

University-Industry Technology Transfer and Coproduction: A Case Study

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Abstract: Universities can promote entrepreneurship and innovation both by training professionals and by offering knowledge resulting from their research. Traditionally, industrial development has benefited from technology transfer (TT) from universities. Although the TT is very known and used, co-ownership and economic exploitation after a TT process remain a challenge to formal University-Industry agreements. In this study we discuss the notion of university-industry coproduction as a means to address formal agreement after TT. The case study is a Brazilian national Program, called CEURS - “Training and Studies for Urban and Regional Sustainability”. The main goal of CEURS is to provide practical training to individuals and teams on sustainability matters, focused on how to fulfill the UN's SDG 2030 Agenda locally (i.e., how to empower projects that are already at the community level so that they can become city programs). To do so, CEURS project was led by an academic network, sponsored by national government agencies. The project was developed at the Federal University of Santa Catarina (UFSC) by academics and students of the Graduate Program in Engineering and Knowledge Management, from the research group on Co-production in Digital Commons, in Brazil. CEURS team has developed *CEURS Platform*, a digital education platform, currently in the process of being publicly transferred to be augmented and operated at a national level. In this article, we analyze the institutional technology transfer agreements available to CEURS regarding the need to meet project demands for technology licensing, technology transfer, open innovation, and joint patents. We offer a critical analysis of a current regulatory process in technology transfer in an academic project that combines education, development, and social demand fulfillment. We conclude that a technology transfer licensing agreement can include principles that may fulfill CEURS project needs for nationalization through university-industry co-production. This study contributes to academics, innovation offices, policymakers, and university managers in formulating diligent and fast processes and strategies through technology transfers.

Keywords: University-Company, Technology transfer, Knowledge transfer, Coproduction, Innovation, CEURS Platform

1. Introduction

University-Industry relationship is an engine for the emergence of innovations and new technologies, given that researchers and professionals from different areas interact (Santana and Porto, 2009), benefiting both by complementing knowledge, skills and resources (Santoro and Betts, 2002). Universities learn from the entrepreneurial commercial vocation and companies take advantage of the university structure and qualified labor, thus reducing their research costs (Closs and Ferreira, 2012).

Traditionally, these relationships include Technology Transfer (TT), with legal instruments designed to formalize the university as the licensor and the industry as the licensee of the created technology. In this view, Universities offer to partners knowledge and/or technologies produced by their academics, to be used directly or as components of goods and/or services to the market. Besides promoting economic growth and local/regional competitiveness, universities hope that TT projects can create opportunities not only to support their economic sustainability (royalties), but also to improve their training processes.

When the project involves co-production between the university and industrial partners, factors such as co-ownership and exploitation of results challenge the terms of TT agreements.

In this paper we study the CEURS project - a program funded by federal funds and designed by an academic network to be applied nationwide through a digital education platform. We check specifically for the regulatory mark available to make CEURS a future industry-collaboration, as initially presumed by its authors.

2. Technology Transfer

Technology Transfer (TT) is the process by which organizations or individuals transfer information, knowledge, technology, or innovation to partner individuals or organizations (Parker and Zilberman, 1993; Roessner and Bean, 1991). It can be a highly complex process, as it involves transferring tacit, explicit, and operational knowledge, and not just the technology itself and its supporting mechanisms (Souza, 2010).

In this core, universities with traditional precepts of teaching and research, move towards a third mission, associated with has been called “entrepreneurial universities” (Asheim, Smith and Oughton, 2011; Klofsten et al, 2019; Autio et al, 2014).

In this new vision, universities act towards social and economic development (D'Este and Patel, 2007; Klofsten et al, 2019; Mendoza and Sanchez, 2018; Bercovitz and Feldmann, 2006), committing to the local community and regional and adding value to the environment in which they operate (Khan et al, 2020).

Universities for standing out in qualified human capital (Romero, Ferreira and Fernandes, 2020), in the production, dissemination, implementation of knowledge, innovation (Bercovitz and Feldmann, 2006; Santos, Veloso and Urze, 2021; Khan et al, 2020), have long collaborated with other organizations on technological advances. These collaborations have intensified in recent years due to the development of new technological platforms (Bercovitz and Feldmann, 2006), the need for funding sources and government policies for academic research (Bercovitz and Feldmann, 2006; Romero, Ferreira and Fernandes, 2020).

Thus, TT has been expanded to University Technology Transfer (UTT) referring to the process in which universities transfer and commercialize knowledge resulting from their scientific discoveries and technological innovations to the market (Li and Tang, 2021). Bercovitz and Feldmann (2006) summarize that UTT is the commercialization of university research through transactions between university and company.

Given the importance of these relationships in knowledge production, innovation and sustainable social development, national and local governments have dedicated budgets, incentives, subsidies and infrastructure for innovation. UTT has been one of these instruments (Gonzalez-Pernía, Kuechle and Pena-Legazkue, 2013), where both actors, universities and firms seek competitive advantage (Li and Tang, 2021).

More recently, universities have been demanded by public agencies to not only foster academic multi and interdisciplinary research networks in scientific projects, but also to promote transdisciplinarity by enrolling social players into research, development and innovation projects. This can be seen by current interest in investigating University-Industry (UI) coauthorship (Kohus, Baracskaï and Czako, 2020), UI joint patents (Petruzzelli and Murgia, 2020), and UI open innovation (Neves, Costa and Reis, 2021).

The combination between scientific and practical knowledge performed by academic-industry teams changes the traditional roles that universities and firms play in innovation projects.

2.1 UTT and the Brazilian Innovation System

In Brazil, TT is directly addressed by the 1988 Magna Carta. The Federal Constitution provides that the State shall promote and encourage scientific development, research, scientific and technological training and innovation, with a view to the public good, the progress of science, technology and innovation and technological research aimed at solving the Brazilian problems and for the development of the national and regional productive system (Brasil. *Constituição da República Federativa do Brasil de 1988*)

The first regulatory instrument for innovation was the Innovation Law of 2004 (Law No. 10.973 - 2004). This Law offers to the Brazilian State and universities means to foster innovation, research and scientific and technological training, including cooperation and interaction between the public and private sectors and between companies (Brasil. *Lei nº 10.973, de 2 de dezembro de 2004*).

After a decade, the law has evolved into the National Science, Technology and Innovation Code (Law No. 13.243 - 2016), with incentives for scientific development, research, scientific and technological training and innovation. In 2018 this National Code was regulated by the Decree No. 9.283, that established measures to encourage innovation and scientific and technological research in the productive environment, aiming at technological capacity building, achieving technological autonomy, and developing the national and regional productive system (Brasil. *Decreto nº 9.283, de 7 de fevereiro de 2018*).

In 2020, Brazil created its National Innovation Policy (Decree No. 10.534). With the aim of increasing the country's competitiveness and, foremost, improving the population's quality of life, this decree establishes measures to foster research and development, protect intellectual property, encourage collaboration between companies, universities, and research institutions, and other actions to promote innovation (Brasil. *Decreto nº 10.534 de 28 de outubro de 2020*).

In all four regulatory instruments, cooperation projects among universities, companies, and private research and development non-profit entities, have been considered strategic to generate new products, processes and innovative services and the transfer and dissemination of technology.

At the operational level, university-industry projects can be formalized by the following ways: (1) *Technology Licensing* (TL) - an agreement in which the university grants a company the right to use a technology developed in its laboratories in exchange for payment of royalties or other forms of remuneration; (2) *Technology Transfer* (TT) - a process by which a university transfers knowledge and technology to a company, which can involve the creation of spin-offs (companies that emerge from academic research) or strategic partnerships between the university and the company; (3) *Open Innovation Projects* (OI) - collaborative projects between companies and universities, in which both parties contribute knowledge and resources to the development of new technologies or products; (4) *Joint Patents* (JP) - patents resulting from joint research and development projects between universities and companies, in which both parties share the intellectual property and the economic benefits arising from the developed technology.

In the following section we study a recent Brazilian case of technology development fostered by the federal government and that is currently in its phase of choosing one or more of these approaches to go nationally.

3. CEURS Program

CEURS is a portuguese acronym for “Urban and Regional Training and Studies for Sustainability”. This program is funded by Brazilian federal agencies (both National Parliament and Science, Technology and Innovation Ministry) and developed by an academic network to develop courses to empower public officials and civil society organization collaborators in cities on how to localize the Sustainable Development Goals (SDGs) of the 2030 Agenda.

CEURS has been developed at Universidade Federal de Santa Catarina (UFSC), by academics of the Graduate Program in Engineering and Knowledge Management (PPGEGC), from the research group of Digital Commons Coproduction (DCC). In order to achieve CEURS national capacitation goal, the group has developed “CEURS Platform”, a digital education platform designed by DCC members with the support of suppliers, with several technological and pedagogical components to apply Neo-learning methodology (Bresolin, Freire and Pacheco, 2021).

To offer its courses, CEURS Platform has learning objects, content and videos designed under the Neo-learning methodology. These components are accessed through a Virtual Learning Environment (VLE) developed in Moodle. There are also complementary information systems that support CEURS courses learning trajectories. In addition to the "CEURS" brand, the technological components of CEURS Platform have been registered at the National Institute of Industrial Property (INPI). Contents such as the eBook "Introduction to the Municipalization of the 2030 Agenda" (Pacheco and Carneiro, 2020), are also part of the CEURS Platform.

Therefore, in relation to the ownership of the technology presented, the CEURS Platform has copyright for each type of component and is the intellectual property of UFSC. This implies recognizing and explaining the intellectual authors in the technical sheets of books, learning objects, videos and information systems created to compose the Platform. Intellectual property is institutional to UFSC, respecting the respective clauses of use and communication of each contract signed under the CEURS Program.

Since October 2021 CEURS courses have been offered to city employees and social organization collaborators, mainly from Santa Catarina State. Using its national academic network, one of the main goals of CEURS project is to take its courses to the other Brazilian States. In order to do so, CEURS Platform has to be transferred and improved to support thousands of students. This challenge is a typical coproduction project where University intends to invite private partners to adopt and improve its initial technology. In the following section we examine the TT and U-I coproduction options, considering current Brazilian Innovation regulatory mark and its potential impact to CEURS goals.

4. CEURS Platform Licensing as a UTT Process

CEURS Platform is the main technological result of CEURS project. It was developed to not only deliver the current courses offered mainly in Santa Catarina state, but also to foster CEURS regionalization in all other Brazilian states. In order to do so, CEURS Platform has to be expanded with more scalability capacity, on-demand support, with a technological evolution plan to instrumentalize digital training on a national scale.

To provide this evolution, DCC research group and UFSC Innovation Department (SINOVA) are preparing a CEURS Platform licensing process. The goal is to enable the use, operation, development and evolution of the training instrument created for the CEURS, taking the Program incrementally to other Brazilian States.

In the following sections we describe how CEURS program was designed as a multi-institutional program, the regulatory references applied to CEURS Platform licensing, and the licensing term that is currently being developed to fulfill CEURS Program goals.

4.1 CEURS Multi-Institutional Cooperation Agreements

CEURS Program was designed to establish a network of academic and governmental organizations to enable its courses and offer them with technological tools to city halls, city councils, and citizens of Brazilian cities. To this end, UFSC signed a series of agreements with academic and research organizations, understood as disseminators of the CEURS Program and potential leaders of its regionalization projects.

As can be seen in Table 1, CEURS has been funded by the federal government (both Parliament and MCTI), developed by a leading university (UFSC), in cooperation with university partners in other states (currently USP and UTFPR). At UFSC, there is a founding contract with FAPESU that allows the management of scholarships and contracts with third parties, necessary for the completion of services in CEURS.

Table 1: Institutional CEURS Players

Player	Sector	CEURS responsibility
Federal Parliament	Government	Federal deputies offer parliamentary amendments to CEURS, submitted to MCTI with the indication of the beneficiary university.
MCTI	Government	MCTI receives the parliamentary amendments and, through a Decentralized Execution Agreement (TED), transfers the funds to the University to carry out the project.
UFSC	Academy	Leads the research and development process of the CEURS project, including the creation of the CEURS technology, offering courses to Brazilian cities, as well as coproduction and knowledge transfer to partner academic groups.
FAPESU	University Foundation	Manages the CEURS project and the contracts with individual and business suppliers to CEURS technologies
USP	Academy	Coproduction of videos and workshops in CEURS, as well as regionalization of the Program in the State of São Paulo, expanding the model of evolution and application of its courses.
UTFPR	Academy	CEURS regionalization in the state of Paraná, with participation in its evolution and dissemination.
Instituto Stela	R&D institute	Through the UFSC-Stela agreement, it provided infrastructure for the project development during the pandemic and has been carrying out an agreement for the dissemination of the Program with partner organizations.
SEBRAE-SC	Business	Provides infrastructure for CEURS online workshops and has been promoting the program to cities in Santa Catarina.
FECAM	Government	The Federation of Municipalities of Santa Catarina promotes CEURS to city halls, as a reference for training in sustainable urban development.
FAPESC	Government	Santa Catarina State Foundation for Science, Technology and Innovation Support that funds the project of creating educational games in the CEURS Program.

In addition to the relationships between the federal government and universities, CEURS has been supported by partner organizations that have offered technological infrastructure (Instituto Stela), technologies and spaces for course transmission (SEBRAE-SC), and dissemination to municipalities and cities in Santa Catarina (FECAM and SEBRAE-SC).

Recently, in 2022, a research contract was signed with the Support Foundation for Scientific and Technological Research of the State of Santa Catarina - FAPESC, through a competitive research funding process, in which the CEURS Team proposed the development of recreational games for the dissemination of the 2030 Agenda.

In sum, CEURS has been developed based on a series of cooperation agreements. These formal partnerships have been fulfilled for specific purposes through a project and work plans (Portella and Sabença, 2019).

After three years of research, development, communication and application in Santa Catarina State, CEURS project has reached its moment to go national. In the CEURS regionalization UFSC will no longer be solely responsible for the instrumental technology of digital training. It is expected to have the adhesion of the other universities partners, and, particularly regarding CEURS Platform, it is expected that the course services and technology evolution can be provided by a responsible and experienced organization. On the economic level, it is also intended that the transfer of technology generates financial resources to be applied in the evolution of research in the CEURS Program, in its continuity in the national network that is planned to be formed from its regionalization.

4.2 Instrumentalization of CEURS Technology Transfer

At UFSC, the CEURS platform licensing process is subject to the recently approved University's Innovation and Entrepreneurship Policy - UFSC IE-Policy (Universidade Federal de Santa Catarina, 2022). Respecting the national innovation regulatory framework, UFSC IE-Policy encourages innovation and entrepreneurship in the activities of research groups at the University. The IE-Policy provides guidelines for UFSC to offer technological training, promote technological autonomy, and cooperation with the country's innovation systems and from abroad. The Policy recognizes innovation and entrepreneurship as instruments for social inclusion and development of the regional and national productive system.

At CEURS project, these innovation principles will be applied to the CEURS Platform licensing process. A licensing agreement is a formal contract that enables the use and exploitation by a company of a technology produced at the university, without transferring ownership of the technology (Agência Unesp de Inovação, 2020; González-Pernia, Kuechle and Peña- Legazkue, 2013).

In order to make CEURS Platform licensing agreement, the DCC research group contacted Sinova/UFSC to request a *public call* for licensing. A public call is an administrative procedure established by law for selecting the most advantageous proposal for the public administration and guaranteeing compliance with the principles of public administration, especially the principles of impersonality and publicity (Brasil. *Lei nº 13.019, de 31 de julho de 2014*; Portella and Sabença, 2019).

In Table 2 we present the main CEURS Platform licensing regulatory terms presented by DCC research group to Sinova/UFSC, in order to elaborate the public call.

Table 2: CEURS Public Call Instrument

Public Call Element	CEURS expectation
Object	Enabling the use, operation, development, evolution, production, commercial exploitation, provision of services, or obtaining of economic advantage within the scope of CEURS Platform, owned by UFSC.
Target Audience	Public or private organizations with proven competence and history in the conception, development, implementation, and evolution of digital platforms may participate in this selection process.
Objectives	To ensure equal opportunities for organizations interested in promoting the CEURS Program by licensing CEURS Platform. To enable the regionalization of the CEURS Program in Brazil

Public Call Element	CEURS expectation
	To find an organization with technical-scientific capacity to offer and evolve the Platform, in order to meet the emerging demands of the CEURS Program regionalization process.
Legal Basis	Law No. 10.973/2004, which establishes the obligation to publish a summary of technological offers on the official website of the ICT for exclusive contracting situations, guaranteeing the constitutional command of the principle of publicity. As applicable, additionally: Decree No. 9.283/18; Law No. 13.243/2016; Law No. 9.279/1996; Law No. 9.784/1999; Law No. 9.279; Law No. 9.609; and Law No. 14.133/2021.
Licensing Mode	1 - Exclusivity of the license of the CEURS® Platform. 2 - Eventual sublicensing subject to UFSC authorization. 3 - Provision for corrective and evolutionary CEURS Platform maintenance. 4 - Economic compensation (royalties) when licensing under contract. 5 - Costs of maintenance or creation of new intellectual property registrations to be defined in complementary projects. 6 - The term of the license will be 10 (ten) years.
Intellectual Proprietary Rights	1 - Acknowledgement that the UFSC is the exclusive owner of CEURS Platform. 2 - This license does not imply ownership transfer.

As it can be seen in Table 2, CEURS Platform licensing public call has the following principles:

- *Exclusivity*: as CEURS will be taken to different states and CEURS Platform will need to be not only maintained but also improved, a single partnership reduces the complexity of management and governance of the technological offer of the CEURS Program.
- *Previous experience*: the organization partner has to have competence and a proven track record in the conception, development, implementation and evolution of digital platforms (i.e., e-government solutions for a broad target audience).
- *Academic Royalties*: the licensing has to bring economic compensation to the University, when CEURS Platform is used in a digital education project;
- *Sustainable business model*: it is required that the organization partner suggest a business model to foster CEURS that go beyond the current funds from federal Parliament, respecting national and institutional innovation regulation;

The principles of CEURS Platform licensing public aim to bring to CEURS project four ways of formalizing coproduction between university and industry: (1) *Technology Licensing* (TL) - the agreement allows UFSC grant to a company the right to use a technology developed in CEURS project in exchange for royalties; (2) *Technology Transfer* (TT) - CEURS team will transfer knowledge and technology to a company; (3) *Open Innovation Projects* (OI) - the licensing includes complementary projects that can be developed as a joint effort between university and the partner; (4) *Joint Patents* (JP) - these complementary projects are related to intellectual property rights to be discussed case by case.

5. Final Remarks

Technology transfer between university and industry has been an effective instrument to bring academic knowledge and products to market. Nevertheless, the complexity of digital society has demanded not only linear relationships but mainly a coproduction between university and industry. Regarding government, modern innovation systems have demanded new regulatory marks and the alignment between different public levels (federal, regional and municipal) decisions.

Academic research groups can meet the demand for university-industry co-production through innovation projects. However, technology transfer regulatory processes should not only focus on delivering results to the industry but also enable the elaboration and development of joint projects.

The case we have studied in this paper is a current challenge to CEURS research group: the only way they can take their project mission to all Brazilian cities is by multisectorial and multi-institutional coproduction. However, the regulatory mark has to include multiple government levels, academic network and open innovation with private companies has been a challenge. CEURS Platform licensing agreement is one of the UTT instruments that can help the university to take the project to other states. It is also a case to help university innovation policy to include multisectorial and multi-institutional coproduction factors in its regulatory mark.

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