increase	0,78275
Exportations increase	0,65754
Commercial and corporate/shareholder value	0,71899
Network with other institutions (national or international)	0,60829
Employment generation	0,70981
Creation of new high technology workstations	0,70992
Salary increase of employees who participated in the university collaboration	0,58915
Professional workforce qualification	0,55902
Purchase of goods and services from local suppliers	0,69582
Purchase of goods and services from national suppliers	0,64134
External investment on the company	0,53917
Public or private financing increase	0,60904
Revenue increase	0,84794
Profit increase	0,80138

Source: Research data (2021).

In the analysis of the commonality present in Table 4, we observed that the variable "investment in the company's infrastructure" had a value of less than 0.5 in addition to the low factor loading previously presented in Table 3.

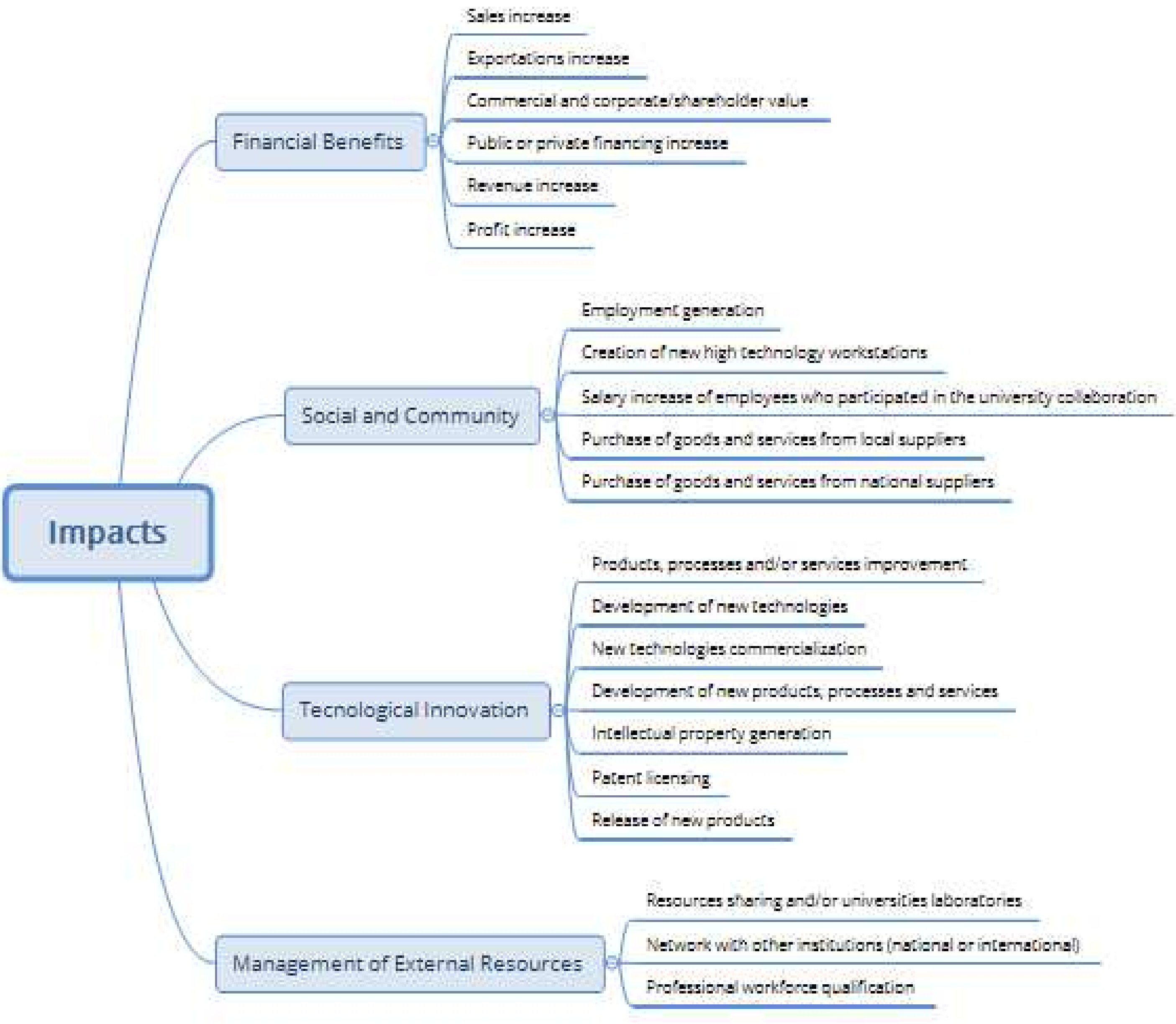
The "creation of new companies" had a value of less than 0.5. The large companies have a solid infrastructure, not being necessary to create a new company to sell newly developed products. On the other hand, to academic entrepreneurs, for example, often the creation of new technology companies (such as startups and spinoffs), as one of the major mechanisms for transferring scientific technology to the market and society.

Consequently, 3 variables were removed from the model: "external investment" (factor loading analysis), "investment in the company's infrastructure" (factor loadings and communality analysis), and "company creation" (commonality analysis).

Factor analysis identified the grouping of data into 4 factors in detriment to the initial 3 Factors (economic, financial, and social). The 4 factors were categorized into financial benefits; social and community; technological innovation and management of external resources.

We built a socioeconomic impact model of collaborations with universities for large companies based on data analysis, shown in Figure 4.

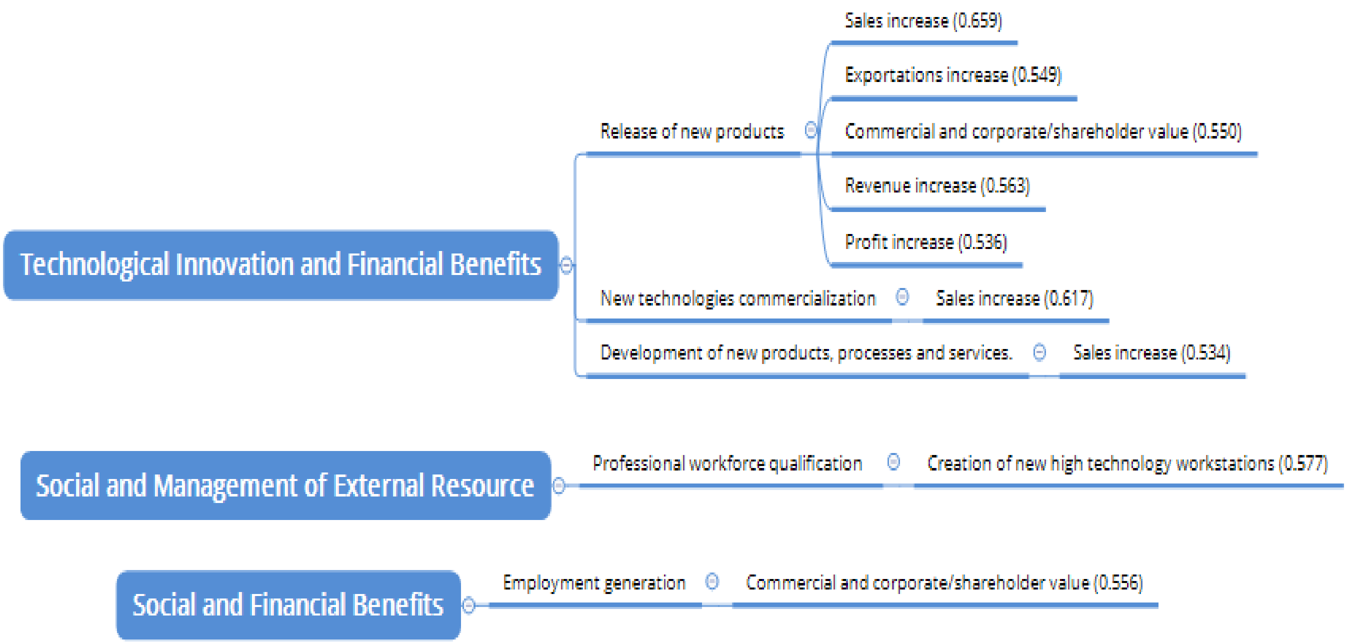
Figure 4: Socioeconomic impacts of university-industry collaborations to large firms



Source: Research data (2021).

We also performed a canonical correlation analysis to quantify the relationships between sets of variables in Statistica® Statsoft software, considering correlation values between variables greater than 0.53. Correlations were identified between Technological Innovation and Financial Benefits, between Social and External Resource Management, and Social and Financial Benefits. The correlation values between those variables are shown in Figure 5.

Figure 5: Canonical correlation



Source: Research data (2021).

The canonical correlation analysis presented information of high strategic value for the socioeconomic impact of university-industry collaborations. We identified the correlation between Technological Innovation and Financial Benefits. The "release of new products" is correlated with "sales increase" (approx. 0.659), "exportations increase" (approx. 0.549), "commercial and corporate/shareholder value" (approx. 0.550), "revenue increase" (approx. 0.563), and "profit increase" (approx. 0.536). The "sales increase" also is correlated with "new technologies commercialization" (approx. 0.617) and "development of new products, processes, and services" (approx. 0,534). We also found a correlation between the Social and Community, and Management of External Resource, "professional workforce qualification" correlated with the "creation of new high-tech workstations" and between Social and Community, and Financial Benefits, the "employment generation" is correlated with "commercial and corporate/shareholder value" (approx. 0.556). (Appendix).

From the results obtained, it can be considered that every investment in research and development (R&D) is consolidated in technological innovation as it results in the launch and commercialization of new products with new technologies that generate financial benefits for companies "rewarding" the dedicated efforts of the companies to innovation. Another result found is the correlation between qualified professionals and new high-tech jobs. Currently, new job positions are created with the most varied nomenclature, requiring diverse skills and knowledge. There is a tendency towards a high level of specialization, thus, most of the high-tech jobs are associated with specific qualifications, for example, experience in PHP language, mobile programming, nanotechnology, data science, polymers, among others, that requires a high professional qualification to occupy these high-tech jobs.

CONCLUSIONS

Although university-industry collaborations are considered to provide the ability to increase socioeconomic growth, there is a literature gap in the field of comprehensive metrics to measure these collaborations' socioeconomic impacts. This work achieved the goal of evaluating the socioeconomic impacts of large Brazilian firms that carry out formal collaborations with universities.

The most representative variables of the constructs, with greater ability to explain the model with the large firms perspective of the socioeconomic impacts of university-industry are, in order: revenue increase; profit increase; sales increase; development of new technologies; development of new products, processes and services; commercialization of new technologies; purchase of goods and services from local suppliers; purchasing goods and services from national suppliers, and launching new products.

The professional workforce qualification" is correlated with the "creation of new high-tech workstations. New technologies commercialization and development of new products, processes and services are correlated with increased sales. Release of new products is correlated with increased sales, exports, revenue, profit, commercial and corporate/shareholder value. The employment generation also is correlated with commercial and corporate/shareholder value.

Theoretical Contributions

The literature points to the need to use more comprehensive metrics capable of measuring the socioeconomic impact of university-industry collaborations with authors such as Audretsch *et al.* (2019), Galan-Muros and Davey (2019), Alessandrini *et al.* (2013) and Etzkowitz *et al.* (2018).

This article performed a comprehensive analysis of the socioeconomic impacts of large Brazilian firms using multivariate statistical techniques to analyze the collected data. The analysis allowed the construction of a model of socioeconomic impacts from the perspective of large Brazilian companies. This work also found a relationship between the "qualification of the workforce" and the "creation of new high-tech workstations". The research and development (R&D) investments are consolidated in technological innovation with the launch and commercialization of new products with new technologies that generate financial benefits for companies that made innovation. The employment generation contributes to elevate the commercial and corporate/shareholder value.

Managerial Contributions

In addition to its theoretical contributions, this research of socioeconomic impact model benefits the companies that will be sure of a way forward to obtain great financial results from investment in R&D and technological innovation with collaborations and universities that will be sure of where to put their greatest efforts so that the results are meaningful for companies and thus enhance your own results according to your best interests.

The indicators can be applied individually to each company so that you can comprehend your position itself in its collaborations, comparing them with the results presented in this article. Universities and governments and public agents will also be able to use the initiators to assess the collaborations they participate. So, it serves all stakeholders involved.

Research Limitations

The limitation of this research is that the final model obtained from the statistical analyzes is focused on large companies, thus, it is important to consider all the initial variables when analyzing other types of companies such as the variable “creation of new startups/spinoffs companies” because it can be essential when analyzing small businesses and academic entrepreneurship. Furthermore, it is a generic model depending on the type of collaboration, the type of market of the companies and the characteristics of the universities. Therefeore, it may be interesting to add or reduce the number of indicators. The study presents the large Brazilian firm's perspective although the results also can be applied to other emerging economies.

Future Research Directions

For future studies, it is recommended to implement the analysis in other groups of companies, both regional and Brazilian, as well as studies in other countries, to compare the results obtained with the ones presented in this research. Furthermore, additional models may be proposed to assess the impact of collaborations in cities, the quality of life of the population and interaction with public agents to improve regional infrastructure.

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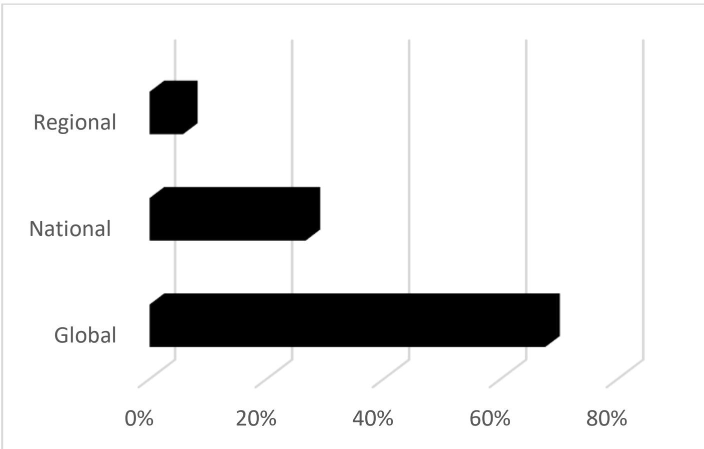
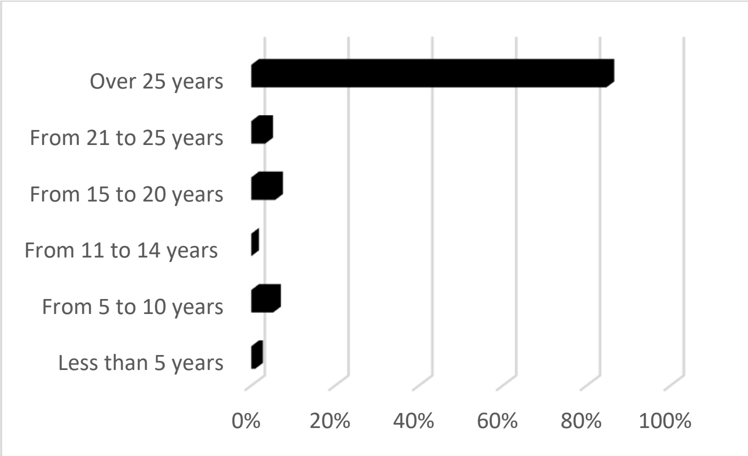
Appendix

A1: Sales areas of the firms



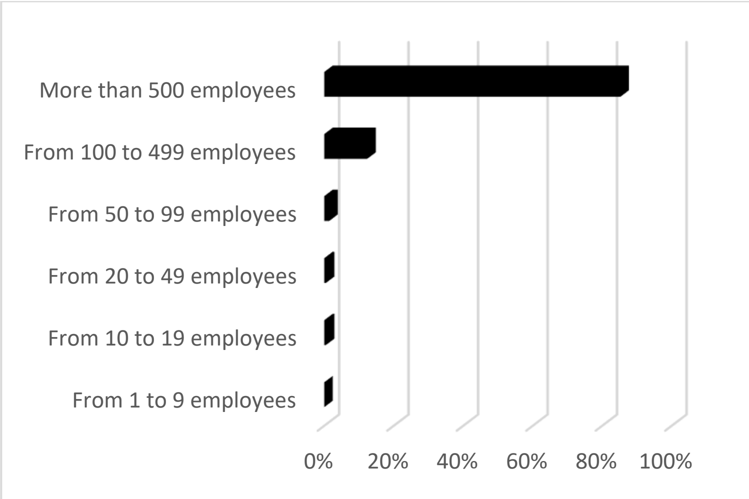
Source: Research data (2021).

A2: Time of existence of the companies



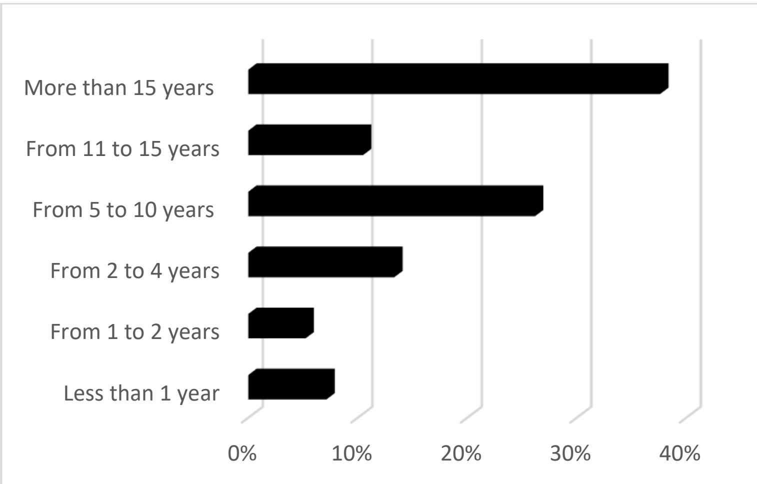
Source: Research data (2021).

A3: Number of employees



Source: Research data (2021).

A4: Time of the first one university collaboration



Source: Research data (2021).

A5: Canonical correlation analisys

Canonical R: ,7029797
Chi-Square: 158,6338 df = (25) p = 0,000000
Number of valid cases: 205

	No. of vars.	Variance extracted	Total redundancy given the other set
Left set:	5	100,00000000%	36,455592822%
Right set:	5	100,00000000%	34,392728732%

	Root 1	Root 2	Root 3	Root 4	Root 5
Value	0,494180	0,065555	0,031510	0,014490	0,003167

	Canonicl	Canonicl	Chi-sqr.	df	p	Lambda
0	0,702980	0,494180	158,6338	25	0,000000	0,449705
1	0,256037	0,065555	23,3411	16	0,105000	0,889063
2	0,177511	0,031510	9,8824	9	0,360126	0,951434
3	0,120374	0,014490	3,5270	4	0,473799	0,982389
4	0,056278	0,003167	0,6297	1	0,427473	0,996833

C1C3	V3	V4	V5	V6	V7	V9	V10
V11	0,466971	0,496819	0,617266	0,534449	0,659729	0,395110	0,421948
V12	0,379173	0,434078	0,473955	0,426731	0,549743	0,337422	0,365020
V13	0,465289	0,509310	0,495193	0,501886	0,550436	0,429917	0,428650
V22	0,343181	0,419127	0,346218	0,407079	0,429717	0,425706	0,368052
V23	0,425059	0,437892	0,494444	0,496726	0,563394	0,339753	0,369297
V24	0,436793	0,411925	0,496333	0,473362	0,536006	0,316142	0,364554

C1C2	v15	v16	v17	v19	v20
v11	0,472609	0,443241	0,418673	0,459400	0,406096
v12	0,410579	0,401581	0,477791	0,451801	0,375454
v13	0,556131	0,496810	0,381009	0,489263	0,405992
v22	0,398440	0,417549	0,321854	0,365595	0,275278
v23	0,484693	0,475283	0,409339	0,434185	0,384118
v24	0,458697	0,446108	0,426137	0,458163	0,438610

C1C4	V2	V14	V18
V11	0,383591	0,405920	0,343793
V12	0,275786	0,315151	0,319353
V13	0,323490	0,524588	0,340734
V22	0,353004	0,528838	0,386013
V23	0,318689	0,382601	0,352933
V24	0,318095	0,334048	0,356093

C2C3	V3	V4	V5	V6	V7	V9	V10
V15	0,443336	0,406839	0,365137	0,417643	0,407949	0,527980	0,489164
V16	0,433756	0,445140	0,450652	0,444703	0,400750	0,514618	0,493859
V17	0,237101	0,319182	0,344997	0,284801	0,391769	0,307736	0,302830
v19	0,392307	0,425113	0,384665	0,432377	0,456953	0,412511	0,422220
v20	0,373217	0,382373	0,310451	0,394947	0,373708	0,424628	0,424470

C2C4	V2	V14	V18
V15	0,418339	0,421631	0,509316
V16	0,408685	0,440868	0,577539
V17	0,202208	0,258466	0,433756
v19	0,256323	0,333429	0,393124
v20	0,311002	0,350629	0,392987

C3C4	V2	V14	V18
v3	0,483060	0,365583	0,351466
v4	0,446527	0,399026	0,395455
V5	0,337989	0,267964	0,309296
V6	0,375867	0,419846	0,393888
V7	0,309834	0,332030	0,287946
V9	0,432871	0,396944	0,366070
V10	0,346691	0,284312	0,244860

Source: Research data (2021).