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Prior art search: partnership between library and technological innovation center (NIT)

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ABSTRACT

Introduction: The protection of intellectual property through patent documents is essential in the activities of the entrepreneurial university, as it facilitates interactions and technological transfers or licensing to society. **Objective:** The aim of this work was to develop and apply a system for carrying out the prior art searches by an University library, in partnership with the Technological Innovation Center (NIT). **Methodology:** The action research method was used and the object of study was the Federal University of São Carlos (UFSCar), focusing on the university library initiative Starteca – space to undertake. Results: the proposal and application of a systematic approach was considered, which comprised: 1] the application of a training course on skills necessary for librarians to perform in the process of searching for precedence and; 2] standardization of the search process execution routine, via manuals, protocols and tutorials. **Conclusion:** It was possible to infer that the rapprochement between the university library units and NIT can contribute to the construction of solutions that support the success of the institutional project of the entrepreneurial university in the Brazilian context, by seeking solutions based on sharing resources and skills, focused on institutionalization of the prioritization search process, aiming to protect intellectual property developed by the academic community, using patent documents.

KEYWORDS

Intellectual property. Prior art search. University library. Technological Innovation Center. Patent.

Busca de anterioridade: resultado da parceria entre biblioteca universitária e Núcleo de Inovação Tecnológica

RESUMO

Introdução: A proteção da propriedade intelectual por meio de documentos de patentes é essencial na atuação da universidade empreendedora, ao facilitar as interações e as transferências ou licenciamentos tecnológicos para a sociedade. **Objetivo:** O objetivo dessa pesquisa foi o desenvolvimento e aplicação de uma sistemática para a realização do processo de busca de anterioridade pela biblioteca universitária, em parceria com o Núcleo de Inovação Tecnológica (NIT). **Metodologia:** Utilizou-se o método de pesquisa-ação e o objeto de estudo foi a Universidade Federal de São Carlos (UFSCar), com foco na iniciativa da biblioteca universitária Starteca – espaço empreender. **Resultados:** contemplou-se a proposta e aplicação de uma sistemática, que compreendeu: 1] a aplicação de um curso de formação de competências necessárias ao desempenho dos bibliotecários no processo de busca de anterioridade e; 2] padronização da rotina de

execução do processo de busca, via manuais, protocolos e tutoriais. **Conclusão:** Foi possível inferir que a aproximação entre as unidades biblioteca universitária e NIT pode contribuir para a construção de soluções que sustentam o sucesso do projeto institucional da universidade empreendedora no contexto brasileiro, ao buscar soluções baseadas no compartilhamento de recursos e competências, focadas na institucionalização do processo de busca de anterioridade, visando a proteção da propriedade intelectual desenvolvida pela comunidade acadêmica, utilizando documentos de patente.

PALAVRAS-CHAVE

Propriedade intelectual. Busca de anterioridade. Biblioteca universitária. Núcleo de Inovação Tecnológica. Patente.

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- **Acknowledgments:** The authors are grateful to CNPq – Conselho Nacional de Desenvolvimento Científico e Tecnológico and to NIT/Materiais – Núcleo de Informação Tecnológica em materiais da UFSCar – Universidade Federal de São Carlos.
- **Funding:** Not applicable.
- **Conflicts of interest:** The authors certify that they have no commercial or associative interest that represents a conflict of interest in relation to the manuscript.
- **Ethical approval:** Not applicable.
- **Availability of data and material:** The data sets generated and/or analyzed during this study are available in the Zenodo Scientific Data Repository.
- **Authors' contributions:** Conceptualization, Research, Methodology: ANDRADE, A. A.; CESAR, J.; SANTOS, C.V.; AMARAL, R. M - Project management: ANDRADE, A. A - Writing - proofreading & editing: CESAR, J.; SANTOS, C.V.; AMARAL, R. M.
- **Image:** Extracted from Lattes
- **Translation:** S. Iacovacci Translation Service

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JITA: IN. Open science.

ODS: 9 - Industry, innovation and infrastructure

Article submitted to the similarity system



Submitted: 06/03/2024 – Accepted: 12/07/2023 – Published: 20/08/2024

Editor: Gildeir Carolina Santos

1 INTRODUCTION

Access to and use of scientific and technological information by players in the innovation system is fundamental to the development, protection, and exploitation of technological solutions in innovative ventures, with social, cultural and economic impacts on society (Rocha; Ferreira, 2004; Ferreira; Guimarães; Contador, 2009; Amparo; Ribeiro; Guarieiro, 2012; Schmitz; Urbano; Dandolini; Guerrero, 2017; Si; Zeng; Guo; Zhuang, 2019).

In this scenario, a country's innovation system includes: "[...] government priority for Science and Technology; scientific and technological production; educational base and availability of qualified human resources; diffusion of innovation within firms [...]" (Rocha; Ferreira, 2004, p. 62). In Brazil, public universities play a central role in the innovation system by providing an opportune environment for scientific research, innovation, and technology-based ventures. They act through the work of specialists in different fields of knowledge, by providing adequate infrastructure for scientific and technological development, and by interacting with society, especially with the productive sector. These characteristics are present in the so-called entrepreneurial universities, which incorporate teaching, research and extension activities, innovation, and technology-based entrepreneurship in their mission to contribute to economic and social development, while maintaining their autonomy and sustainability (Etzkowitz, 2004; Jansen; Zande; Brinkkemper; Stam; Varma, 2015; Schmitz; Urbano; Dandolini; Guerrero, 2017; Fujita; Mata; Sousa, 2023).

In the work of Brazilian entrepreneurial universities, it is important to highlight the role of technological innovation centers (TICs). They are present in some universities, such as the Universidade Federal de Campinas (UNICAMP), the Universidade Federal do Rio de Janeiro (UFRJ), the Universidade de São Paulo (USP), the Universidade Federal do Rio Grande do Sul (UFRGS) and the Universidade Federal de São Carlos (UFSCar) since the 1990s, but until then their institutionalization in universities was not mandatory (Katz; Prado; Souza, 2018; NIT/Materiais, 2023).

The mandatory institutionalization of TICs began with the Innovation Law (Law No. 10.973 of 02/12/2004), which came with the mission of managing innovation policy in public education and research institutions. With the Innovation Law, universities that didn't have TICs began to implement them, and those that already had them improved and incorporated new processes that bring together a variety of skills related to the management of intellectual capital, such as carrying out technological prospecting and intelligence processes, managing the protection of intellectual property through patents and varieties, technology transfer, forming a culture of innovation and entrepreneurship in the institution, among other work processes (Jansen; Zande; Brinkkemper; Stam; Varma, 2015; Paranhos; Cataldo; Pinto, 2018; Katz; Prado; Souza, 2018; Lima; Sartori, 2020; Tomaz; Fischer, 2022; Oliveira, 2021; Fortec, 2024).

A common work process for TICs in Brazil, related to protecting intellectual property through patents, is the prior art search. Its purpose is to search and analyze information through various sources, such as scientific publications and patent documents, intending to prove the novelty¹ of the patent to be filed (Faria; Milanez; Yanai; Martins; Oliveira, 2019; Gabriel Junior; Moura; Alves; Bochi; Brandão; Correa, 2020; Loveniers, 2018).

In addition to being part of the scope of action of TICs (Bueno, 2018; Lopes, 2021), the activity of searching for prior art is directly related to the skills of information science professionals (Oliveira, 2021; Amparo; Ribeiro; Guarieiro, 2012; Silva, 2020; Ran; Song; Yang, 2021), as it involves searching for information in databases of scientific publications and

¹ Innovative: According to Industrial Property Law 9.279 (Brazil, 1996, ch. II, art. 11), "an invention and a utility model are considered new when they are not included in the state of the art.

patents to survey the state of the art² (Yu; Kehoe, 2001; Ferreira; Guimarães; Contador, 2009; Feng; Zhao, 2015; Colea; Lysiakb, 2017). Thus, activities related to the state of the art searches have been adopted by university libraries in the United States and China as a strategy to foster innovation and technology-based entrepreneurship (Feng; Zhao, 2015; Liao; Zhou, 2022; Mitroshin, 2019; Wallace; Reinman, 2018; Ran; Song; Yang, 2021; Si; Zeng; Guo; Zhuang, 2019).

Moreover, despite the importance of research and technological prospecting for the academic community and Brazilian entrepreneurs, this source of information is rarely used (Ferreira; Guimarães; Contador, 2009; Ravaschio; Faria; Quoniam, 2010; Camargo, 2011; Cole; Lysiak, 2017). Among the reasons, especially in the academic community, are the following facts: Researchers are not aware of the benefits that these documents can bring to the research and innovation processes (Amparo; Ribeiro; Guareiro, 2012; Colea; Lysiak, 2017; Faria; Milanez; Yanai; Martins; Oliveira, 2019; Gabriel Junior; Moura; Alves; Bochi; Brandão; Correa, 2020; Milanez, 2015); the fact that Brazilian Ph.D. students ignore patents as documents that provide technological information for academic work (Ravaschio; Faria; Quoniam, 2010; Camargo, 2011); the lack of structure in TICs, especially human resources, which makes it impossible or discontinuous to provide services (Katz; Prado; Souza 2018); and the fact that research related to patents is complex (Colea; Lysiak, 2017).

Based on the description of the institutional competencies of TICs (Bueno, 2018; Lopes, 2021) and university libraries (Oliveira, 2021; Amparo; Ribeiro; Guareiro, 2012; Silva, 2020; Ran; Song; Yang, 2021) in terms of access to and use of scientific and technological information, is it possible to intuit that there is an overlap of competencies? Could this overlap contribute to the success of the entrepreneurial university institutional project? In this context, to broaden the understanding of how the rapprochement between university libraries and TICs can contribute to the success of the entrepreneurial university institutional project in the Brazilian context, based on solutions based on the sharing of resources and competencies, focusing on the institutionalization of the prior art search process, the general objective of this article was to develop and apply a system for carrying out the prior art search process by the university library in partnership with the TIC, and to understand this rapprochement. The action research method was used and the object of study was the Universidade Federal de São Carlos (UFSCar).

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2 PROTECTION OF INTELLECTUAL PROPERTY BY THE ENTREPRENEURIAL UNIVERSITY

In this article, the concept of an entrepreneurial university includes institutions with the capacity to respond commercially to stakeholders, research, and partnerships sponsored by the productive sector, as well as the establishment of a support infrastructure for academic entrepreneurs (Lopes, 2021). Innovation and entrepreneurship in the entrepreneurial university are considered from the perspective of knowledge (creation, dissemination, and application) to

² State of the Art: The state of the art is one of the most important concepts in patents. In general, it consists of everything that has been disclosed to the public prior to the filing date of the patent application. This disclosure may be in written or oral form, by use, or by any other means, in Brazil or abroad (Brazil, 1996, chap. II, art. 11, p.1). Since inventions must be new to the whole world, once the invention has been disclosed, it can generally no longer be protected by patents (point 2.6.2). In other words, even if the inventor himself discloses his invention, it generally becomes part of the prior art and can no longer be protected. Examples of disclosures that prevent patent protection include: putting the product on the market; exhibiting the technology at trade shows or events; presenting academic papers; publishing a scientific article. There are a few cases where the technology is excluded from the prior art for a short period of time (and can still be protected by patents). This is the case of Grace Period (Brazil, 1996, Chapter II, Art. 12); Unionist Priority and Internal Priority (Brazil, 1996, Chapter II, Section II, Art. 16-17).

promote economic and social development while maintaining autonomy and sustainability (Schmitz; Urbano; Dandolini; Guerrero, 2017). Entrepreneurial universities are present in different countries, such as the United States (Harvard, Stanford, Berkeley, and the Massachusetts Institute of Technology), the United Kingdom (Newcastle University), China (Wuhan University), and Brazil (Universidade de São Paulo, Universidade Estadual de Campinas, Universidade Federal de Viçosa, Universidade Federal de São Carlos) (Etzkowitz, 2012; Si; Zeng; Guo; Zhuang, 2019; Brasil Junior, 2023).

The government-university-enterprise (triple helix) interaction is an essential factor for an entrepreneurial university (Tomaz; Fischer, 2022). In this interaction, each party contributes its respective competencies: the university contributes "by providing knowledge and technology, companies contribute by decoding knowledge and applying it to the production process, and the government acts as an agent responsible for stability and security in the relationships" (Tomaz; Fischer, 2022). The quadruple helix (HQ) and the quintuple helix (HQQ), both associated with the university, are also important for the innovation scenario (Mineiro; Castro; Amaral, 2019). The quadruple helix also takes into account media and cultural issues as well as organized civil society (Carayannis; Campbell, 2009; Mineiro; Castro, 2020). The fivefold helix (HQQ) includes environmental issues and responsibility for sustainability, considering, for example, the reduction of environmental impacts caused by spin-offs, start-ups, and the companies associated with them (Mineiro; Souza; Castro, 2018; Mineiro; Castro; Amaral, 2019).

The management of intellectual property by TICs becomes strategic in the interactions between universities and actors in the innovation system, as it comprises a set of practices that enhance the development, protection, and exploitation of technological solutions (Vasconcelos; Silva, 2018; Machado; Holanda; Santos; Bandeira; Menezes; Nogueira, 2022). According to Gabriel Junior; Moura; Alves; Bochi; Brandão; Correa, (2020, p. 346), "Intellectual property is a broad system that grants legal rights to the owners of these productions resulting from activities in the industrial, scientific, literary and artistic fields". Intellectual property thus includes industrial property (patents, industrial designs, trademarks, geographical indications, and trade secrets), copyright (computer programs, related rights, and authors' rights, which include the scientific production of articles, books, monographs, artistic performances, phonograms, and broadcasts), and sui generis protection (plant varieties, protection of new plant varieties, topography of integrated circuits, and traditional knowledge) (Tatum; Tatum; Fabris; Russo; Jesus, 2018).

In order to regulate and standardize services related to the protection of intellectual property, many agreements, treaties, global protection systems, and classification systems have been created under the responsibility of the World Intellectual Property Organization (WIPO) (Brasil, 2019). There are global protection systems that "guarantee that an application for international registration or filing of an intellectual property right will have effect in any of the signatory states, provided that it is duly instructed by the applicant" (Brazil, 2019, p.4). In Brazil, the body in charge of industrial property is the National Institute of Industrial Property (INPI).

In the process of protecting intellectual property through patents, it is necessary to conduct a prior art search, which consists of checking the state of the art of a particular process or product in various sources of information, such as scientific publications and published patent documents, to identify the novelty (novelty and inventive step³) of the patent applied for (Gabriel Junior; Moura; Alves; Bochi; Brandão; Correa, 2020; Loveniers, 2018).

³ Inventive step: According to Art. 13 of Industrial Property Law 9.279, an invention is endowed with inventive step whenever, for a person skilled in the art, it does not derive in an evident or obvious manner from the state of the art (Brazil, 1996).

The information collected and analyzed in a prior art search can support not only applying for a patent but also scientific research, showing what has been developed, as well as providing information that can serve as support to identify the most promoted technological areas, the institutions, or companies that hold a significant number of patents, the most studied technological areas, and the most explored market niches (Moura; Santos; Magnus; Consoni; Gabriel Junior, 2019; Santos; Rossi, 2022). It is worth noting that there are no specific databases with models of prior art reports, but access to patent documents can be found in patent databases such as Patentscope, Espacenet, INPI patent databases, among others (Andrade; Camargo; Amaral 2022b).

Although the process of searching for prior art is fundamental for the protection of industrial property and subsequent transfer or licensing, in the context of the entrepreneurial university, authors such as Andrade, Camargo and Amaral (2022a; 2022b) have indicated the absence of institutionalized routines in Brazilian Science and Technology Institutions, involving the provision of prior art search services by TICs in partnership with university libraries, such as manuals, tutorials, courses for training and mentoring researchers, among others.

Thinking about the potential and knowledge that a library has, working in partnership with TICs becomes advantageous, because as well as providing information services, a pleasant space, and infrastructure to foster and support technology-based innovation and entrepreneurship initiatives, human resources are a differentiator for libraries. Librarians can work with culture-specialized knowledge, mastery of mother tongues and languages, oral and written communication skills, the ability to cooperate and work in teams, mastery of technologies, and extensive knowledge of information sources and resources (Teixeira, 2020).

3 METHODOLOGY

The qualitative approach guided this investigation, which covered the practices and social interactions involved in the development of the process of seeking precedence in the context of entrepreneurial universities in Brazil. Action research as a research method allows the use of multiple sources of information, an emphasis on the perspective of the people studied, and a constant interaction between action and conceptual formulation through the involvement of researchers in a participatory manner (Thiollent, 2004; Creswell; Creswell, 2018). Participant observation and categorical content analysis were used to collect data and analyze information (Marietto, 2018; Sampaio; Lycarião, 2021).

The object of study of this research was the Universidade Federal de São Carlos (UFSCar), São Carlos-SP Campus, with a focus on the University Library initiative "Starteca - entrepreneurial space", which has been operating since 2019 intending to integrate innovation and entrepreneurship activities developed by organizational units: Integrated Library System (SiBi) / Community Library (BCo), Innovation Agency (AIn), Center for Technological Innovation in Materials (NIT/Materiais), UFSCar Enterprise Center (NUEmp).

The NIT/Materiais specializes in technological forecasting and intelligence, and works to provide "information on new ideas in technology and materials to assist companies, business associations and institutions in drawing up scientific, technological and business development plans" (NIT/Materiais, 2023). Inaugurated in 1995, the NIT/Mateiriais was initially supported by government programs, the Program for the Support of Scientific and Technological Development (PADCT) and the Program for the Training of Human Resources in Strategic Areas (RHAE) of the CNPq, to provide technological consulting services and other types of

services with technological information to industrial sectors that use metal alloys, polymers, ceramics, glass, and their composites, as well as in their products and processes.

The presence of the NIT/Materiais at UFSCar paved the way for the creation in 2007 of the Technological Innovation Center, called the UFSCar Innovation Agency (AIn), which is strongly involved in the institutionalization of practices related to the management of intellectual property and the promotion of a culture of entrepreneurship and innovation at UFSCar (AIn, 2024). Its presence at AIn UFSCar signals the Brazilian government's efforts over time to promote closer interaction between universities and companies, which researchers such as Ferreira, Guimarães, and Contador (2009) consider essential for the success of innovation initiatives in the Brazilian academic context.

The "Starteca - entrepreneurial space " is located in the University Library (BCo) and acts as an innovation hub, providing scientific and technological information services and spaces for conversation and interaction that contribute to bringing the academic community and the productive sector closer together (Sanca Hub, 2023; Starteca, 2024).

With the implementation of Starteca, UFSCar, corroborating the theoretical discussions presented in this research, undertakes a series of initiatives and social practices that involve the approximation and establishment of strategic intra- and inter-organizational partnerships, strengthening its performance as an entrepreneurial university. By contributing to the establishment of partnerships between UFSCar's organizational units, Starteca promotes interpersonal interactions between a variety of internal and external actors, following the global trend of university libraries advancing in the provision of patent information services and metric studies to support the academic community. It is also transforming its physical spaces to accommodate a variety of unconventional uses, such as maker and coworking spaces (Oliveira; Cassiavilani; Spinola; Amaral; Ferrari Jr, 2020; Feng; Zhao, 2015).

In order to ensure the effectiveness and consistency of the research method, based on the reliability of the collection and analysis of information, the planning, and execution of the research followed the guidelines of Thiollent (2004), Marietto (2018) and Sampaio; Lycarião (2021), which resulted in a research protocol based on stages to guide and maintain the focus on the collection and analysis of information, as can be described in Chart 1. For the stages of implementing the solution and evaluating the impact of the intervention, the extension project "Course in Patent Technology Information: focus on Priority Search" was formalized at UFSCar (UFSCar/PRoex, 2022).

Chart 1. Action research protocol

Exploratory stage	Information collection and analysis
<ul style="list-style-type: none"> ● Mastering the theoretical conceptual framework: defining the research question and objective; ● Preparing the research: defining the techniques for collecting and analyzing information; ● Selection of the research object: UFSCar, with a focus on BCo's "Starteca – entrepreneurial space" initiative; contact with the individuals responsible; disclosure of the research objectives to the participants; clarification of the researchers' role; ● Diagnosis: 1] definition of the problem situation and the needs of the Starteca - entrepreneurial space team, and; 2] the formation of work teams with researchers and participants. 	<ul style="list-style-type: none"> ● Participation in informal and working meetings, events, and courses; ● Recording observations (detailed notes on situations considered relevant); ● Analysis of documents, portals, and institutional social networks; ● Identifying the social context of the individuals observed; ● Holding and participating in seminars aimed at building

Planning stage	<p>solutions together;</p> <ul style="list-style-type: none"> ● Categorization and analysis of data; ● Triangulation of the data, confirmation of the results by the participants, revisiting the data (using a "spiral behavior"), the coding (categories and relationships), and the results; ● Writing up the results, highlighting the library's role in the prior art search process in partnership with NIT/ Materials and Aln.
<ul style="list-style-type: none"> ● Definition of priorities and scope of action, based on the diagnosis; ● Building potential solutions in a shared way, involving researchers and participants; ● Planning and specification of the research project; ● Planning of activities to solve the problems of "Starteca - entrepreneurial space", which involved the development and application of a system for searching for prior art: 1] emphasis on bringing BCo and Aln closer together; 2] training course for the SIBi, BCo, and Aln teams; 3] Manual and protocol to guide the community in searching for prior art; ● Elaboration of an action plan (system for the search for prior art) that is legitimate to the characteristics and needs of the UFSCar community. 	
Solution implementation stage: system for preform an prior art search	
<ul style="list-style-type: none"> ● Institutionalization of the partnership between the BCo units (Starteca - entrepreneurial space), Aln, NIT/Materiais, and NUEMP; ● Communication of the action plan to the Starteca, Aln, and NIT/Materiais teams; ● Implementation of the system, aimed at developing skills in industrial property protection, by searching for patent prior art; ● Offering and monitoring the patent prior art search course. 	
Stage of evaluating the effects of the intervention in terms of the research question and the problem	
<ul style="list-style-type: none"> ● Incorporation of improvements, made after the application of the first offer of the anteriority search course; ● Internal and external communication of the results; ● Institutionalization of the system in BCo's practices (Starteca - entrepreneurial space) in partnership with Aln. 	

Source: Prepared by the authors

The course in Technological Information on Patents, in which the system for searching prior art was developed and applied, was carried out in collaboration with master researcher Elizete de Aguiar Andrade from the UFSCar Postgraduate Program in Information Science, the collaborator Janaina Cesar from the UFSCar Innovation Agency, the NIT/Materials researcher Celise Villa dos Santos and, Prof. Roniberto Morato do Amaral from the UFSCar Information Science Department. The course was given to librarians from BCo (different campuses) and the Federal Institute of São Carlos, where there was a lack of knowledge about intellectual property and prior art searches. In Section 4 (Results), we will look at the results and discussions of the action research, which includes a system for conducting a prior art search, an emphasis on

bringing organizational units closer together, a prior art search course, guidelines, and standardization of the prior art search process.

4 RESULTS

In a general context, the results achieved in this research by investigating the role of the BU as an active player in the entrepreneurial university include:

- a) The recognition of the library in the university context, as well as the characterization of the approach between the organizational units involved with innovation initiatives and technology-based ventures at UFSCar: BCo, AIn, NuEmp, NIT/Materiais and SIBi and.
- b) The development and application of a system for carrying out the prior art search process, by sharing the skills and resources of UFSCar's organizational units: BCo, AIn, NuEmp, NIT/Materiais, and SIBi.

Subsections 4.1 to 4.4 describe in detail the results achieved in the research.

4.1 System for permorm an prior art search

In the exploratory phase of this action research, a set of challenges were identified, including the lack of knowledge among the academic community at UFSCar: 1] about the processes of industrial property protection and prior art search; 2] about the benefits and ease of access to and use of technological information from patent documents (Oliveira, 2021). Also, 3] the lack of institutionalized procedures for preparing the prior art search process, such as manuals and standardized routines; 4] the insufficient number of staff to meet the demands of the academic community. Opportunities to improve service delivery by bringing the organizational units closer together were also identified: BCo "Starteca - Entrepreneurial Space", AIn, and NIT/Materiais, based on their organizational competencies and focus of action.

As a solution, a system has been proposed and implemented, consisting of a set of work processes, social practices, and tools aimed at searching for prior art in an organized and efficient manner, as well as developing the skills necessary for the academic community to use patent documents as a source of technological information. The proposed system includes 3 macro-actions:

- 1) Emphasis on bringing together the organizational units involved in innovation initiatives and technology-based ventures;
- 2) Priority search course;
- 3) Guidelines and standardization of the prior art search process.

4.2 Emphasis on bringing together organizational units involved in innovation initiatives and technology-based ventures

The rapprochement between the organizational units BCo, AIn and NIT/Materiais at UFSCar, institutionalized through an extension activity, favored the scenario for the development and implementation of the prior art search system, as it created a strong synergy

of skills between these units, which a priori had already contributed to the creation and implementation of the "Starteca - entrepreneurial space" initiative. This rapprochement was strategic in overcoming challenges related, for example, to the lack of infrastructure at the AIn, especially in terms of the number of employees, and the availability of physical space to carry out initiatives to promote an entrepreneurial culture. It also contributed to improving the results of the research project by adding knowledge and practices related to librarians' skills that are indispensable in development and patenting processes, such as the retrieval of scientific and technological information from databases, as indicated by Oliveira (2021).

It was observed that the activities of the BCo, being a central university library and serving the internal (academic) and external (residents of São Carlos-SP) communities, include a variety of social practices that are inherently extensionist and related to getting closer to society. In the course of this research, we also noticed that the BCo acts as a "gateway" to the entrepreneurial university, transforming the library equipment into the most democratic and active interdisciplinary space in the university, through a variety of actions such as fostering culture, innovation, and entrepreneurship beyond a conventional performance, as pointed out (Cassiavilani, 2020; Andrade; Camargo; Amaral, 2022a; Oliveira; Cassiavilani; Spinola; Amaral; Ferrari Jr, 2020).

It is important to note that the main observed result related to the rapprochement between the organizational units BCo "Starteca - Entrepreneurial Space" and AIn, was the change in the functioning of the BCo "Starteca - Entrepreneurial Space", which began to act as a kind of branch of AIn, expanding the capillarity of AIn's operations and its multi-campus presence in the UFSCar community. The rapprochement between the librarians, the technical team of AIn, and the researchers of NIT/Materiais has added skills to the activity of searching for prior art. Skills such as those of librarians related to access, retrieval, and organization of scientific and technological information (Silva, 2020). Competence of Ain technicians in intellectual property protection processes, in explaining the importance of the information collected in the prior art search for drafting intellectual property protection applications and deciding on protection. Competence of NIT/Materiais researchers in analyzing the scientific and technological information collected in the prior art search process and in making decisions about scientific research and product development.

In this context, the convergence of the working practices of these organizational units, which does not exist in the Brazilian institutions associated with the National Forum of Innovation and Technology Transfer Managers (FORTEC) (Andrade; Camargo; Amaral, 2022a, 2022b), can contribute significantly to meeting the challenges of building entrepreneurial universities.

4.3 Prior art search course

The development of intellectual property skills in the academic community is fundamental to the performance of UFSCar as an entrepreneurial university, close to the demands of society and concerned about its social and economic impact on the region in which it operates. Therefore, this systematic macro-action, based on the challenges identified in the exploratory phase of this research, included the development and application of the Priority

Search Course, by the working teams of the AIn and NIT/Materiais units. The course aimed to develop the skills needed to access and use scientific and technological information, focusing on identifying and analyzing the state of the art of technologies developed by the academic community, contributing to the culture of innovation and technology-based entrepreneurship at UFSCar.

The course was divided into 4 units, which included a series of theoretical and practical activities related to the protection of intellectual property through the patent document and the prior art search as a fundamental process for this protection. The course was taught in hybrid mode (classroom and distance learning) and lasted 30 hours. The teaching material consisted of texts, references, presentations, and videos related to the specific learning objectives of each unit. Through the communication forum in the Google Classroom learning environment, three professors accompanied and guided the participants through the practical activities. The course was taught in person at the "Starteca - Entrepreneurial Space" facilities, reinforcing the importance of a space whose essence is to support innovation and entrepreneurship. Information on the course units, duration, curriculum, and learning objectives can be found in Chart 2.

Chart 2. Prior art search course

Unit 1 - Introduction to intellectual property	Learning objectives:
<ul style="list-style-type: none"> Sources of technological information and aspects of information sources Patent system Patent documents 	<ul style="list-style-type: none"> Know the concepts and elements of intellectual property; Understand the patent system, identifying the structure of a patent document and the main sources of information.
Unit 2 - Technological communication	Learning objectives:
<ul style="list-style-type: none"> Retrieval of technological information from patents and other sources Characteristics of patent databases Search strategy in patents: (Terminology, synonymy expansion, patent sections, Boolean operators) 	<ul style="list-style-type: none"> Know the concepts of access to and use of technological information, identifying the various communication media Develop and apply a search strategy based on a technological description, using the functionalities of different databases
Unit 3 - Scientific communication	Learning objectives:
<ul style="list-style-type: none"> Information retrieval from scientific databases; Characteristics of scientific databases; Search strategy in scientific databases (terminology, Boolean operators) 	<ul style="list-style-type: none"> Know the concepts of access to and use of scientific information, identifying the various communication media; Develop and apply a search strategy based on a technological description, using the functionalities of different databases
Unit 4 - Priority search report	Learning objectives
<ul style="list-style-type: none"> Analysis and synthesis of scientific and technological information Preparation of a prior art search report 	<ul style="list-style-type: none"> Analyze, comparing the information collected with the state of the art of the technology studied;

- Apply the concepts of intellectual property search, preparing a prior art search report.

Source: Prepared by the authors

The first offering of the course had a total of 15 participants, including 06 SIBi librarians, 06 postgraduate students, 01 AIn analyst and 03 external librarians from partner institutions. As a result, the "Starteca - entrepreneurial space" work team received the necessary training to guide the community in drawing up the anteriorly search report.

4.4 Guidelines and standardization of the prior art search process

In order to guide the academic community at UFSCar, to standardize the practices for carrying out the prior art search process and, consequently, to guarantee the quality of the prior art search report in terms of content, completeness, reliability, and consistency of the analyses to support the decision-making processes regarding patenting, a prior art search report template has been developed and implemented. The template contains several fields of information to be filled in by the researcher. The content of the report was organized in the form of a script of questions to guide researchers in defining and refining topics of interest and in retrieving scientific, technological, and commercial information. The script of questions for the prior art search is shown in Chart 3.

Chart 3. Roadmap for performing the prior art search

Stages of the prior art search process	Description of the steps in the search for prior art
Identification of the prior art search initiative	a) Project title; b) Name of the technology; c) Persons responsible for developing the technology; d) Date of report preparation (month / year); e) Team responsible for preparing the report; f) Department(s) related to the technology; g) Center(s) related to the technology; h) External partners.
Aim of the prior art search	General objective: a) Determination of the state of the art, to assess the novelty of the invention and/or inventive step; Possible specific objectives: b) Survey of similar patents; c) Survey of scientific publications d) Drawing up science and technology indicators for the technique
Definition of the search object	a) Type of technology being investigated: product, process, software, equipment. b) Characterization of the technology to be investigated.
Designing the search strategy	a) Definition of keywords, and synonyms (Portuguese, English); b) Definition of the International Patent Classification; c) Definition of patent and non-patent databases (scientific publications); d) Elaboration of the search expression, e) Adapting the search expression to the selected databases, f) Collecting information

Stages of the prior art search process	Description of the steps in the search for prior art
Identification of the prior art search initiative	a) Project title; b) Name of the technology; c) Persons responsible for developing the technology; d) Date of report preparation (month / year); e) Team responsible for preparing the report; f) Department(s) related to the technology; g) Center(s) related to the technology; h) External partners.
	g) Organizing collected documents and metadata: date collected, number of records per information source, formats, storage location and analysis tools to be used.
Definition of essential technical characteristics of the technology	a) Characteristics related to the benefits of the technology (advantages or benefits in terms of performance, efficiency, quality, etc.); b) Characteristics related to technical differentials (what is related to the parts that have been altered/improved and that differ from the state of the art); c) Characteristics related to functional improvement (what is related to the use of the object, be it in a more practical, comfortable and/or efficient way). more practical, comfortable and/or efficient in its use and/or manufacture)
Analysis - preliminary selection of documents	a) Focused on metadata (bibliographic records) b) Assessment of the relevance of the documents, based on the presence of keywords, and the presence of aspects related to the essential characteristics of the technique under analysis; c) Identification and selection of relevant documents.
Extended document analysis	a) Analysis of the text of the documents; c) Identification and selection of the relevant documents (patent and non-patent); b) Comparative analysis of the relevant documents based on the essential characteristics, with emphasis on the claims chart, in order to highlight the technical differentials of the proposed technology, as well as highlighting the technical effect achieved/provided by said technology; d) Application of the European Patent Office categories (Loveniers, 2018).
Final considerations	Writing an opinion on the patentability of the intended technology, by means of an argumentative text, based on the results achieved.
References	List the references consulted, including the relevant patent documents and scientific publications collected.

Source: Prepared by the authors

Finally, the system involved making a manual available on the Starteca website, intending to guide the UFSCar community (professors, students, researchers, and civil servants) in carrying out the prior art search process, considering that patent applications to be filed with the INPI must indicate, in the Descriptive Report, the state of the art understood by the applicant to be relevant to understanding the invention or utility model. The manual implemented by the research system comprised three macro questions that guided the work:

- 1) Timing of the report (when?): The result of the prior art search process is in the form of a report, which should comprise an investigation of the state of the art considering existing technologies. It is recommended that the report be prepared at the beginning and end of the project/research, to avoid rework or wasting resources, and if possible also during the development of the project/research, because if any technology is identified that conflicts with the project/research under development, there may be time for changes/adjustments to the project. The results of the prior art search process will provide professors, students, researchers, and staff at UFSCar with useful information both to guide the research and in the future to support the assessment of UFSCar's Special Intellectual Property Commission (COEPI) as to its potential for innovation and, if approved by COEPI, the request for a patent application to be examined at the National Institute of Industrial Property (INPI);
- 2) Who is responsible for drawing up the prior art report: members of the UFSCar community, with the support of the BCo "Starteca - entrepreneurial space", should draw up the report work team in partnership with AIn.
- 3) Drawing up the prior art search report (how?): Those responsible are advised to be clear about their objective and the subject of the search. You need to know what the intended technology is. What are the technology's technical advantages compared to technologies already described in the state of the art? What are its technical features? What technical problems have been solved? What technical effect has the technology to be protected achieved? In cases where the technology refers to an object of practical use or simple devices, has any functional improvement related to the use of the object/device been identified, whether in a more practical, convenient, and/or efficient way in its use and/or manufacture?

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It was possible to observe that the librarians from UFSCar acted strongly in guiding the "Elaboration of the search strategy", since they have a set of competencies very particular to the profession, related to the retrieval and organization of scientific and technological information, as Silva (2020) states. The AIn team focused its efforts on raising awareness of the importance of the prior art search report and its legal implications in the processes of industrial property protection and technology transfer or licensing.

6 CONCLUSION

The joint action between university libraries and TICs, a rare practice in the Brazilian context, is proving to be an important mechanism for addressing challenges in the process of creating entrepreneurial universities, such as facilitating interactions between members of the different organizational units involved in the development of technologies and the protection of intellectual property. It can also facilitate interactions between the university and society for the licensing of technologies and the development of products.

The joint activity of searching for prior art in the university library, by providing strategic information on the state of the art in the development of a given technology, guides

researchers and future entrepreneurs on the best actions to take with regard to the development and protection of technologies developed in the university context.

This approach has resulted in the development of a legitimate system to meet the needs of UFSCar, with a view to building competencies and having the academic community autonomously carry out the prior art search report, which includes 1] a focus on bringing together organizational units involved in innovation initiatives and technology-based ventures, and; 2] A prior art search course and; 3] Guidelines and standardization of the prior art search process. This approach, neglected by Brazilian institutions, is strategic for the success of the Entrepreneurial University and could contribute to the construction of solutions that sustain the success of this institutional project in the Brazilian context, seeking solutions based on the sharing of resources and competencies.

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