SCIENTIFIC CULTURE

INTERDISCIPLINARITY AS A FRAMEWORK FOR DISCUSSION IN TECHNOLOGY TRANSFER PROCESSES: THE CASE OF THE TECHNOLOGY PARK OF A UNIVERSITY OF THE JESUIT UNIVERSITY SYSTEM IN MEXICO

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ABSTRACT

This article shows the advances in the understanding and structuring of technology transfer from the university as a complex problem that needs to be addressed in an interdisciplinary way. Based on the research work carried out by a group of academics from the Ibero-American University in Mexico City (Ibero) and the National Autonomous University of Mexico (UNAM) on technology transfer practices in the universities of the Jesuit University System in Mexico (SUJM), the needs and opportunities for participation of specialists in different disciplines with diverse perspectives – Biotechnology, Marketing, Technology Transfer Management and Gender and Sustainability Studies – that problematize the findings of a concrete case of a Mexican Jesuit university that carries out technology transfer efforts and actions from its own innovation park are put forward. Through a qualitative methodology, which includes discussions with specialists in different fields of knowledge, documentary research, field immersion, a case study and focus group, a path towards an interdisciplinary conception of SUJM technology transfer as a non-linear and emergent process is described. The results obtained point towards a vision of planned, effective, flexible, adaptable, and humanistic technology transfer with challenges to summon the impulse of integrative dynamics of disciplinary and interdisciplinary organization in a harmonious way. Consequently, some novel initiatives are proposed for the initiation, continuation, and maturation of formally structured interdisciplinary actions in SUJM universities but also applicable in other universities that seek to foster technology transfer process within their ecosystems while using an interdisciplinary approach. The study contributes to the understanding and structuring of university technology transfer as a complex problem that must be addressed in an interdisciplinary way. The study describes a path toward a conception of technology transfer as a nonlinear and emergent process. As a result, it proposes innovative initiatives for structuring interdisciplinary actions in universities seeking to promote this process, applicable not only in the SUJM but also in other institutions.

1.INTRODUCTION

Universities play a pivotal role in the transfer of technology, a function that complements their core activities of teaching and research. This process primarily aims to develop and implement new products, services, processes, or applications. It necessitates a close partnership between universities and companies to drive innovation and technological progress. Such collaboration is a multifaceted effort involving diverse stakeholders with varying objectives, values, and resources [1,2]. Therefore, technology transfer is regarded as an interdisciplinary phenomenon that requires the integration of different perspectives and knowledge domains to effectively address the challenges and opportunities it presents.

Interdisciplinarity, understood as the integration of various academic disciplines to address a specific research question, entails fostering open dialogue, collaboration, coordination, and the exchange of diverse models and methodological tools between the different fields of knowledge [3]. This approach not only enhances the comprehension of the phenomenon under scrutiny but also catalyzes the generation of pioneering and inventive solutions to complex problems, regardless of institutional, educational, and social factors that inhibit interdisciplinary work [4].

This article addresses the issue of technology transfer within the Jesuit University System in Mexico (SUJM); it focuses on a specific case involving a technology park at one of these universities, aiming to develop a pathway that facilitates interdisciplinary discussions and establishes a structured integration process. The research methodology involved in-depth discussions with specialists from various disciplines, documentary research on the theoretical concepts of interdisciplinarity and transdisciplinarity, immersive fieldwork at a university technology park, and a comprehensive case study development. Finally, a focus group of disciplinary experts was facilitated to discuss the stated problem of the case study. These methods intend to shed light on technology transfer within the SUJM. The interdisciplinary approach proposed here seeks not only better articulation among different disciplines but also the creation of a common language that facilitates dialogue and overcomes resistance to interdisciplinary and transdisciplinary work through concrete activities involving individuals from various disciplines [5].

This research represents an effort to advance a theoretical and methodological approach that contributes to the understanding and management of technology transfer in SUJM universities from an interdisciplinary perspective. Based on critical analysis and interdisciplinary reflection, initiatives are proposed for the initiation, continuation, and maturation of formally interdisciplinary actions in SUJM universities, as well as to enrich research and practice in this field.

Following this introduction, Section 2 provides a theoretical framework for understanding interdisciplinarity in the context of technology transfer. Section 3 describes the methodology used in this study, including qualitative techniques and fieldwork. Section 4 presents the technology park case of study, detailing the interdisciplinary practices and findings. Section 5 discusses the perspectives and contributions of specialists from different disciplines, highlighting the interdisciplinary interactions observed. Finally, Section 6 concludes the paper with a summary of key insights, implications for practice, and suggestions for future research.

2.THEORETICAL APPROACH TO INTERDISCIPLINARITY

It cannot be stated that there is a consolidated state of the art on interdisciplinary research given the intense debate around the very definition of the construct whose limits, scope and distinctive features are not yet framed [6]. Such disparity of criteria derives, according to Jahn, Bergmann and Keil [3] from the fact that its definition and substantive features vary depending on the discipline or field of knowledge from which they are formulated [6,3], as well as the value of interchangeability with the concepts of multidisciplinarity and transdisciplinarity given by some authors [7], even though the three constructs refer to different approaches and scopes of collaborative research within the field of supradisciplinary inquiry.

Considering the above, Andersen [8], from a perspective of the philosophy of science, states that the interdisciplinary perspective of research can only be approached from its natural antecedent, collaborative research, which the author defines as that which starts from the division of labor, either in disciplinary or supradisciplinary fields, and where there is a combination of labor, materials and resources oriented to the production of new knowledge in a fast and profitable way, with a better number of results and a lower number of errors; which, expressed in other terms, translates into a greater number of people generating and using new knowledge with substantial savings in time and production costs, in addition to favoring the breadth and speed of the distribution of findings.

On the other hand, part of the literature reviewed in this regard fluctuates around the differences

between disciplinary and supradisciplinary research, including interdisciplinarity, where there is agreement in pointing out that neither interdisciplinarity nor any other supradisciplinary research practice implies a break with disciplinary practices insofar as they require them to develop [9] and that their analysis should be oriented towards the points of convergence and complementarity between both research modalities and, also, towards the way in which knowledge is approached and generated [3,10]. In this sense, Wilthagen, Aarts and Valcke [11], argue that the value of supradisciplinary inquiries or analyses, among which they include interdisciplinarity, lies in their ability to question the potential and limits of disciplinary approaches, thus contributing to the progress of individual disciplines and the generation of new and complex scientific knowledge. For their part, Aagard and Siune [7] add to this the ductility of interdisciplinary analyses to expand the levels of detail of the construct that constitutes the object of study of specific research, as well as their ability to perceive, describe and establish dynamics between these levels.

In the described scenario, Burges, Brugman and Boeynaems [12] analyzes the current tendency of large educational and research institutions to favor collaborative inquiry in the modality of interdisciplinarity, as the most profitable, accelerated and stimulating way for a research project to lead to new research, ideas and opportunities from the approach of an object of study shared by the different disciplines involved. Perhaps for this reason, the literature of the last two decades has been profuse in its treatment of interdisciplinarity, assuming it as a disruptive and democratizing tool of traditional science that may constitute too rigid a way to address complex objects of study associated with global issues that transcend traditional disciplines [13], innovation or knowledge transfer [14,15,16]. In a similar line of thought, Burgers, Brugman, and Boeynaems [12] focus their analysis on demonstrating that the importance that interdisciplinary inquiry has acquired in recent decades in most fields of knowledge is due to its contribution to the relaxation of the traditionally rigid boundaries on which the different academic disciplines are sustained.

The previous contextual explanations allow the literature to delve into the definition of the construct, to discover interdisciplinary research as that research practice that addresses a specific research question through dialogue, collaboration, coordination and transfer of models and methodological tools between the different disciplines involved [16,6]. Jahn et al [3] point out that this type of practice is characterized by the fact that the definition of the research, its objectives, conceptualization, operationalization, integration, and presentation of results are carried out jointly. For their part, Rousseau, Zhang and Hu [17], emphasize the integration of the epistemic aspects of individual disciplines: research traditions, schools of thought and perspectives, while Caro et al [6] refers to the transfer of methods from one discipline to another to generate new applications, new theoretical developments and even new disciplines.

From less complex perspectives, both Choi and Pak [14] and Cohen-Miller and Pate [15] define interdisciplinary research as a common, coordinated, and coherent effort aimed at harmonizing the links between disciplines. Effort whose effectiveness depends on the members of the research team or group overcoming the cognitive [4], epistemic [18], methodological, intellectual and technical [4] difficulties derived from the differences between disciplines, the various ethical approaches, the power games, the resistance to adopt and manage techniques and/or research methods outside their disciplines and, even, the use of different technical-professional languages [19,4,20]; additionally, MacLeod [4], adds the presence of institutional barriers and lack of appropriate policies as stumbling blocks that hinder interdisciplinary interaction, preventing research teams from tackling complex problems in a cognitively manageable way.

Nowell et al [19] argue that approaching interdisciplinarity from the perspective of its benefits, challenges, possible learning and methodological combinations could offer a more efficient view of the work in addition to strengthening its effectiveness and impact. MacLeod [4] takes up Huutoniemi, Thompson, Brunn and Hukkienen [21] and Klein [22], when he **advocates** the creation of institutional and administrative environments favorable to interdisciplinary coordination and communication from targeted funding strategies, restructuring of departments, reformulation of schemes in peer review in indexed journals to avoid the devaluation of interdisciplinary publications, academic promotion systems, creation of interdisciplinary research centers that minimize current physical obstacles, such as the location of disciplines in different buildings, and, finally, flexibility of educational systems anchored in disciplinary premises, perspectives and values.

Another important group of authors analyzes in their works the challenges faced by interdisciplinarity in terms of the construction of theoretical frameworks and state of the art. In this regard, Burgers et al [12] review the difficulties of determining the state of the art of research in

progress when considering that different disciplines use equally different methods and approaches to address the same topic, which forces researchers to elaborate syntheses that take into account all the literature from the totality of the disciplines involved in the object of study. At the time of the systematic literature review, interdisciplinary research adopts a multidisciplinary character in order to be able to combine and categorize the different disciplinary approaches associated with the same object of study, thus avoiding, in the opinion of Berger, Viney and Rae [23] one of the most difficult pitfalls to circumvent in terms of interdisciplinarity: the tendency of researchers to theorize, approach and approach the object of study from the perspective of their own individual discipline.

A difficulty that Semino, Demjén, and Demmen [24] describe as a framing problem, the way in which specific aspects of a topic are presented in a research situation. Thus, academic and specifically research groups, with different disciplinary backgrounds will tend to prefer specific framing approaches, close to their cognitive and epistemic background over others that are foreign to them. Even when researchers from different disciplines seem to have reached a consensus to analyze the same construct in a common framing framework, their operationalization may differ in relevant aspects, making it difficult to achieve the coherent and harmonious whole that Choi and Pak [14] describe as the central axis of interdisciplinary research.

Given the above, Burges, Brugman and Boeynaems [12] points out the need to prioritize systematic literature reviews to reach a deep understanding of how the different disciplines involved conceptualize and/or operationalize a common construct, which will allow achieving the harmonious synthesis advocated by Choi and Pak [14]. Brugman, Burgers and Vis [25], agree with Burges, Brugman and Boeynaems [12] and Semino, Demjen, and Demmen [24] in pointing to literature meta-analysis as the best tool of interdisciplinary research to focus the object of study. Explained in simple terms, the previously cited authors as well as Rákosi [26], Van Stee [27] and Brugman, Burgers, and Vis [25] argue that the state of the art of interdisciplinary research should be built from the analysis of the state of the art of each of the disciplines involved in relation to the shared object of study.

Therefore, it can be stated that for the most recent literature, the construction of theoretical frameworks and states of the art of interdisciplinary research can only be considered rigorous if it starts from an extensive and well-structured meta-analysis of the methodological, cognitive and epistemic contributions of the disciplines involved, which is congruent with what is pointed out by MacLeod [4], for the research team to achieve a sufficient degree of coordination and integration of background concepts, methods, epistemic standards and technologies from the totality of the scientific domains involved, which, in turn, will facilitate the generation and implementation of innovative and creative solutions that solve highly complex problems.

Perhaps, the large number of publications focused on cognitive, methodological and epistemic convergences and differences has prevented the literature from being sufficiently interested in the relational difficulties that might arise between members of such research teams when collaborating towards a common goal [19, 28, 29]. On the other hand, interdisciplinary research starts from structures of division of labor where team members accept to make partial contributions to the research project instead of performing the totality of the individual procedures themselves, which implies a partial renunciation of epistemic autonomy [30], strongly rooted in disciplinary research, where the researcher accepts, defends and takes responsibility only for what he/she has inferred by him/herself, for the **knowledge** he/she has generated individually. However, in interdisciplinary research the final result, accountability and **responsibility** are not attributed to a single individual but to the team as a whole, regardless of the role that each of its members has played in the project, which can lead to internal conflicts and questioning. Andersen [18] argues that, to avoid questions about the responsibility of authors in interdisciplinary research, the role of trust among team members must be strengthened, which is not always easy and has forced some scientific journals to require research teams to include in their articles a contribution statement that specifies the contributions of each member.

Finally, a small group of authors add to the described barriers the difficulties of measuring the success or failure of interdisciplinary projects [4], whose evidence in the opinion of Yegros-Yegros, Raffols and D'Este [31] is scarce, disorganized and inconclusive because, even when research of this type is being promoted in practically all fields of knowledge it is not yet well underpinned due to the fact that, frequently, its production lacks the rigor presented by the products generated from the disciplinary fields [4], which could be solved if the construction of its theoretical framework is considered from meta-analysis structures, as previously stated.

3. TECHNOLOGY TRANSFER FROM UNIVERSITIES AS A COMPLEX PROBLEM ENVISIONED AS INTERDISCIPLINARY

Technology transfer from universities is an activity that supports their teaching and research function through technological development aimed at generating concrete solutions that can be manifested in new products, services, processes or new applications. As part of their institutional mission, universities invest an important part of their resources in research and technological development with two main purposes: to contribute to knowledge itself and to contribute to solving society's problems; taking care of the environment and the welfare of communities. The industry is in charge of scalability up to production, distribution and delivery. There are other actors that also intervene in this binding scheme, such as governments and civil society organizations. There are several reasons why universities and companies seek linkage and collaboration for technology transfer. According to Rodríguez [32], universities have several reasons for technology transfer: it is a way to generate financial income and gain access to government funds, it provides recognition for creating applied technology for industry, improves student training, generates new basic and applied research, and creates postgraduate programs in collaboration with companies. On the other hand, industry drivers for technology transfer include the acquisition of technology and its efficient application, access to complementary skills, problem-solving, design and development of technologies, access to basic research, sharing the cost of research and technology development, and training of human resources.

The relationship that is generated between universities and industry to achieve their objectives, requires the construction of links between various agents and factors. According to Hilkevics & Hilkevics [1], technology transfer is a complex process that involves participants from academia, government and business, with different objectives, value systems and resources. For their part, Siegel, Waldman, Leannne and Link [2] identify as actors involved in the technology transfer process university scientists, university technology managers–also known as Technology Transfer Offices (TTOs) and companies that commercialize technology. Mexico's National Council for Science and Technology (CONACYT) identifies as agents involved in technology transfer: industry/the market, entrepreneurial capital/financing, human resources, the government, regulatory framework, research centers and higher education institutions, and technology commercialization [33]. In the same sense, López et al [34] indicate the importance of considering the actors that systematically influence the transfer "such as those who work in the companies, whether they are scientists who develop the commercial applications of the transferred knowledge, or the users who will apply it, or decision-making executives".

In a more detailed way, Ritter [35], in his model of good practices for technology research organizations, indicates the elements that must be taken into account for the good functioning of technology transfer from universities to companies: social, cultural, environmental and industrial context; governance and management; organizational structure of technology research composed of the organizational management of projects, business development, market service, contracting and portfolio of services; networks of collaborators: partners, colleagues, competitors; clients, foundations and beneficiaries; facilities and equipment; support activities such as financial management and personnel management. The interactions between these elements are shown in Figure 1:
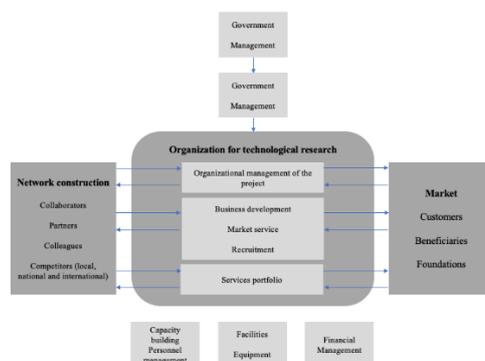

Figure 1. Outline of the best practice model for technology research organizations [35]

It can be stated that technology transfer from universities is a complex phenomenon due to the number and variety of actors involved, their relationships and implications, as well as the

diversity of possible products generated.

From an operational point of view –which is the point of view of the research team of this article–, it is possible to foresee different fields of knowledge that take part in the processes and transactions that make up technology transfer, such as engineering, design, administration, marketing, education, law and public relations, among others. By broadening the scenario, it is possible to recognize the relevance of other specific fields of the social sciences and humanities that can shed light on the knowledge of technology transfer. The recognition of this epistemological breadth on technology transfer is the starting point for interdisciplinarity that the research team recognizes for the exploratory and critical analysis of the research problem.

4. A PATH TOWARDS THE INTERDISCIPLINARITY OF TECHNOLOGY TRANSFER AT SUJM

Currently, the role of universities points towards economic development in addition to research and teaching that requires an interdisciplinary structure that facilitates knowledge-based innovation [36]. In this sense, the entrepreneurial activity of the university goes through several questions of an interdisciplinary nature such as knowing where the capabilities come from, a question proper to Strategic Management, or the effects of social rootedness from the point of view of psychology; likewise, from the economic point of view, examining different incentive systems that explain certain behaviors and results within university systems [37].

To move towards interdiscipline and transdiscipline, it is necessary to build a common language within the university, which opens the dialogue on the concepts of interdiscipline and transdiscipline, so that they do not lose their meaning or wear out and overcome resistance to

interdisciplinary and transdisciplinary work through concrete activities involving people from different disciplines [5]. How to establish this dialogue and how to carry out participatory activities between people from different disciplines are issues that are not fully defined, so it is necessary to have background information on the establishment and conditions of the conversation and interdisciplinary work, which will allow progress in the construction of a collaborative and common language.

This study tackles technology transfer in SUJ universities from its naturally complex character, which propitiates a meeting of coordinated and aligned perspectives that take place in a specific context and that depend, to a great extent, on the actors involved. To this effect, the following research question was posed: How can diverse disciplinary visions be integrated around technology transfer in a specific institutional environment such as the SUJM? This question is broad and unpredictable in scope, so in order to answer it, an exploratory and reflective work route was established that involves both the research team and the research subjects in an exchange of ideas, positions and proposals. It is important to emphasize that this case is part of a framework research project of greater scope in terms of the number of universities studied and the central approach.

The methodology developed in this case is divided into four moments. As the study progressed, the qualitative techniques used were expanded and deepened to respond to the findings and needs identified by the research team. In this sense, the methodological process shown below not only describes the research tools used, but also shows the path followed by the research team in the construction of an interdisciplinary effort to problematize technology transfer in the SUJ. Figure 2 illustrates the process followed.
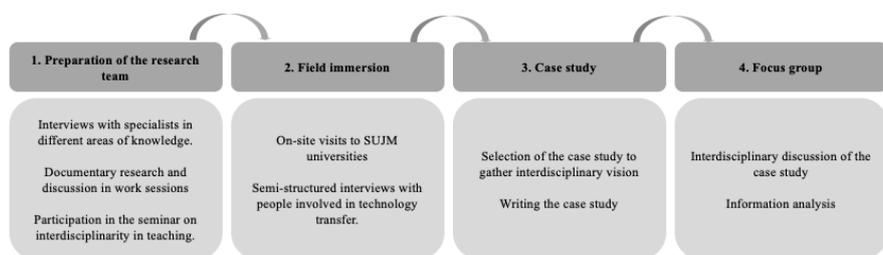

Figure 2. Case development process

In the preparation stage of the research team to address the problem of interdisciplinarity in technology

transfer – given the proximity of the research team's areas of expertise[1] – a limited understanding of the

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[1] The team is composed of four researchers with different academic backgrounds in science, engineering –one researcher with a second

career in law– and postgraduates at master's and doctoral level in management and engineering. The previous research work of the

various conceptions and practices of interdisciplinarity was identified to address the research problem. The first step consisted of interviewing, separately, specialists in various areas of SUJM knowledge about current practices on interdisciplinarity in research, the gender approach in this field and its relationship with the SUJM mission. In parallel and in conjunction with the academic team that has developed an interdisciplinary teaching project within the same university, a seminar entitled 'Building the interdisciplinary space'[2] was held to discuss the fundamental concepts of interdisciplinarity and transdisciplinarity in another of the university's major missions. On the other hand, a collection of scientific and academic papers on interdisciplinarity was compiled and discussed in the weekly sessions of the research team. During these sessions, different academic approaches to the phenomena of multidiscipline, interdiscipline and transdiscipline were discovered, and their main semantic and pragmatic divergences were identified; it was possible to observe that the way in which concepts are defined derives in the way in which they are applied and instrumented. This first step allowed the research team to establish a common starting point on interdisciplinarity in order to advance in the structuring of the research.

During the year 2022 and with the purpose of covering the field immersion to collect experiences of technology transfer in SUJM universities, the research team conducted sessions and on-site work visits to four selected universities of the same System, in order to identify the technology transfer models and processes of these knowledge centers. Prior to the organization and planning of the visits, it was decided to consult a decision-maker at each university in order to have a first approach to the most important aspects and problems of technology transfer, to get to know the actors involved and the relevant relationships, and to prepare a work agenda for the visits. The person responsible for the Park's management of this case study responded in a timely and favorable way to the request, so a teleconference was held to make contact and gather general information about the Park.

The information obtained sensitized and oriented the members of the research team for the visits to the selected universities. During the field visits, interviews were conducted with academic personnel (research and teaching), administration, students and entrepreneurs involved in the technology transfer processes. The interviews were conducted in a semi-structured way based on the objectives defined by the research team and documented in audio and written form.

The selection of this case study was based on the identifiable elements collected for its approach from an interdisciplinary perspective; in addition to being the case with the best background prior to the on-site visit, which facilitated its structuring. The case study was integrated from the interviews conducted in May 2022[3], to different people involved in the operation of the Park: director, administrative coordinator, research director, professor-researcher, graduate who works in the park, graduate who works in the park, entrepreneur graduated from the university whose company is hosted in the Park and representative of a Mexican company with national and international presence, also hosted in the Park.

In order to expand the perspectives on the problems and practices of technology transfer in the Park, a focus group was organized with four researchers and experts in different disciplinary fields from the Ibero-American University Mexico City and the National Autonomous University of Mexico, for a discussion in a Gesell chamber of the university where the research team was assigned. The participants were previously provided with the case study structured in the following topics: background, profile, operation, linkage, services, challenges and opportunities, in addition to the research proposal including the following questions: 1) What are the academic concerns that arise -from the point of view of each participant- about the case study? 2) What relevant problems are identified in the case study, from the point of view of each participant? 3) What methodologies does each participant consider that they could use to investigate or solve the relevant problems identified? 4) Which are the disciplinary fields that each participant considers it is necessary to integrate in order to investigate or solve the relevant problems identified? During the discussion, two members of the research team asked the questions in person while the other two members of the team monitored the environmental conditions and the recording from an attached control room. Finally, the recording was transcribed and the statements of each of the participants were analyzed.

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team members has coincided in the processes of innovation and technology transfer. A close interdisciplinarity of the team is assumed because although the fields of study are not the same, they are coincident in the research problem and, in that sense, conceptually close.

[2] The seminar 'Building the interdisciplinary space' was carried out in 8 sessions of 2 hours each between January and March 2022.
[3] The interviews were recorded in audios totaling about seven and a half hours.

5. VARIOUS PERSPECTIVES ON THE SAME PROBLEM: INTERDISCIPLINARITY

The analysis of the discussion conducted by the focus group revealed different positions on technology transfer, some coinciding and others unique in their approaches. The dialogue began with the presentation of the participants, in which they commented on their backgrounds and experiences in teaching, research and management. This first impression served to foster an atmosphere of trust and to establish the differences and coincidences of the participants on the subject of technology transfer and specifically on the case study.

The expert in biotechnology started from a previous experience at her university, which did not end successfully due to the lack of contacts that would help to promote the construction of a technology park or the creation of a technology transfer office; they emphasize her scientific knowledge, the training of students and the development of biotechnological solutions to environmental problems. The expert in technology transfer management is critical of the results obtained by the Park due to the lack of planning for its proper functioning and performance; given her experience in technology transfer, she understands the problems of the case well and offered some possible solutions. Likewise, the marketing expert referred mainly to the operational problems from a pragmatic and results-oriented management approach as a priority for the Park's development. On the other hand, the expert in gender and sustainability studies expressed that in a first approach it was not clear to her what the Park was and she had to reread the case to understand it better – possibly due to the disciplinary style of writing the case by the research team –, however, her incursion into the topic was naturally integrated into the conversation. Moreover, the gender studies expert began with a pointed question: How could this project help in challenging the multiple inequalities that exist as a SUJM institution of higher education?

As the conversation progressed, the experts confirmed points of view and took up assertions previously expressed by the other participants, giving way to coincidences and group understanding. The following diagram shows the main ideas identified by the research team from the questions asked to the participants. The following figures graphically present a synthesis of the contributions of the experts in the previously defined areas of analysis. Figure 3 corresponds to the biotechnology expert's perspective on the case, Figure 4 contains the contributions of the expert in

technology management, Figure 5 deals with the observations of the expert in marketing and Figure 6 shows what was expressed by the expert in gender and sustainability studies.
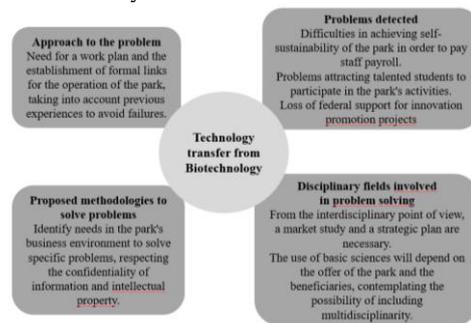

Figure 3. The transfer of technology from biotechnology
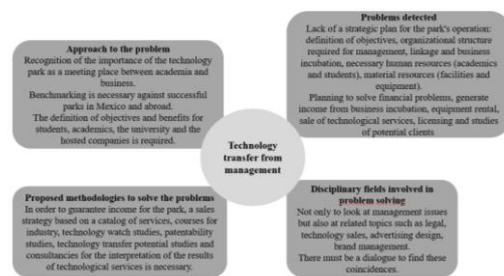Source: the authors based on the biotechnology expert's speeches.

Figure 4. Technology transfer from management
Source: Own elaboration based on the interventions of the expert in technology management.
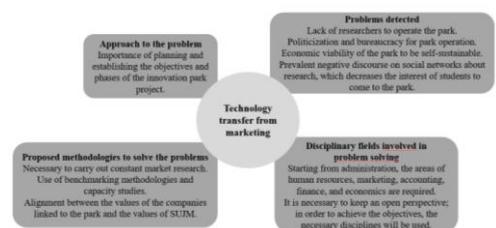

Figure 5. Technology transfer from marketing
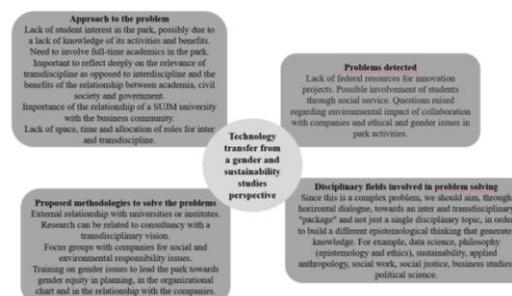Source: the authors based on the statements made by the marketing expert.

Figure 6. Technology transfer from a gender and sustainability studies perspective
Source: the author based on the interventions of the expert in gender and sustainability studies.

Each of these perspectives, in their description, can detonate new research approaches on technology transfer: the technological approach undoubtedly, with interest focused on transfer as a means to consolidate knowledge in solutions placed in the market (lucrative or social); from management, as a pragmatic criticism to decision-making processes and the importance for universities to make a constant technological surveillance and transfer of technologies without major brake; marketing as an integrating axis of other branches of administration to strengthen the value offer aligned with what the market and society require; and from the gender and sustainability approach, the necessary discussion on inclusion, social responsibility and the dynamic transition towards transdisciplinarity.

Huutoniemi et al [21] state that interdisciplinarity has three dimensions: 1) the scope or what it integrates; 2) the type of interaction or how it integrates; 3) the type of objectives or the purpose of it. According to the characterization proposed by the Huutoniemi team, Table 2 presents a qualitative qualification of the interaction constructed from the focus group. The scope can be narrow or broad in terms of the number of elements interacting in the case; the type of interaction speaks more of the quality and goes from empirical to composite in terms of its complexity; the type of objectives focuses on the expected or necessary results around the topic of analysis that goes between instrumental and epistemological, the latter as the need to build a body of knowledge that is not known or developed.

Table 1. Qualitative rating of interdisciplinarity on the case

Attributes	Biotechnology	Management	Marketing	Gender and Sustainability Studies
Scope of interdisciplinarity	Limited	Limited	Limited	Broad
Type of interdisciplinary interaction	Composite	Composite	Composite	Empirical
Type of interdisciplinary objectives	Instrumental	Instrumental	Instrumental	Epistemological
Source: Own elaboration, based on the focus group conducted.				

In the case of biotechnology, as an applied science, it is understood as one of the possible beginnings of the technology transfer process. The expert in this field indicates concerns and needs, from the point of view of a direct beneficiary of the rapprochement with other disciplines, with an eminently practical sense for the generation and dissemination of technology. It is possible to observe a great proximity to technology transfer in the terms in which it is proposed by the research team, so that the possibilities of interdisciplinary work are broad and clear.

The management expert instrumental criteria for the achievement of technology transfer in an effective and efficient way as a starting point. She points to business, legal and advertising disciplines as necessary elements for the achievement of strategic objectives. There is a coincidence with the approach to technology transfer as seen by the research team and that there are no significant disciplinary barriers for joint work; in any case, an integration of knowledge can be foreseen.

The marketing expert expressed interest in bringing marketing tools closer to technology transfer in the terms in which it is presented by the research team. She emphasizes the discursive aspects of technology transfer to achieve its goals. In this sense, there is a possibility of close interdisciplinary work, aiming at generating new possibilities and applications on the subject.

From the perspective of the expert in gender and sustainability studies, a certain distance from the approach to technology transfer as presented by the research team is evident, possibly due to the topic itself, which is very specialized, and due to the disciplinary approach. of the research team based on the achievement of results of an instrumental nature. Therefore, a possible interdisciplinary work would require a greater approach through dialogue to form a comprehensive shared vision of the phenomenon of technology transfer.

The group of experts agreed on the case focused on market analysis, planning, linkage, inclusion, the generation of extraordinary income for the institutions as one of the results of technology transfer, the participation of various disciplines that are necessary for the exercise of the transfer, the integration of students in technological development and innovation projects, among other elements. However, the differences in the contributions emphasize tensions within the institution and the necessary management of knowledge, i.e., learning from experiences without giving up projects.

6. CONCLUSIONS

Technology transfer is managed, i.e., it is primarily a strategic action involving multiple disciplines, but it is also part of an organizational system that is first linked inwardly to identify research teams willing to translate their technological developments into improved products, services or processes – this is nurtured by the state of the art of

the subject in question. Given its interaction with other disciplines, it also presents tensions, challenges and risks, which is why it is an object of study. From the beginning of the project, the research team established the fundamental rule of interaction: active listening requires connecting what is perceived with the senses and assimilated knowledge, which means it undoubtedly eventually challenges convictions. To address this process, the research team defined seminar-type meetings to address the issues that would provide a practical view of technology transfer through reviewing and discussing the literature but also the experience of its members. This prepared the team to go to the field. Then an understanding of the topic and its possible implications allows the development and implementation of an appropriate methodological approach for the integration of different perspectives involved.

In this sense, there are three main lessons learned: interdisciplinarity is not a goal but a consensual process that is built throughout the interaction between disciplines; discipline is necessary because it allows going deeper into a topic that will contribute to others as necessary; listening and trying to understand the approach of other disciplines of knowledge provides elements to broaden the spectrum of analysis and, if necessary, of action.

Interdisciplinarity, understood as the intersection of different specialized viewpoints that congregate around a problem, with a scope beyond its own borders and that confronts the methodologies established by each field of knowledge, requires openness to dialogue and empathy at the epistemological level. These conditions do not arise spontaneously; they must be built and cultivated. Therefore, it is assumed that there is no single path to interdisciplinarity; in any case, it will be necessary to analyze the experiences of each initiative for a better understanding of the phenomenon and eventually its possible management.

The research team agrees that this interdisciplinary exercise contributed to a better understanding of the technology transfer process in the case study and provided new elements for further discussion. The proposals identified in the literature to measure interdisciplinarity are far from achieving it. However, evaluating the quality of interdisciplinarity is a priority and represents an opportunity to develop a solid construct applicable to research and teaching work in universities. During the development of the methodological exercises, the epistemological tension between the actors relaxed, and postures moved towards collaboration and coordination, pointing towards a better shaping of the complex problem of technology transfer in the university innovation park.

There are opportunities for interdisciplinary work in universities like SUJM to enhance research on technology transfer, broaden the understanding of the problem, identify emergencies resulting from the dialogue of diverse disciplines involved, and associate restructured methodologies to propose integral solutions.

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