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PRESENCE OF INNOVATION IN SCIENTIFIC RESEARCH GENERATING IMPACTS ON PROFESSIONAL MASTER'S CAREERS IN USP PROGRAM

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ABSTRACT

The present study aimed to map the dissertations presented to the Professional Master's Degree Program in Management and Innovation in the Animal Industry of the School of Animal Science and Food Engineering (FZEA) of the University of São Paulo (USP), identifying the presence, nature, and degree of innovation in each of them. The methodology applied was based on the development of a dissertation evaluation model using criteria founded on qualitative research, carried out through the perception of academic and market experts, and the main indicators were measured to assess the impacts generated in professional careersof the students. The research universe in this case study considered all the dissertations defended in the Program in the period between 2015 and 2019, totaling 71 essays. The analysis tools used included descriptive statistics, principal component analysis (PCA), and factor analysis (FA). In the end, a strong effects of innovation was identified, which generated distinct positive impact results, such as: in the author's career, in the organization to which the author was affiliatedand in the generation of business opportunities. According to the obtained results, there are strong indications that the Program helps transform the reality experienced professionally by its target audience.

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INTRODUCTION

The classical definitions of innovation derive from economic aspects that have as the main focus the role of technology in the evolution of producing and applying technological and scientific knowledge over time. According to Martin (2016), innovation in the 1960s was exclusively related to manufacturing in developed countries;it was based on technology; it involved, primarily, previous Research and Development (R&D); it was developed by large companies, often based on R&D conducted in their own laboratories, and it frequently involved patenting processes. The author recognized that most indicators designed to measure such innovations could be "missing" much of the innovative activity that is incremental and involves little or no formal R&D. Rantin (2016) stated that, in general, innovation is the process of transforming knowledge into products and processes that can be placed on the market. Innovation, therefore, is one of the main tools for competition in the market (MANUALDEOSLO, 2018). In this sense, the choice of the theme related to innovation and its different impacts for the development of the study in the dissertations defended in the Professional Master's Degree Program in Management and Innovation in the Animal Industry seems to be an interesting object of research. The Professional Master's Degree Program in Management and Innovation in the Animal Industryof the School of Animal Science and Food Engineering of the University of São Paulo (FZEA-USP) begin its activities in 2012. At the end of the year 2019, the Program accounted for 71Master's defenses. Trying to understand the degree of impact that these essays produced, in the professional careers emphases, constituted the problematization of this study. The initial premise of the studywas to confirm that "the Program has an innovation bias in the scientific and technological research that wascarried out, with the generation of distinct impacts stemming from the detection of elements that, together, can help in the transformation of the reality experienced professionally byitsMaster's students".

THEORETICAL ASSUMPTIONS

According to Drucker (2014), innovation has a direct effect on society and the economy, with a corresponding change in the behavior of customers, consumers, and people in general. Innovation includes

managing processes and resources to manage creativity, developing new concepts and methods to be brought to market. It is through the adoption of innovation that any company is able to redefine the sectors in which it operates, to create new industries, and to conquer a leadership that will establish the rules of competition for its own benefit (DAVILA, EPSTEIN and SHELTON, 2009, p.46).

The Oslo Manual (2018) uses the definition of technological product and process (TPP) innovation, focusing on the technological development of new products and new production process technologies created by companies. According to Mattos, Stoffel, and Teixeira (2010), in the past, the improvement of productivity was achieved through investments in infrastructure and newly installed capacities. It is now globally pervasive that a key element of productivity growth is innovation.The incrementswith the use of labor and capital explain only part of the growth in productivity. The other half is defined by innovation, which generates greater efficiency in companies that adopt it. In order to obtain lasting competitive advantages, companies need to incorporate at their core a culture of preventing problems and analyzing risks that can significantly impact the business.One metric of innovation in a company is the amount of resources allocated to research and development (R&D) activities and the qualification of personnel focused on innovation management, enabling the incorporation of new knowledge and new processes or new products to serve new markets. According to the Oslo Manual (2018), the most utilized source in the field of innovation with regard to terminologies used by researchers at the Organization for Economic Cooperation and Development (OCDE), Joseph Schumpeter's argument influenced the structuring of the term 'innovation'. Referred to as "creative destruction", this author describes that old technologies are replaced by new ones through a dynamic process of economic development. Thus, considering the five activities involving the innovative process, it is possible to state that economic and social growth involves leveraging business opportunities, recognizing entrepreneurial capacity, and setting up careers and companies. Dziallas and Blind (2019) highlighted that academic research does not indicate a common general framework for measuring innovation. Moreover, it remains unclear whether academic achievement metrics are applicable to organizations.

MATERIAL AND METHODS

The presentstudy is descriptive and exploratory in nature (GIL, 2010; VERGARA, 2002). Starting in mid-2013, the Professional Master's Degree Program in Management and Innovation in the Animal Industry (GIIA), of the Faculty of Animal Science and Food Engineering (FZEA) of the University of SãoPaulo (USP),was inserted by CAPES categorization in the greaterarea of Administration. The purpose of this Program, since its inception, was to act in the training of researchers and innovation agents who could contribute to the development of internal R&D within the organizations that they were included, in addition to carrying out scientific and technological projects in the area of management and innovation in all links of the Animal Industry business chain.Thus, it has sought to work on the improvement of human capital to raise the level of innovation and growth of Brazilian agribusiness, as the main backdrop.

Characterization of the sample data: In this sense, the GIIA Program was divided into the following fields of research: Management in the Animal Industry and Innovation in the Animal Industry. Below are the definitions contained in the Program's proposal.

Management in the animal industry: its principle is to develop professionals in technical areas that need to improve systemic views of businesses and entrepreneurs in order to promote the ability to act in the areas of administration, marketing, quality management, and logistics in agribusiness, especially in the animal industry; and,

Innovation in the animal industry: its principle is to develop technological, product, and process solutions, covering various specialties that operate in the production chain of the animal industry. The directive, in both areas, is to train the researcher through the development of research with an applied focus but not exclusive of others, and to transform the acquired knowledge in the form of dissertations, business plans, and processes that involve aspects of innovation, intellectual property, and the registration of trademarks and patents, seeking to contribute to a leap in quality in the generation of improvements for organizations (public or private) in the target business environment. The dissertation database of the GIIA Professional Master's Program of FZEA/USP is available in the online platform of the USP Bibliographic Database, known as Dedalus, which is part of the Integrated Library System of the University of São Paulo (USP). In this study, it was established that the dissertation database for the period between 2015 and 2019, which included a sample of 71 dissertations (*i.e.*, all the dissertations defended from the beginning of the Program until the end of 2019) would be considered the database for the fulfillment of the study. With these data in hand, the following critical analysis groups were established:

- Analysis of the dissertation author's characteristics;
- Analysis of the dissertation characteristics;
- Specialized evaluation of the dissertation as an innovation model.

In order to classify the research carried out in each dissertation, an important assumption was that the used database shares differences and similarities that stand out, thus creating an arrangement and obtaining groupings that are characterized by homogeneity within the group and, simultaneously, heterogeneity between groups, so that, in this way, it would be possible to carry out the statistical procedures. In summary, 4 general steps were followed:

- In order to generate the groupings, it is necessary to select the variables;
- Apply factor analysis to reduce the numberof original variables, represented by non-correlated factors, without losing information;
- Analyze groupings of factors and classify the dissertations in exclusive and distinct groups;
- Describe and analyzethe groupingsto validate the proposed taxonomy (hypothesis of interpretation of the innovation attributes).

Qualitative data and ethical aspects of the study: In order to achieve the objectives proposed herein, among other strategies, a data spreadsheet was developed with the intention of characterizing the 71dissertations of the GIIA Program from the period between2015and2019. This spreadsheetwas used as the basis of the qualitative analysis for the study of the degree of innovation and impacts of the Program. A select group of academic and market experts were invited to participate as respondentsin the survey. This type of non-probabilistic sampling is configured by the fact that there is a dependence, at least in part, on the researcher's judgment to select the elements of the population to compose the sample (MATTAR, 2001). The respondents had access to the spreadsheet prepared by the responsible researcher, based on the clear and transparent communication of the objectives to be achieved and with absolute guarantee that the voluntarily filled data was confidential and to preserve the rights of those who understood how important the analysis was. For this purpose, the research project was submitted and approved by *Plataforma Brasil*, under CAEE No. 87688718.2.0000.5422. Out of respect for the evaluator's privacy, the name or any data or element that could, in any way, identify him/her was kept confidential. The invitation was sent to 10 evaluators, 6 of whomwere willing to participate in the study. Among the six participants, 3 had an academic profile at the doctoral level,while the other 3 hada market profile and solid experience with projects in innovation agencies. In order to fill in the spreadsheet with data regarding the author's main occupation, affiliations with teaching/research, and if he/shewas currently enrolledin a Doctoral

Program in progress/completed, the Lattes Platform and the LinkedInwebsite databases were consulted. The task of each evaluator, based on these collected data, was to carry out a perception analysis for each of the dissertations defended in the period, attributing a grade from 1 to10based on their understanding of the considered attribute.The explanation for the use of this scale is based on the ease of understanding the numbering system from 1 to 10. Also, Cummins and Gullone (2000) recommend the 10-point scale as the best alternative because it has better stability, regardless of the sample. This qualitative research was carried out on the 10thand 22ndof July, 2020. After the spreadsheet was filled in by the evaluators, the data were compiled into a results sheet so that a qualitative and statistical critical analysis of the answers could be elaborated.

Dissertation framework as an innovation model: In order to better understand the innovation, a classification model was created based on the attributes and criteria used for analysis.The model proposed by Mattos, Stoffel, and Teixeira (2010) served as a guide for this study and can be seen in Table 1.

Once the data referring to the variables were obtained, it was necessary to represent them in an orderly and summarized manner. Based on the existing dependency structure between several of the observed variables (represented by the correlations or covariances between them), FactorAnalysis (FA) enables the creation of a smaller set of factors (latent variables), obtained as a function of the original variables. Hair et al. (2009) considered that multivariate analysis can be an important supporting tool for the complementarity of qualitative analyses. The statistical analyses carried out in this study were conducted using the Minitab software, version17 (Pennsylvania, USA), and in the hypothesis tests, an = 5%was adopted.

RESULTS AND DISCUSSION

From the data obtained from the 6 evaluations carried out by the academic and market experts, a set of variables that dealt with innovation and its impacts on academic studies was selected. Individualized analysis of continuous variables obtained by expertevaluation.

Table1. Classification of Innovation into attributes and criteria

Attribute	Meaning	Evaluation criterium
Primary occupation of the author	Research on the Lattes platform and/or the LinkedIn websiteregarding the place of work	Student, public employee, employed, autonomous professional, liberalprofessional, entrepreneur (1, 2, 3, 4, 5 and 6)
Affiliated with Teaching/Research	Research on theLattes platform and/or the LinkedIn website regarding whether the author works with teaching	No or Yes(0or1)
Enrollment in a PhD (ongoing/completed)	Research on theLattes platform and/or the LinkedIn website regarding whether the author is enrolled in a PhD	No or Yes(0or1)
Field of research	Framework of work in the Program's fields of research	Management, Innovation, or both(1, 2, or3)
Link in the agribusiness chain	Identification of the position of the theme in the agribusiness chain	Input links, Production, Processing Industry, Distribution, Services or Consumption(1,2,3,4,5, and 6)
Application of work	Dissertation is situated in the field of theory or is applicable to organizational management or in the creation of a product or service	Theoretical,organizational, or technological (1, 2, or 3)
Relative to the impact on the author's career	To what degree does the dissertation have the potential to boost the professional career of the author	Perception scale that goes from 1 to10, with:1(very little) and10(very much)
Relative to the impact on the organization	To what degree can the dissertation affect the outcome of the organization where the author is inserted	Perception scale that goes from 1 to10, with:1(very little) and10(very much)
Relative to the potential of generating business	To what degree can the study result generate business	Perception scale that goes from 1 to10, with:1(very little) and10(very much)

Source: Research data.

Relative to the impact on the author's career

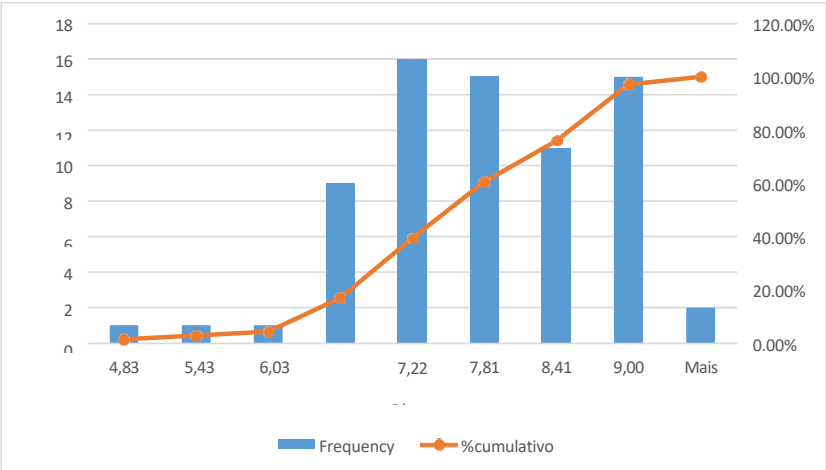


Figure 1. Histogramof impact on career

Based on the analysis of the dissertations and their respective authors, a Scorecard was developed to conduct multifactorial statistical analyses.

Statistical analysis of the data: Statistical analysis techniques were used in order to characterize and explain the behavior of the variables evaluated in the dissertations, during the period from 2015 to 2019, of the GIIAProgram, based on information generated by expert analysis.

The data that confirms this are: a) 51% of the authors, at the time of the study, worked in private companies, mostly within the target segment (agribusiness); 24% were public employees; 13% were entrepreneurs; 7% were self-employed professionals; 4% were liberal professionals, and only 1% was characterized as a student. This information is critical for the characterization of the target audience that the Program aims to work with, *i.e.*, the results show that this target audience that expects qualification is fully compliant with the

proposal to serve professionals who are already in the labor market (99.0%), in its different insertions; and b)almost all the links in the target business chain were significantly considered in the defended dissertations, with 51% of the essays addressing themes related to the specialized agribusiness services link; 20% focused on themes related to the processing industry link;10%defenses focused on the input-producing link; 10%were related to the production link itself; 8% addressed topics related to consumption and consumers and, finally, 1% focused on the distribution link in the agribusiness chain.

Cumulative percentage and descriptive statistics of the Impact on the Career

Block	*Frequency*	*Cumulative %*
4.83	1	1.41%
5.43	1	2.82%
6.03	1	4.23%
6.62	9	16.90%
7.22	16	39.44%
7.81	15	60.56%
8.41	11	76.06%
9.00	15	97.18%
More	2	100.00%

Column1	
Mean	7.520188
Standard error	0.113619
Median	7.333333
Mode	7.333333
Standard deviation	0.957369
Sample variance	0.916555
Kurtosis	-0.06541
Asymmetry	-0.07035
Interval	4.766667
Minimum	4.833333
Maximum	9.6
Sum	533.9333
Count	71

Source: Research data.

In order to assess the impact on the career (Figure 1), a perception scale was used by the evaluators, ranging from 1 to 10, in which: 1 (very little) and 10 (very much). The analysis of the mean, 7.5, indicates a high probability that the research results will positively affect the authors' careers. In addition, a maximum value of 9,6,which is considerably close to the top of the scale, and negative asymmetry are excellent indications that the reviewers agreed that it is very likely that the dissertations, somehow, are likely to leverage the authors' professional trajectory in a positive way.

Relative to the impact on the organization: To assess the impact on the organization (Figure 2), a perception scale was used by the evaluators, ranging from 1to10, in which: 1(very little) and 10(very much). The analysis of the mean, 7.4, and of the histogram, which presented an accumulated percentage of almost 67% above the mean, supported by the negative asymmetry, is a strong indication that the dissertations positively impact, with medium to high degree, the results observed in the organizations, according to expert assessment.

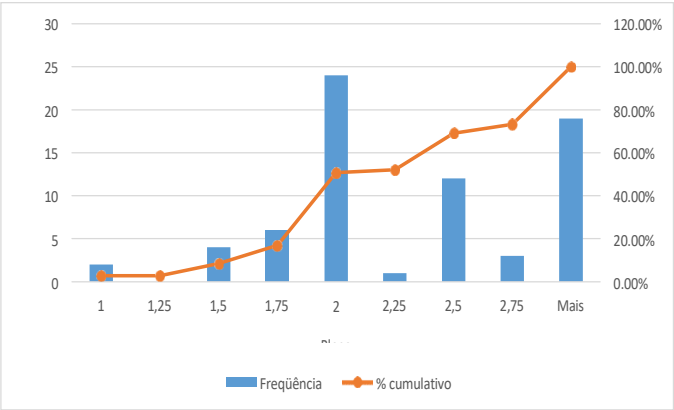


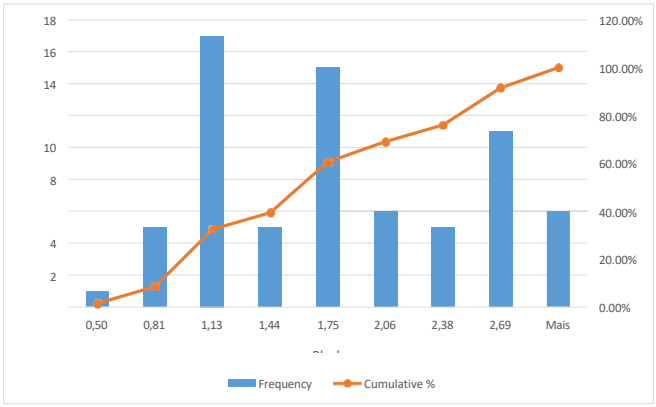
Figure 2. Histogramof the impact on the organization

Cumulative percentage and descriptive statistics of the Impact on the Organization

Block	*Frequency*	*Cumulative %*
4.83	1	1.41%
5.33	1	2.82%
5.83	3	7.04%
6.33	7	16.90%
6.83	12	33.80%
7.33	7	43.66%
7.83	18	69.01%
8.33	10	83.10%
More	12	100.00%

Column1	
Mean	7.377934
Standard error	0.113673
Median	7.666667
Mode	7.666667
Standard deviation	0.957824
Sample variance	0.917427
Kurtosis	-0.35736
Asymmetry	-0.54014
Interval	4
Minimum	4.833333
Maximum	8.833333
Sum	523.8333
Count	71

Relative to the potential for generating business



Source: Research data.

Figure 3. Histogramof the potential for generating business

Cumulative percentage and descriptive statistics of the Potential for Generating Business

Block	*Frequency*	*Cumulative %*
4.83	1	1.41%
5.43	1	2.82%
6.03	1	4.23%
6.62	9	16.90%
7.22	16	39.44%
7.81	15	60.56%
8.41	11	76.06%
9.00	15	97.18%
More	2	100.00%

Column1	
Mean	7.520188
Standard error	0.113619
Median	7.333333
Mode	7.333333
Standard deviation	0.957369
Sample variance	0.916555
Kurtosis	-0.06541
Asymmetry	-0.07035
Interval	4.766667
Minimum	4.833333
Maximum	9.6
Sum	533.9333
Count	71

Regarding the potential for generating business assessment (Figure 3), a perception scale was used by the evaluators, ranging from 1 (very little) to 10 (very much). The analysis of the mean, which was approximately 6.9, in addition to asymmetry tendingrelatively towards zero, an interval of 4.5, a nearly linear cumulative percentage, a flat frequency distribution, and highly negative kurtosis indicate that the dissertations have medium to high business generation potential, with some essayspresenting anelevated capacity for generating business with a strong innovation bias.

CONCLUSIONS

The Program's strengths lies in the training of professional researchers who can contribute to the development of scientific and technological projects in the area of management and innovation in all links of the Animal Industry business chain. In this context, it is important to highlight the results obtained in the qualitative study, where the impact of the qualification intended by the Program was analyzed, in the most different facets: technological, organizational, and related to the transfer of knowledge. Under the general panorama, apprehended by the research methodology and obtained through the literature review and based on primary data collected by the collaboration of experts, the relevance and effectiveness of multivariate analysis in Principal Components and Factor Analysis is noteworthy in qualitatively legitimizing the obtained results. In the end, a strong innovation bias was identified (organizational or technological, depending on the field of research and other factors intrinsic to the content of each dissertation), which generated different impact results, such as: in the author's career, in the organization with which the author was affiliated and in the generation of business opportunities.

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