

Generation of intangible assets in the Federal Institute of Piauí: analysis of the production potential of human capital

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ABSTRACT :Higher Education Institutions (HEIs), typical knowledge institutions, are strategic in the generation of intangible assets (Intellectual Capital). These institutions have mechanisms to encourage research and scientific production and have Human Capital with high levels of academic qualifications. Therefore, knowing the potential of human capital in the process of generating intellectual capital is also important to guide the institution's actions in developing strategies to stimulate scientific production. The objective of this research is to identify the influence of academic qualification of human capital in the generation of intangible assets (Intellectual Capital). To this end, a search was carried out in the Lattes Platform of the CNPq (National Council for Scientific and Technological Development) to identify the intellectual production, specifically full articles published in journals, of the permanent teachers of the IFPI Campus São João do Piauí, in the period 2016-2020. It was found that Teachers form the teaching staff of the institution with doctors, masters and specialists. In addition, it was noticed that 41.2% of the Teachers are responsible for the identified production, and that 58.8% of the Teachers did not publish complete articles in journals, considering the period of the research. The results suggest that academic qualifications can influence the production of intellectual capital by teachers. This framework requires from the institution the capacity to implement institutional policies and elaborate strategies to enable the insertion of Teachers in strict sensu postgraduate courses and to stimulate scientific production.

KEYWORDS –Faculty, Federal Institutes, Higher Education Institution, Intellectual Capital, Scientific production

I. INTRODUCTION

From the knowledge-based economy, intangible assets assumed an important role in the organizational value creation process. In this sense [1] highlight that several economic institutions such as the OECD (Organization for Economic Cooperation and Development) and the World Bank are concerned with the assessment of Intellectual Capital (IC), a group of intangible assets.

IC is the sum total of human capital, structural capital and relational capital [1]. Within the scope of Higher Education Institutions (IES)[2] highlights the importance of the IFES (Federal Institutions of Higher Education) to understand how the dynamics of the IC works, as well as its differential. Also according to the author, the IC is decisive in generating value and, therefore, it is necessary to look for ways to better manage and disseminate it.

HEIs, typical knowledge institutions, are strategic in the generation of Intellectual Capital and seek to train professionals who act in social development [3]. This process takes place through the encouragement of scientific initiation and development of various teaching, research and extension projects. In addition, these institutions have a qualified human capital with different levels of academic qualifications. Therefore, the project presents the theme "Generation of intangible assets at the Federal Institute of Piauí: analysis of the production potential of human capital".

Intangible assets are considered important differentiation factors, as well as generators of benefits for educational institutions, so they must be considered and used strategically by management [4]. Thus, it is necessary for institutions to know the potential of intellectual production of human capital.

Understanding the importance of human capital for the production of intellectual capital, Federal Universities and Institutes invest in scholarships, grants and other institutional policies to foster teacher education and research development. Therefore, a question seems pertinent: does the academic title of human capital (teachers) influence their capacity to generate intangible assets (Intellectual Capital)?

HEIs have mechanisms to encourage research and scientific production, such as internal and/or external notices. Thus, the project is justified by the fact that, in addition to having these mechanisms, HEIs have a high amount of human capital, teachers and administrative technicians, with varying levels of academic degrees, such as Doctors, Masters, Specialists and Graduates. In this sense, knowing the potential of human capital in the process of generating intellectual capital is also important to guide the institution's actions in developing strategies to stimulate scientific production. Furthermore, the intellectual production of Human Capital is related to the performance of these entities, both public and private [3].

The issue prompts us to reflect on questions about the teaching role in the generation of intangible assets (Intellectual Capital) in the Federal Institutes of Education, Science and Technology. Thus, this research has the general objective of identifying the influence of academic qualification of human capital in the generation of intangible assets (Intellectual Capital), and has the following specific objectives: analyze the valuation of academic degrees within the scope of the Federal Institute of Piauí – São João do Piauí Campus, from the mechanisms used to promote teacher training, identify the intellectual production of the Teachers of the Federal Institute of Piauí – Campus São João do Piauí.

To achieve the proposed objectives, the article is divided into five topics, including this introduction, which presents the context of the topic and the research objectives. Topic two is composed of the theoretical framework, which is divided into two subtopics, contextualizing the concepts of intangible assets and a portrait of HEIs in the Brazilian context. Topic three corresponds to the methodology. Topic four presents the analysis and discussion of the results. In topic five, the final considerations are presented.

II. THEORETICAL FRAMEWORK

This section presents a review of the literature on two central points: intangible assets and value creation; Higher Education Institutions in the Brazilian context.

I. INTANGIBLE ASSETS: STRATEGIC ELEMENTS IN VALUE CREATION

Studies in relation to intangible assets must consider two main points: i) concepts adopted in science and in specific communities or accounting standards; ii) the distinction between intangible assets and intellectual capital. For the authors this is necessary, since intellectual capital and intangible assets denote the same value, however, they present different perspectives [5].

[6] Highlight that several theories about intangible assets emerged in the 1990s. During this period, several research streams were formed in different disciplines, such as Economics, Business Management, Sociology, Finance, among others. However, the authors emphasize that the Resource and Capacity Theory (TRC) is responsible for providing basic data for the development of the theoretical body on intangible assets.

According to [7] intangible assets are highlighted as factors that enable companies/organizations to obtain competitive advantages in the information and knowledge age. However, it is necessary that there is an efficient and effective management of these assets by companies and organizations so that competitive advantages are obtained.

Within the academic community, the various groups of intangible assets are commonly identified as Intellectual Capital. Thus, [8] explain that there are several concepts in relation to a standard definition for Intellectual Capital, however, researchers generally resort to works published in the late 1990s.

Intellectual capital does not only cover the human capital produced in organizations, but also its structure and external relations. In this sense, it is understood that intellectual capital goes beyond what is observed by the company in relation to the creation of value that is produced by human knowledge [3], it is

essential to also consider other aspects, such as the organizational structure and relationships with strategic audiences.

By definition, intellectual capital encompasses knowledge-based activities and processes that contribute to innovation, value creation, competitive advantages and far-reaching benefits for companies, adding value to the various stakeholders [9].

Therefore, intellectual capital is composed of human capital, which is related to knowledge, skills, attitudes that are generated by individuals; structural capital, which corresponds to organizational support and internal structure; and relational capital, which represents the horizontal and vertical relationships of organizations with the external environment [10].

The future of intellectual capital is about raising awareness of the importance of social capital, as well as recognizing new forms of social capital. Therefore, it is essential to recognize, measure and value this capital, considering its various groups. Business capital, for example, is connected to innovation and creativity. Participatory capital, on the other hand, refers to the creation of a structure that enables the participation of citizens in the development of government policies and in the decision-making process [11].

In this way, intellectual capital is recognized as a strategic resource for organizations [12], it is possible to state that the creation of value comes from the strategic alignment of knowledge management around organizational processes [13]. Knowledge management is essential to stimulate the generation of intellectual capital, both in educational institutions and in organizations from different sectors of the economy, since knowledge significantly contributes to improving what is available and seeking new working methods.

Especially in relation to the public sector, it is possible to observe aspects that denote the valuation of intangible assets as strategic elements in the value creation process. In public administration, for example, there are several objectives that are not of a financial nature, unlike what happens in the private sector, whose main objectives are the profitability and value of the company. Furthermore, even the public and private sectors have the same inputs when it comes to production, such as human resources, knowledge, financial resources, raw materials and factories [14] It is possible to perceive a greater appreciation of human capital in public sector organizations, especially in the context of HEIs.

II. INTANGIBLE ASSETS IN HEIS AND POLICIES TO ENCOURAGE ACADEMIC DEGREES AND SCIENTIFIC PRODUCTION IN THE CONTEXT OF IF'S

A portrait of higher education in Brazil shows that there are 302 public HEIs and 2,306 private HEIs. In relation to public HEIs, 43.7% are state; 36.4% federal; and 19.9% municipal. Approximately 3/5 of federal HEIs are universities and 36.5%, they are Federal Institutes of Education, Science and Technology (IFs) and Federal Technological Education Centers (CEFETs) [15].

Public institutions of higher education have a fundamental role, both in the preparation and training of individuals, benefiting them from knowledge that can be applied in the context of companies and society in general [16]. Thus, knowledge is valued in the organizational environment due to the possibilities of obtaining advantages over others. Thus, it is necessary to consider the profile of human capital and its capacity to generate intangible assets, which reflects the importance of studies on knowledge management and intellectual capital [17].

In the age of knowledge and information, a context in which accelerated changes and increasingly evident technological advances occur, a new form of strategic resource has emerged that goes beyond the tangible resources of organizations, which considers, above all, intangible resources, for example, knowledge and intellectual capital, as a fundamental part of obtaining competitive advantages and achieving organizational goals [18].

The scenario of uncertainty and complexity is typical of the knowledge society, which is based on the development and circulation of information. Teaching associated with research is the most advanced and innovative means between theory and practice, enabling more quality and transformation among those involved

[17]. In addition, this practice enables the insertion of Teachers and students in the scientific environment and the production of knowledge and generation of new technologies.

In Brazil, the HEIs that follow the indicators that are present in the National System of Evaluation of Higher Education (SINAES) prioritize some items of the IC, even if in an embryonic form [8]. For [19], most private HEIs do not have intangible asset valuation models, which makes it impossible to value teachers based on their results, remunerating them only for their titles. That is why although IC dissemination tools generate benefits for HEIs, there are still difficulties in its implementation[8].

In 1976, the CAPES Postgraduate Evaluation System (Coordination for the Improvement of Higher Education Personnel) was created, with activities grouped into the following lines of action: evaluation of stricto sensu graduate studies, access and dissemination of scientific production, investments in the training of high-level human resources in the country and abroad, promotion of international scientific cooperation and induction and promotion of training initial and continuing education of teachers for basic education in classroom and distance formats [20].

This system serves as an instrument by which the university community uses in search of a standard of academic excellence for national master's and doctoral courses. Based on the results obtained in the evaluation, policies for the postgraduate area are formulated, as well as for the dimensioning of development actions, scholarships, aid and support [21].

In the context of Federal Institutions of Higher Education in Brazil, the Federal Institutes of Education, Science and Technology stand out. In art. 1 of Law 11892/2008, The Federal Network of Professional, Scientific and Technological Education, linked to the Ministry of Education, was created within the scope of the federal education system.

The aforementioned law also highlights that in relation to regulations, assessments and supervision, both of institutions and higher education courses, Federal Institutes have become equivalent to federal universities [22].

These institutions are formed by decentralized teaching units, with the presence of the Federal Network of Professional, Scientific and Technological Education, spread throughout the national territory, thus enabling the offer of professional and technological education, as well as the development of technological innovations according to local specificities [23]. For [24], the main objective for the creation of a new institutional matrix, based on the Federal Institutes, was configured in the capacity to redirect the educational policy, while the expansion of new units occurred.

In 2019, the Federal Institutes already had a total of 661 units. Of this total, 38 Federal Institutes stand out; 02 Federal Technological Education Centers (CEFET); 01 Federal Technological Unit of Paraná (UTFPR); 22 technical schools linked to federal universities and Colégio Pedro II [23]

In the scope of the State of Piauí, The Federal Institute of Education, Science and Technology of Piauí (IFPI) is an institution that articulates higher, basic and professional, pluricurricular, multicampi and decentralized education. Currently, there are 21 units in the state, distributed in 18 municipalities. Of this total, there are 17 campuses, including the São João do Piauí Campus, 3 advanced campuses and 1 Rectory [25].

In the Brazilian context, the development and implementation of public policies aimed at assessing and certifying workers' knowledge and skills has been observed, despite their entry into professional training programs. Within the scope of the Teaching Career of Basic, Technical and Technological Education (EBTT), law 12,772/2012 made it possible for teachers to recognize knowledge for the purpose of obtaining Retribution by Title [26]. To enter the EBTT career, teachers must have the minimum academic degree of graduates.

Therefore, the aforementioned law proposes the equivalence between the activities carried out throughout the academic life of the Teacher and the degrees obtained from admission to graduate programs [27].

However, law 12.772/2012 provides for equivalence of academic degrees only for remuneration purposes. Therefore, recognizing the importance of conducting *stricto sensu* postgraduate courses for the improvement of teaching, research and extension processes, as well as for the acquisition of new knowledge and development of research projects, scientific and/or technological production, IFPI, like the other members of the Federal Network, invests in the training of its teaching staff, through the granting of licenses for training, as well as through the establishment of institutional partnerships to offer *stricto sensu* postgraduate courses.

In this sense, the interinstitutional master's and doctoral programs, the so-called MINTER and DINTER, stand out. These programs are offered in partnerships with other institutions, and are aimed at training civil servants at the master's or doctoral level. In 2017, the IFPI in partnership with the UFPI (Federal University of Piauí) offered courses in Public Management, Political Science and Education; and in 2019, they offered the course in Materials Engineering [28; 29]. In addition to these own initiatives, the Federal Institutes participate in *stricto sensu* postgraduate programs on the national network, such as ProfEPT (Professional Master's Program in Professional and Technological Education), which aims to provide training in professional and technological education to employees of the Federal Network of Professional, Scientific and Technological Education. Among other goals, the program seeks to stimulate the production of knowledge and the development of technologies, based on scientific research [30].

III. METHODOLOGY

This research is characterized as a case study. According to [31], this type of research aims to investigate a contemporary phenomenon (the case) in depth in the context of the real world, being mainly used when the limits that exist between the phenomenon and the context are not clearly evident. As for the objective, the research is descriptive and the approach is quantitative.

Descriptive research aims to identify, record and analyze characteristics, as well as factors that are related to the phenomenon or to the process. The descriptive case study is the one that describes the variables, as well as providing new views on the realities that are already known [32].

The methodological procedures adopted are in line with the objective of identifying the influence of academic qualification of human capital in the generation of intangible assets (Intellectual Capital) at the IFPI Campus São João do Piauí. Therefore, three main steps were carried out: definition of the sample and period, identification of human capital and data collection.

The sample consisted of 34 effective Teachers from the São João do Piauí Campus, thus excluding 2 substitute Teachers. Data collection was performed on the CNPq Lattes platform, considering a 5-year period (2016-2020).

After identifying the names of the effective professors, through the Unified Public Administration System (SUAP) and confirmation by the pedagogical coordination of the Campus, the CNPq Lattes platform was accessed and the name of each individual was inserted. For this research, only scientific production registered as complete articles published in journals was considered. At this stage, a structured script was elaborated including: coded name of the teacher; Academic degree; number of complete articles published in journals per year.

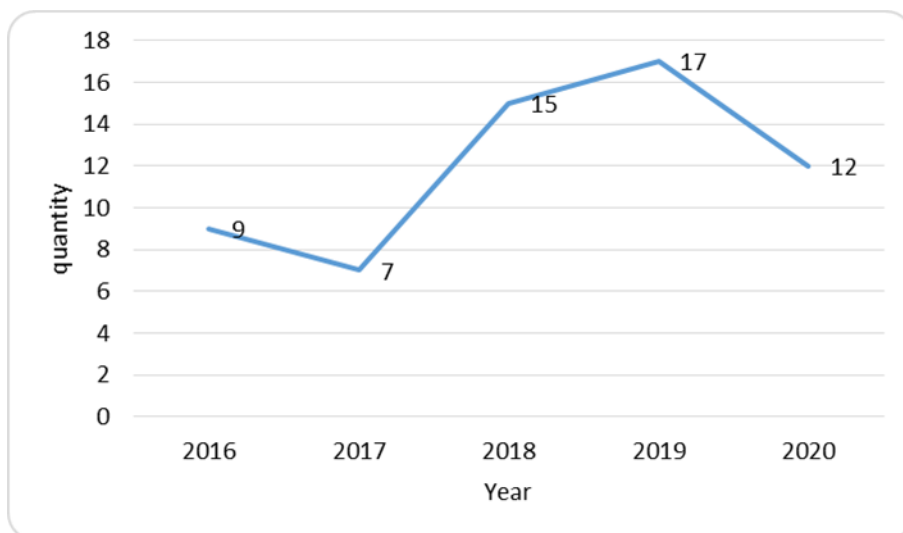
After collected, the data were tabulated and presented in the form of figures of frequency of production volume per year, publication by Teacher, Teachers' qualifications and Teachers' production volume according to the degree.

IV. ANALYSIS AND DISCUSSION OF RESULTS

The scientific production of Teachers, intangible assets of the Intellectual Capital group, can be externalized, for example, through scientific articles, published in journals or conference proceedings, books or book chapters, texts in newspapers [33] The evaluation of this production is necessary, since the results can impact both researchers and HEIs [34].

In this research, only scientific production categorized as complete articles published in journals was considered. This type of production is more considered by the evaluation systems, especially by CAPES, which places greater emphasis on articles in journals, when compared to articles published in conference proceedings [35]. Therefore, considering the search criteria, a total of 60 complete articles published in journals was identified, in a five-year time frame, as shown in Fig. 1. It is possible to observe that the annual production volume changed over the period studied.

Figure 1 - Annual volume of scientific production of Teachers

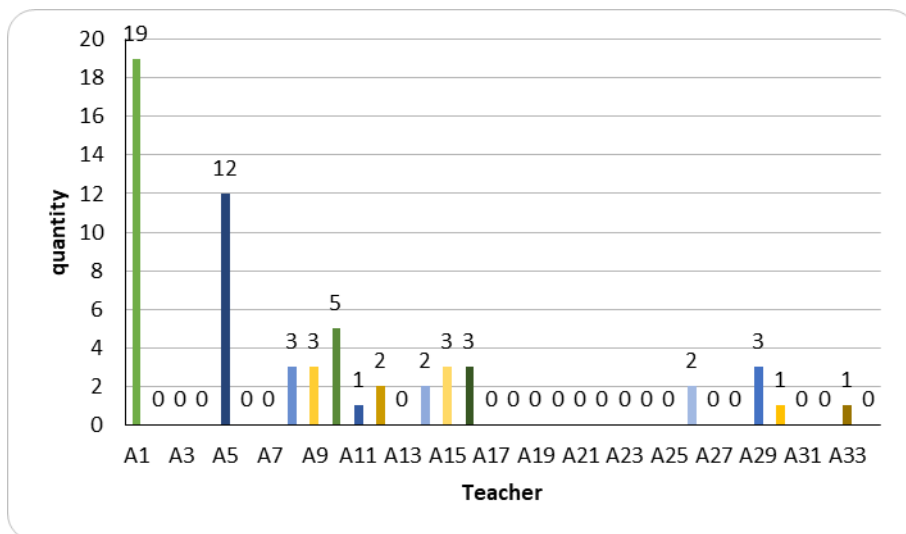


Source: elaborated by the authors (2021).

It is observed that the highest production volumes were registered in the years 2018 and 2019, respectively 25.0% (15 articles) and 28.3% (17 articles) of the total publications. These results can be influenced, for example, by the number of Teachers enrolled in graduate programs in the period. one of the criteria considered by the Ministry of Education (MEC) in the development of development policies, as well as by CAPES in the expansion and consolidation processes of strictu sensu graduate programs in Brazil.

In Fig. 2, the sums of the scientific production of each Teacher during the studied period are presented. By analyzing the sum of publications distributed by Teachers, it is possible to see that they have different quantitative profiles, ranging from 0 to 19 publications. It is also observed the concentration of scientific production in certain Teachers.

Figure 2 - Total volume of scientific production per Teacher



Source: elaborated by the authors (2021).

*Caption: The abbreviations, A1... A34 represent the coded names of the Teachers.

From a total of 34 effective Teachers, it is observed that 41.2% (14 Teachers) are responsible for the institution's total production. These Teachers can be inserted in research groups and collaboration networks, in graduate programs, or even have a high number of advisees or scholarship holders, factors that positively influence productivity. These Teachers contribute to the development of scientific bases and the expansion of knowledge. The scientific production of the Teachers has an impact on the institutional brand, an intangible asset related to the perception of the HEI's strategic audiences. In this sense, [36] explains that the prestige of the institution's researchers attracts other researchers, encouraging the formation of scientific collaboration networks.

It is also possible to notice that some Teachers at the institution have low intellectual production, especially in relation to complete articles published in journals, the object of interest in this research. However, it is highlighted that these Teachers can present other types of intellectual production, such as articles published in conference proceedings and book chapters.

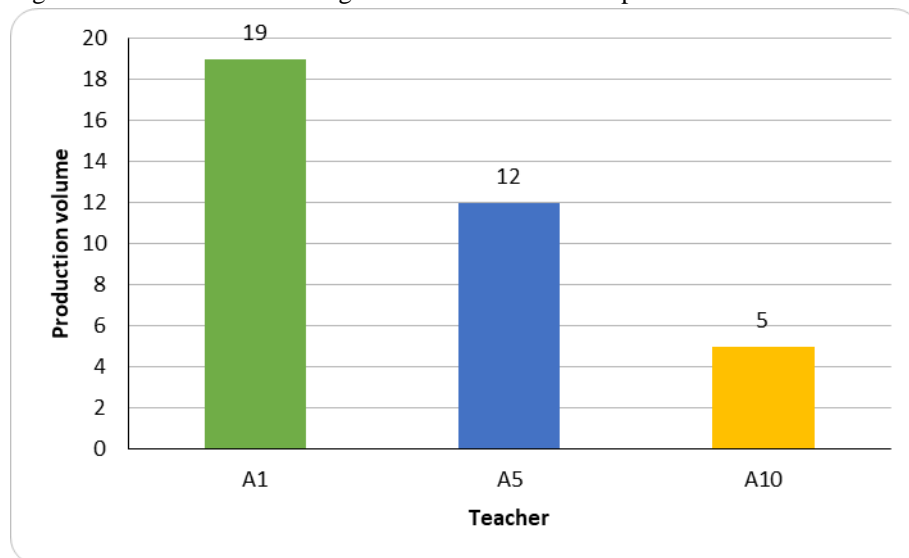
Also in Fig. 2, it is observed that 58.8% of the institution's permanent Teachers did not publish full articles in journals in the time frame considered by the research. This picture can be a reflection of a number of factors, such as: the scarcity of resources for research development; the high workload dedicated to teaching activities, which compromises the development of research and extension activities; the academic lifetime of the Teacher and the low participation in research groups and scientific collaboration networks.

Also, according to [37], the strong process of controlling work and reducing the autonomy of teachers, from the expansion of institutional regulation through external evaluations, as well as the implementation of a centralized curriculum and payment of bonuses, contribute to reduce the time of Teachers to practice research. In the Brazilian context, the increase in evaluation requirements generates work overload and difficulty in handling the demands of academic and administrative work linked to graduate studies[38].

The extremes identified in this example reinforce that there are different quantitative profiles: a more productive group; a middle group; and another group with low production. These observed differences may be a consequence of the academic career stage of the Teachers, as, according to [39], long periods in the academy are necessary for the researcher Teacher to present high peaks of scientific production.

The most productive group represents the Teachers with the greatest impact on the generation of Intellectual Capital in the Institution, being responsible for raising productivity (Fig. 3). Other research with objectives directed towards the evaluation of scientific production also identified the presence of a more productive core of research Teachers, such as the one developed by [40]. Faculty with above-average scientific production, compared to their peers, can considerably increase the average number of publications in a particular field of knowledge or institution [33].

Figure 3 - Teachers with the highest volume of scientific production



Source: elaborated by the authors (2021)

*Legend: The abbreviations, A1, A5, A10 represent the coded names of the Teachers.

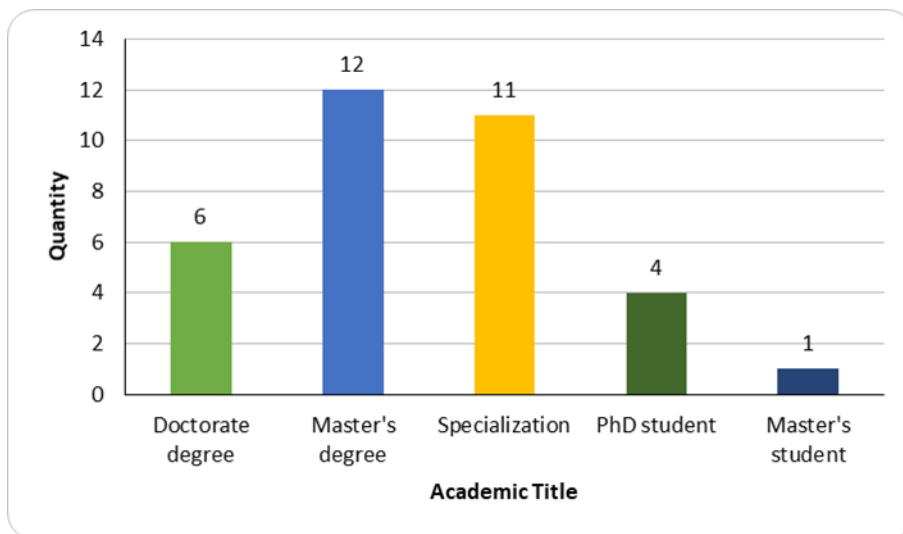
It was observed that from a total of 60 articles identified, 36 were produced by only 3 Teachers. Thus, considering that the institution has 34 permanent Teachers, it is evident that 60.0% of the publications came from research by 8.8% of the Teachers. Also noteworthy is Teacher A1, responsible for 31.7% of the publication of full articles in journals. According to Prince's law of elitism [41], all areas of knowledge have some authors who are more productive, being responsible for raising the productivity of each area. Thus, it seems natural that a few Teachers are responsible for a greater quantity of publications and, in this way, contribute to the increase in the Institution's average productivity.

Regarding the title of Teachers or current stage in the academic career (Fig. 4), it was found that of the total number of effective Teachers at the Institution (34) there is a predominance of masters and specialists, 35.3% and 32.3%, respectively. It is still possible to see that 17.6% of the faculty is composed of doctors. Another percentage that deserves to be highlighted is that related to Teachers who are enrolled in *stricto sensu* graduate programs, 14.7%.

However, the predominance of a given academic degree may vary according to the administrative category and academic organization of the institution. In public universities, the granaries of postgraduate programs, there is a greater concentration of Teachers with doctoral degrees. Corroborating, [42] verified that at the Federal University of Pampa (Unipampa) there is a greater predominance of Teachers with PhDs, equivalent to approximately 70.0% of the institution's faculty.

The academic title, an aspect valued in the selection and hiring processes, seeks to denote the level of knowledge of teachers [43]. The number of Teachers enrolled in *stricto sensu* graduate programs, 14.7%, demonstrates the group's interest in expanding knowledge and increasing academic degrees. Therefore, several educational institutions develop policies and strategies to promote the elevation of the title of the teaching staff.

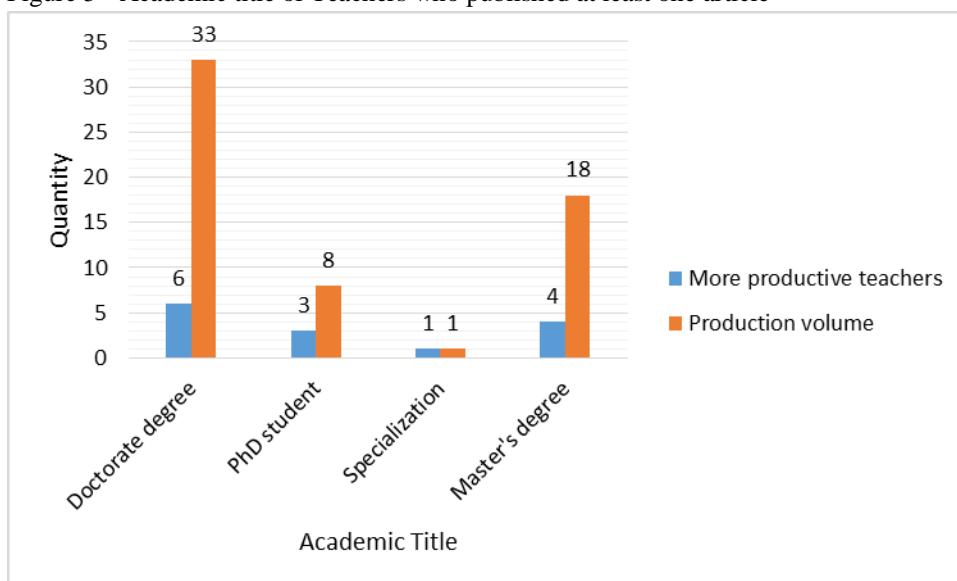
Figure 4 - Title of Teachers or current stage in the academic career



Source: elaborated by the authors (2021)

The Federal Institute of Piauí (IFPI) currently signs partnerships with institutions to carry out stricto sensu postgraduate courses, the so-called inter-institutional programs (DINTER, MINTER) to support teacher education. In 2018, IFPI established a partnership with the Federal University of Sergipe (UFS) for Master's and Doctorate courses in Intellectual Property Science, exclusive to the institution's permanent employees. These programs have as main objectives the training of doctors and masters of the permanent staff of Institutions far from large centers; to foster and strengthen the academic production of Higher Education Institutions. In specific cases, funding institutions, such as CAPES, provide funding resources and scholarships [44]. Subsequently, the title or current stage in the academic career of Teachers who published at least one complete article in journals, in the considered period, was analyzed (Fig. 5). The results obtained in this research show that Teachers with a doctorate (6 Teachers) and master's degrees (4 Teachers) are more productive in relation to their peers. Together, these two groups of Teachers published 85.0% of the identified production. Specifically, Teachers with a doctoral degree published 55.0% (33 articles), and Teachers with a master's degree published 30.0% of the articles.

Figure 5 - Academic title of Teachers who published at least one article



Source: elaborated by the authors (2021)

Analyzing the publication volume of Teachers with specialist degrees, it was observed a low participation of this group in the generation of Intellectual Capital in the Institution, only 1.7% of the identified production. The results found in this research suggest that academic qualifications can influence the production of intellectual capital by teachers. Validating,[45] identified a correlation between the volume of scientific production and the researchers' qualifications. For the authors, researchers with higher degrees have a greater volume of production.

V. FINAL CONSIDERATIONS

In this research, we sought to identify the influence of academic qualification of human capital in the generation of intangible assets (Intellectual Capital). For this purpose, the CNPq Lattes Platform was used as a search base. Although scientific production is externalized from various types of documents, such as full articles in journals, articles in conference proceedings, books, book chapters, among others, this research considered only the production categorized in the Lattes curriculum as "Full articles published in journals".

After analyzing the results, it was noticed that the faculty of the IFPI Campus São João do Piauí is composed of Teachers with PhDs, masters, specialists, as well as Teachers in the process of completing master's and doctoral courses. Furthermore, in relation to the productivity of teachers, it was possible to identify the existence of a more productive nucleus, responsible for raising the average productivity of the set of teachers.

The results obtained also suggest that academic qualifications can influence the production of Intellectual Capital by Teachers, since of the volume of articles identified 85.0% were developed by Teachers with PhDs and masters. The titles of the Teachers and their respective intellectual productions give credibility and visibility to the Institution. Also, this production can contribute to the development of the scientific and technological bases, as well as to the intellectual, social and economic development of the region.

The results found, aligned with the objectives, respond to the research problem and present a diagnosis of the real situation of the analyzed institution, with regard to the production of Intellectual Capital. Therefore, the research presents information that can be used strategically by decision makers. In this sense, the research allows the Institution to know its intellectual production; plan short, medium and long-term actions to foster the development of research; reposition your brand and ways of acting.

Furthermore, considering that Teachers with higher degrees had higher volumes of production, it seems urgent to develop policies and strategies to foster an increase in the academic degrees of Teachers. This framework requires from the institution the capacity to implement institutional policies and develop strategies to enable the insertion of Teachers in stricto sensu postgraduate courses. These policies and strategies are necessary, as the institution is based on the teaching, research and extension tripod. In addition, Intellectual Capital in the context of Federal Institutes is important, as it contributes to offering quality education, producing scientific knowledge and strengthening the Institution's brand.

Some limitations in this study can be reported: the choice of only one campus of the Federal Institute of Piauí; the selection of a specific type of scientific production, complete articles in journals; and the time frame. Therefore, it is suggested for future research to expand the sample and the time frame, as well as the analysis of other types of scientific production, such as articles published in conference proceedings and book chapters

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