

Relevancia de los Mecanismos para la transferencia de tecnología y conocimientos en el contexto Universidad-Empresa

Relevance of the Mechanisms for the transfer of technology and knowledge in the University-Business context

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RESUMEN: El conocimiento útil impone a las Universidades el rol de generadoras de tecnología en vínculo con el tejido productivo. El desarrollo tecnológico define avances en sociedades modernas. Cuba, con esta premisa, pretende la Economía del conocimiento como política de gestión del gobierno basada en innovación. Este trabajo argumenta el necesario perfeccionamiento de los Mecanismos para la transferencia de tecnología y conocimientos en el contexto cubano Universidad-Empresa para la explotación del conocimiento empleando métodos de análisis, síntesis, teórico-jurídico, exegético y revisión documental que permitieron consolidar mecanismos jurídico-instrumentales de esta relación, así como determinar el impacto de creaciones intelectuales universitarias.

Palabras clave: Transferencia de tecnología y conocimiento; Mecanismos de transferencia; Canales de transferencia; Propiedad Intelectual; Contratos de licencia; Vínculo universidad-empresa.

ABSTRACT: Useful knowledge imposes on universities the role of technology generators linked to the productive fabric. Technological development defines advances in modern societies. Cuba, with this premise, seeks the Knowledge Economy as a government management policy based on innovation. This work argues the necessary improvement of the mechanisms for the transfer of technology and knowledge in the Cuban context University-Business for the exploitation of knowledge using methods of analysis, synthesis, theoretical-legal, exegetical and documentary review that allowed to consolidate legal-instrumental mechanisms of this relationship, as well as to determine the impact of university intellectual creations.

Keywords: Technology and knowledge transfer; Transfer mechanisms; Transfer channels; Intellectual property; License contracts; University-business link.

Introducción

Technological and social progress has intensified the degree to which knowledge is integrated into economic activity, determining its application to production at higher levels of social welfare and economic growth. With the extension of the scientific and technological content of economic activity, the affiliation of useful knowledge to organizational and business management processes is exalted. These are elements of the Knowledge Society and the Knowledge Economy System. The University, from its social function, plays a relevant role.

The technologies protected by Intellectual Property Rights, through their different modalities, operate in the economic traffic as an essential means for the holder when, by himself or through third parties, he places them in the economic traffic. The dynamizing character exercised by the transfer of technologies and knowledge implies an additional technical legal approach that considers the valorization of innovations, in the form of intellectual creations protectable by IPR.

The symbiosis between TT and economy becomes relevant in the international context from the consideration of R&D&I development in the design and orientation of public policies and TTC support programmes, according to Palao Moreno (2020, p.17). The IPR, from its protection modalities, has been the ideal medium for this exchange. This context requires the adaptation and creation of legal tools capable of supporting the new productive arrangements. The mechanisms that serve these operations tend to be varied, complex and difficult to assimilate in terms of regulation.

The exchange and flow of capital between countries with variable economies, within the framework of global technological market activities, has boosted the use of TT mechanisms because their flexibility for transfer allows them to be used by any actor in the market. According to Palao Moreno, they play "a strategic role in relation to significant issues such as economic growth, social welfare, sustainability or the very development of countries" (2020, pp.23-24).

The nature of TTC gives them an instrumental character. Technology, innovation and knowledge have an impact on public policies that favour R&D&I development.

This multidimensional vision is very useful for the implementation of the current political and economic guidelines that Cuba has set in terms of technological development and innovation in its 2019 Constitution. It also serves as a basis for the profound modifications to which it is subjecting its economic model from the reordering of the very role of the actors in its public-private business platform. The urgency to improve the university-society link, in the productive economic environment, with emphasis on strategic sectors and territorial and local development, is expressed

in the objectives of the Strategic Planning 2017-2021 of the Ministry of Higher Education and in its working system (Tarragó Ayra & Rodríguez Saíf, 2022, p.164).

It is important to highlight the role of universities and research centres as the main drivers of knowledge and technology generation, which has led them to build bridges with the productive sectors in order to respond to growing social demands. Both the research results transfer units and the legal instruments that formalize the operations constitute ways of managing and commercializing knowledge in IPRs.

A priori, there is a need to articulate multidisciplinary networks and alliances (Contreras Villavicencio et al., 2017), with institutional and management capacity that not only involves the researcher, but also connects other elements that make possible an effective link with industry, government and society. Cuba, in its position as a technology-acquiring country, does not escape this challenge. A particular challenge for universities is to multiply their institutional role in favour of the quality, quantity and relevance of scientific research, technological development and innovation for inclusive sustainable development (Saborido, 2020). The normative context is propitious for the improvement of the IPR system in the country.

The problem involves the insufficient theoretical and technical-legal construction of TTC mechanisms in the national scenario, which transcends the exploitation of IPR in the Cuban University-Business context. For this reason, the aim of this paper is to argue the need for the improvement of these mechanisms for the efficient exploitation of research results. This favours the internal scientific dynamics of universities as part of the science system and the cycle of their research, with a view to the industrial application of the results.

The methodology corresponds to a qualitative study, by means of an exploratory, explanatory and descriptive socio-legal research, taking into account that the subject has generally been approached in the country from areas other than Law. A non-experimental approach is employed, using the following research methods: analysis-synthesis, induction-deduction, observation, legal-theoretical, exegetical and document review.

Development

The evolution of societies shows that the exploitation of new knowledge is imperative. The use of the products of scientific and/or technological research has an impact on (or even determines) the power of the productive system in each country. The acquisition of this new knowledge, the

development of new technologies, the promotion of these activities and the planning and establishment of ways of making the best use of their results are strategic activities for these purposes. The University as a social institution has a high commitment to the global context and to the knowledge economy, which results in the advancement of knowledge, human resources training, local and national economic and social development (Tarragó Ayra & Rodríguez Saíf, 2022, pp.163-164). The status of researchers, higher education centres and the state apparatus itself in the national productive system, from this point of view, play a role that is transcendent even to the scope of technology as an object of the transfer process.

Defining technology is complicated, as its scope encompasses knowledge in different areas. The World Intellectual Property Organization (WIPO) in its 1977 Licensing Guide for Developing Countries has defined technology from the systematicity of the knowledge itself in terms of the manufacture of a product, the application of a process or the provision of a service. Etzkowitz (2016), considering the results of research, defines it as a bidirectional flow from university to industry and vice versa, with different degrees and forms of academic involvement and in which a variety of modalities coexist. The process integrates the value chain from research to the transformation of the result into a new or improved product/service that responds to a societal problem. Thus, the term encompasses the process of learning to understand, use and replicate the acquired technologies, including the capacity to choose, adapt and integrate them to the local conditions of the recipient.

The Ibero-American Manual of indicators of linking the University with the socio-economic environment (Red Iberoamericana de Indicadores de Ciencia y Tecnología, RICYT, 2017) considers that the activities of transfer of results within the third mission are related to: the generation of knowledge and the development of capacities in collaboration with non-academic agents and the development of legal and cultural frameworks that guide the opening of universities towards this environment, the use, application and exploitation of knowledge and other capacities existing in the university outside the academic environment, as well as training, the sale of services, advice and consultancy, carried out by universities in their environment.

Similarly, it establishes that the transfer of research results includes the following modalities: a) Technological linking; industrial and intellectual property; entrepreneurship; b) Student internships, staff mobility, courses and extracurricular training activities, formation of networks whose results contribute to scientific research; c) Commercialization of scientific research results;

d) Research, advisory and consultancy contracts supported by research projects; e) Non-academic dissemination.

Transfer cannot be limited to technology in the strict sense of the term. It is wise to consider knowledge explicitly, and when it is inextricably linked to a previous research activity, to refer to transfer of research results (Vargas Vasserot & Aguilar Rubio, 2023). This category highlights the growing cooperation between academic and research institutions with industry, in particular universities, which exalts the object and status of the representative parties in the process: university and business. A challenge to be faced in the Knowledge Society is the legal protection of useful knowledge through IPRs and plural legal protection. This notion deserves to be approached beyond its strict link to IPRs, referring also to knowledge that grants the capacity to use and exploit it, where legal mechanisms play a relevant role.

The legal-instrumental mechanisms are impregnated with both the characteristics of the actors in context and the priorities of the agreements negotiated for research and its subsequent exploitation. It can therefore be inferred that IPRs are highly relevant to TT processes. Patents, trade secrets, licensing, plant breeders' rights and copyrights are tools that grant exclusive rights over intellectual results that meet the criteria for protection.

From their instrumental conception, TTC mechanisms are modalities of business cooperation between different partners or suppliers used to access technology and knowledge, as well as to share synergies in the field of innovation, R&D and competitive knowledge. They reach key dimensions: the subjective or institutional (relating to the legal personifications of a public or private nature that interact in the process) and the legal-formal (relating to the legal formulas assumed to model and modulate the relationships, from the complexity of their transfer objects and variants: exchange, cooperation, licensing, acquisition, etc.). These are complex contractual operations of great flexibility, combining their public and private extension. Achieving a coherent articulation of these mechanisms in their multiple variants among the work priorities of the universities is essential in order to provide the human, financial and material resources adapted to each operation, in accordance with the interface used and the applicable legal instrument.

The entrepreneurial ecosystem that is generated is articulated from the interrelation of various actors: the universities themselves, both in their training role, through entrepreneurship chairs and courses, and in the field of assistance and linkage of potential entrepreneurs through incubators, accelerators, entrepreneurial centres or technology-based companies (EBT) split into star-ups and

spin-offs; R&D institutions, generating and transferring innovative knowledge; business entities, fostering the development of business networks and business mentoring. These synergies include the possibility for the companies that make up the productive fabric to encourage the emergence of new entrepreneurs through spin-offs and by providing corporate support.

The OTRIs, assumed as a germinal structure intrinsic to the third mission of the universities, have opened the doors to the development and consolidation of other structural-institutional mechanisms that complement their competences: University-Business Foundations, Research Management Units, Project Offices, Entrepreneurship Support Units, Units in University Research Institutes and R&D managers directly assigned to research groups. Other structures close to the real knowledge of business demand, the Technology Centres, have also been created. Smaller organizational structures include Technology Parks, Science Parks, Incubators of technology-based companies and Business Centres or Centres for the valorization of intellectual and industrial property. These initiatives illustrate the university's desire to exploit legal entities that can be assimilated in their constitution and functionality to research results transfer operations.

Public, national or regional policies, taking into account the above, should start by recognizing the status of these initiatives and assess the possibilities of enhancing the development of the ecosystem (Montoya Pineda 2016, p.143). The combined development of the elements of the so-called knowledge triangle: innovation, research and education according to Vargas Vasserot & Aguilar Rubio (2023) is considered a key aspect to boost the needed competitiveness of economies. Without considering the search for profit or profit motive as a priority for public universities, it is advisable to adjust their accounts in order to become self-financing.

Authors such as Carbajo Cascón & Curto Polo (2018), believe that the transfer of results is directly related to the commercial exploitation of research achievements in the university environment, mainly, although not exclusively, in relation to technical inventions. The peculiarities of scientific activity mean that the research community is often more interested in scientific ideas, methods or theories than in the form in which they are expressed or the technical problem they may solve. This defines scientific property as a category, considering several options for legally modelling the attribution of ownership over research results (Carbajo Cascón & Curto Polo, 2018, p.32). However, the fact that the professor has a duty to research, a consequence of his or her research function, cannot be translated into an obligation to invent.

Since the enactment of the Bayh-Dole Act, the protection of university research results through exclusive rights has been seen as the most efficient way to achieve a return on investment and to promote technological and community progress. This seems to be particularly true for research results relating to technical inventions, especially if they are eligible for patent or utility model protection. Another important debate in this field deals with the question of ownership of scientific research results achieved in the university environment. The nuances, expression and success with which such issues have been addressed in national legislation has been diverse¹.

These and other issues must be addressed by the clauses of the contracts that guide the economic traffic that usually support the TTC operations in the University-Business scenario. For example: confidentiality agreements facilitate the secure transfer of secret information, so that the disclosing party's confidential information is protected from disclosure to third parties (e.g. an inventor discloses her invention to an investor).

Public-private partnership agreements describe specific contributions of parties working towards a common goal (e.g. a university and a private company working on a joint research and development [R&D] project). The benefits of such linkages should be considered: recognition of public sector researchers for their contributions; growing interest in their research in the private sector; practical experience gained by students; financial reward for researchers. Tax incentives, research grant programmes and IPR protection are results of joint R&D projects.

Other forms such as licensing agreements allow one party to exploit the IPRs of another party in return for the payment of a royalty (e.g. the right to use a patented technology). There are three main forms of licensing: exclusive, non-exclusive and sole.²

¹Entre las normas que consagraron la titularidad de la Universidad en detrimento del privilegio del profesor: Bélgica 1991, Dinamarca 1999, Japón 1999, Alemania 2002, Austria 2002, Finlandia 2007 y que consagraron la misión de transferencia en el entorno universitario: EEUU 1986, Suecia 1997, Italia 1999, Francia 1999. A nivel Comunitario se considera la Cumbre de Lisboa 2000 como consagración de esta estrategia. (Vasserot, 2012, pp.83-84).

² Entre los mecanismos de transferencia se subraya el alcance de las licencias. Correctamente ejecutadas, permiten a la Universidad desarrollar nuevas estrategias para rentabilizar y explotar en un mayor grado sus resultados. La singularidad del contrato de licencia de patente en el ámbito universitario reside tanto en circunstancias subjetivas como objetivas. Se podría hablar, pues, de una relación obligacional triangular entre profesor-universidad-licenciataria, donde se hace necesario delimitar no sólo las obligaciones, legales o contractuales, de cada uno de ellos, sino también sus intereses, en ocasiones, contradictorios.

Assignment agreements provide for the transfer of IPRs from the owner to a third party or the transfer within the framework of an employer-employee relationship (e.g. assignment to a publisher of rights in a literary work or assignment of the right in respect of an invention).

The purpose of research contracts is to carry out research services in exchange for a consideration that is usually financial, obtaining patents, utility models, plant varieties, articles, books or book chapters in a specific area of research; products resulting from technological development and innovation activities, such as industrial design, integrated circuit diagram, software, pilot plant, industrial prototype, business secrets, technology-based companies (spin-offs), innovations generated in business management, innovations in processes, procedures, services, consultancy, etc.

Among the main advantages of protecting university inventions through patents, some authors highlight the patent system as a mechanism for promoting technological innovation. The university patent, understood as an incentive to innovation, would reward the researcher for his or her investment, in economic and temporal terms, offering greater legal security, based on the possibility of continuing with future developments. The knowledge can thus be separated from its creator, without prejudice to the fact that the creator, the researcher, can actively participate in the commercial development of his invention and obtain part of the income generated in this phase. Patents constitute an important informative documentary fund that provides legal security in terms of the exclusive use of what is protected and constitutes the written reflection of the R&D results of their inventors, presenting a large amount of bibliographic and informative data. In addition, it allows the generation of competitive strategic innovation alliances between universities and the private sector; pacts that ultimately affect the distribution of benefits, access to technology, dissemination of knowledge, as well as the orientation of university research, which would serve to confirm that the innovation process is informed by the general interest. University patents are revealed as a potential source of income that compensates for the investment made, either through their direct exploitation or by transferring ownership. They not only allow the creation of value from the use of knowledge but also a value from the exchange of knowledge.

Cuba has intensified its efforts to harmonise with international practice in this area. Article 21 of the Constitution of the Republic of 2019 promotes an educational, scientific and cultural policy that marks the advancement of science, technology and innovation as essential elements for economic and social development, implementing forms of organisation, financing and management of

scientific activity. The IPR and TT systems have been transformed from a new regulatory package that aims to harmonise practice in this area with international standards. The normative implementation of the international legal obligations of the TRIPs Agreement introduces formulations and justifications based on theoretical approaches and practical experiences of others, or in another sense, constructions from other scenarios, thus imposing rules that respond to a market economy context integrated into the multilateral trade system. As can be seen, this conception differs from the one that led to the Cuban system established with the repealed Decree-Law No. 68 of 1983 and the basis of the protection of intellectual creativity.

The enactment of Decree-Laws No. 336 and 337 of 2016, in force since October 2018, with regard to contractual provisions as instrumental mechanisms in technology transfer operations, shows, a priori, a fragmentation of the current legal regime and the lack of a clear systemic definition of the obligations of the parties with regard to intellectual property contracts. From this point of view, problems of contractual typicity are revealed in relation to the configuration of the modalities foreseen in the law. Likewise, the anti-competitive clauses that should be avoided in IP contracts are insufficiently regulated. The attributions of ownership and the right to remuneration in academic agreements have not been clarified either.

The legal status of the actors involved in the process is another issue to be studied. The promulgation of Decree No. 363 of 2019, as well as Resolutions 286 and 287 of 2019, show the first advances in the organisation of this issue. Even so, the organisation of the management structures lacks defined contours and sufficient legal support for their generalisation. This requires a comparative legal study of schemes and practices that take into account the fact that Cuban universities do not have appropriate legal structures for these purposes, such as start-ups, spin-offs, associations, foundations, civil persons or technology-based companies. The governance approach for the Cuban context implies an enquiry into the actors involved, as well as the incremental participation of foreign actors and investors. This requires an approach to sustain the balance of public and private interests.

Some particularities concur in the country, such as the public character of the universities, main research centres and an important number of companies, as part of the Cuban system of Science, Technology and Innovation (CIT) led by the State. At the same time, a growing group of unipersonal or collective business figures from the private sector are converging, introducing situations that have yet to be deciphered in the business dynamics. This emerging non-state sector,

embodied in the Self-Employed Workers (TCP), Non-Agricultural Cooperatives (COOP) and Micro, Small and Medium Enterprises (MSMEs), is intended to be a demanding sector of the innovations coming from universities, although at present "they are usually restricted mainly to a set of activities with low added value, unable to absorb large volumes of technologies from higher education" (Andrés, Dutrénit & Nateram, 2017, p.43). Fostering linkages through public policies implies that these must necessarily be comprehensive and stimulating.

The strategic planning of the Ministry of Higher Education (MES) 2012-2020, constituted an enabling framework for development through STI management aimed at achieving economic and social impact, based on its values, commitment and motivation. This was manifested in the Regional Conferences on Higher Education for Latin America and the Caribbean, CRES 2018, where Cuba set out its criteria on the public policies needed to advance in this direction. Likewise, Cuba's National Plan for Economic and Social Development (PNDES) 2030 establishes six strategic axes, designed under a systemic approach, which articulate the country's economic and social development proposal for 2030. In turn, it constitutes the main tool for achieving the essential objectives set out in the Conceptualisation of the Cuban Economic and Social Model of Socialist Development. The six strategic axes of the PNDES 2030 were expressed in macroprogrammes and programmes, which are articulated with the goals and targets of the 2030 Agenda. For a development model such as the Cuban one, the main orientation of the innovation systems aligned with the IPR Systems is to address productive and social needs that contribute to human well-being, with special attention to the processes of social inclusion, recognising the role of the government and public policies, without ignoring market elements (Rodríguez Batista & Núñez Jover (2021); León Díaz et al. (2021) and Díaz-Canel & García (2020)).

This panorama conditions the insertion of the Cuban economy in the global context. It boosts the knowledge-based economy based on the experience of technological sectors such as biotechnology, the software industry and other digital media, as well as the pharmaceutical industry. It confirms the need for a theoretical, legislative and practical renewal of Cuban IPR systems in relation to the TTC. The improvement of the mechanisms, given the relevant role of the Cuban public university and other IPOs, for their efficient connection with the productive fabric is an urgent need for the domestic legal system.

Conclusions

The application and exploitation of results obtained in the form of technological innovations constitutes a challenge for the articulation of TTC mechanisms in the link between universities and the business system. These mechanisms, as a proposed category, form a theoretical construction for the delimitation of legal institutions in accordance with their instrumental and articulating role due to the purpose they pursue in economic traffic. As a concept, it explicitly considers knowledge, recognising in the framework of the exploitation of university intellectual creations the transfer of research results as a more precise category.

The instrumental mechanisms of TTC, in their structural and formal dimension, pose challenges for the Law in its adaptation to the University-Business scenario. These challenges for Cuba include the need to establish an adequate regulatory framework so that the legal personifications fulfil their corresponding role and that the operations, transactions and businesses guarantee the exploitation of IPRs. Addressing these shortcomings from the conceptual foundations of the TTC is fundamental to understand the diffusion of technology and knowledge through complex instrumental legal mechanisms. IPRs are direct facilitators of TTC in this area.

This premise requires Cuban universities to play a more active role in their relationship with the productive fabric, making the most of the results of their research. Strategic alliances, as well as the participation of territorial governments in them, are important initiatives. There is a need for multidisciplinary networks, with institutional and management capacity, in which not only the researcher is involved, for the industry-government-society link.

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