INTERNATIONAL TECHNOLOGY TRANSFER FOR SUSTAINABLE DEVELOPMENT: AT WHAT COSTS?

Transferência internacional de tecnologia para o desenvolvimento sustentável: a que custos?

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**Abstract:** During the United Nations Conference on Sustainable Development, gathered in Rio de Janeiro from 20 to 22 June 2012, one of the common vision designed in the document “The Future We Want” is the need to achieve sustainable development by promoting sustained, inclusive and equitable economic growth, creating greater opportunities for all and reducing inequalities, among others. Research and innovation in higher education institutions in developing countries, allied to the promotion of collaboration among research institutions, universities, the private sector etc., are some of the means to reduce inequalities and contribute to the sustainable development (UNITED…, 2012, p. 2, 45, 52). In this meaning, the goal of this research project is to identify and analyze elements that affect the insertion of universities in the global value chain regarding innovation. Based on three research subjects: international strategic alliances (ISA), open innovation – particularly concerning academy-industry cooperation – and transaction costs theory (TCT), it is expected to be possible to understand how the academy can engage in international innovation – and analyze what are the differences between Brazilian universities and similar institutions located elsewhere.

**Keywords:** intellectual property. Knowledge transfer. International contracts. International strategic alliances. Academy-industry cooperation.

**Resumo:** Durante a Conferência das Nações Unidas sobre Desenvolvimento Sustentável, ocorrida no Rio de Janeiro entre 20 e 22 de Junho de 2012, uma das visões comuns designadas no documento “O Futuro que Queremos” é a necessidade de atingir o desenvolvimento sustentável por meio da promoção do crescimento econômico sustentável, inclusivo e equitativo, entre outros. Pesquisa e inovação em instituições de ensino superior dos países em desenvolvimento, aliadas à promoção da colaboração entre organizações de pesquisa, universidades, setor privado etc., são alguns dos meios para reduzir as desigualdades e contribuir para o desenvolvimento sustentável (UNITED..., 2012, p. 2, 45, 52). Nesse sentido, o objetivo deste projeto de pesquisa é identificar e analisar elementos que afetam a inserção das universidades na cadeia global de valor pertinente à inovação. Baseado em três referenciais teóricos: alianças estratégicas internacionais, inovação aberta – particularmente pertinente à cooperação universidade-empresa – e teoria dos custos de transação, espera-se compreender como a academia pode se engajar em inovação global – e analisar quais são as diferenças entre as universidades brasileiras e suas similares estrangeiras.

**Palavras-chave:** propriedade intelectual. Transferência de conhecimento. Contratos internacionais. Alianças estratégicas internacionais. Cooperação universidade-empresa.

**1 Introduction**

Stablishing inter-organizational R&D strategic alliances (SA) have been becoming more common as long as knowledge generation is requiring different technological and scientific fields to be put together. One of its internal characteristics is the transaction costs inherent for stablishing cooperation among different organizations. These costs may be analysed by the clauses which integrate such contracts and regulate intellectual property (IP) ownership, further development of the technology, financial terms of the license (or assignment) etc.

Features like nature of the technology transfer (REDDY; ZHAO, 1990), development stage of the technology (BOZEMAN, 2015), political and social systems allied to language and religion (MALIK, 2000), IP ownership and commercialization (WIPO, 2015), strategies and characteristics of the contracting parties (KIRCHBERGER; POHL, 2016) were successful analysed elsewhere.

These features may be reflected in contracts (or agreements) and, allied with other information available, can be analysed as variables inherent to transaction costs that arise during the formation of SA, regardless the organizations are taking part in it.

**2 Theoretical Framework**

**2.1 International Strategic Alliances**

The blooming of ISA among companies during the 1990s had been notice since the 2000s (KANG; SAKAI, 2000; CALOGHIROU *et al.*, 2003), driven by firms necessity of lowering research costs, strengthening market presence and accessing intangible assets such as managerial skills and knowledge of markets.

Teece (1992) defines SAs as a web of agreements whereby two or more partners share the commitment to reach a common goal by pooling their resources together and coordinating their activities. When these agreements concern about two or more organizations engaging in cooperative research and development (R&D) activities for generating technological advances, one can say there is a R&D strategic alliance.

**2.2 Open Innovation**

According to Chesbrough (2003), a single organization cannot innovate in isolation, it has to engage with different partners to acquire ideas and resources from external environment to stay abreast of competition; this is the starting point for opening firms’ processes (DAHLANDER; GANN, 2010).

Morandi (2013) states that R&D cooperation is a form of strategic alliance, besides being an open innovation mode, so it is expected participants shall face challenges in both R&D and alliance management. Besides, industry-university joint research projects differ from inter-firm cooperative agreements in research aims and relational aspects, presenting higher uncertainty – caused by more ambitious research targets – and equivocality – caused by strong differences in identity and mission of contracting organizations.

Etzkowitz and Leydesdorff (1995) studied how universities take part in R&D alliances, and developed the model of the triple helix, which describes how government-industry-academy interactions take place within innovation economy. This model tells the potential to economic and innovative development within knowledge economy is based on a preeminent role for the university and on the hybridization of elements from three actors to the generation of new institutional and social shapes for knowledge production, transfer and use.

**2.3 Transaction Costs**

Coase (1937), when studying the firm, introduced a new approach that can be used in R&D alliances: transactions and their costs are the central subject of analysis, not technology. Williamson (1985) improved this notion by introducing some elements which refine the theory of transaction costs: human behaviour, as opportunism and bounded rationality, and attributes of transactions, as asset specificity, uncertainty and frequency of transactions.

According to Landes and Posner (2003, p. 8), transaction costs tend to be higher in intangible assets, as intellectual property – central assets in R&D alliances – leading to lower normalization.

Caloghirou *et al.* (2003) see transaction costs and incomplete contracts as a theoretical perspective which approaches the firm with the tool of cost-benefit calculus. They argue that, in the area of R&D, these costs may be very high due to spillovers (externalities), hence incomplete contracts and the possibility of opportunistic behaviour that they entail.

**3 Methodology**

**3.1 International Technology Transfer Contracts**

Knowledge transfer, or technology transfer, is formalized through international treaties or international contracts (FLORES, 2008, p. 19), which basic types are assignment or licensing. WIPO (WORLD…, 2015, p. 6) differentiates between technology licensing and technology transfer: the last one only takes place when the licensor delivers both technology (IP asset) and know-how, and licensee absorbs how to use, adapt and improve both technology and know-how. This helps to explain why technology transfer agreements are more complex than other contracts: this gives rise to several issues, or clauses, that shall be negotiated for stablishing an alliance.

**3.2 Theoretical Modelling**

Literature about technology transfer is rich and broad, including researches who deal with academic technology transfer, since this subject can be analysed by using different approaches. Bozeman *et al.* (2015) have revised the contingent effectiveness model of technology transfer (CEMT2), which intends to organize the research streams. This model, nonetheless it doesn’t include international technology transfer, can be adopted as a guide for identifying the main subjects which take part, and consequently generate transaction costs, in industry-university cooperation.

The dimensions, or technology transfer contingencies, of this model include these non-exhaustive dimensions: i) characteristics of the transfer agent; ii) characteristics of the transfer media; iii) characteristics of the transfer object; iv) demand environment; and v) characteristics of the transfer recipient. Effectiveness of these contingential dimensions is studied by different approaches: i) out-the-door (was anything transferred?); ii) market impact; iii) economic development, iv) political advantage; v) development of scientific and technical human capital; vi) opportunity cost considerations and vii) public value.

**3.3 Research Modelling**

Considering the Bozeman’s CEMT2 model and the elements in transaction costs theory (TCT) developed by Williamson, one can evaluate the difficulties to stablish ISA

**TRANSFER AGENT**

* bonded rationality
* Information asymmetry (opportunistic behavior)
* transaction frequency
  + Technology Transfer Offices – TTOs

**DEMAND ENVIRONMENT**

* uncertainty (primary)
  + regulatory environment

**TRANSFER MEDIA**

* specificity
  + Intellectual Property Rights – IPRs

**TRANSFER RECIPIENT**

* bonded rationality
* information asymmetry (opportunistic behavior)

**TRANSFER OBJECT**

* specificity
  + technology
  + knowledge

Figure 1. Conceptual frame relating macrofeatures of transaction costs (TCT) with contingent effectiveness’ dimensions (CEMT2). Source: authors’ conceptualisation.

between academy and industry (Figure 1).

Considering R&D ISA’s, or international technology transfer, Williamson’s transaction costs elements may be evaluated by the following variables (Table 2).

Table 2. Variables present in TCT, considering contingencies in CEMT2.

|  |  |  |
| --- | --- | --- |
| **CEMT2** | **TCT** | **Variable** |
| Demand environment | Uncertainty | Innovation regulatory environment  Schedule for product development  Dispute resolution |
| Transfer media | Frequency | Type of contract  Contract period  Organizational structure for negotiation |
| Transfer media  Transfer object | Specificity | Subject  IP ownership  Development stage of the technology  Exclusive or non-exclusive licensing  Technology improvements  Sublicensing  Territory  Field of use  Payment |
| Transfer agent  Transfer recipient | Limited rationality | Williamson’s incomplete contracts |
| Transfer agent  Transfer recipient | Information asymmetry (opportunistic behaviour) | Subject  Development stage of the technology  Technology’s essential information  Field of use  Payment |

Source: authors’ conceptualisation.

This methodology can be used both for inter-firm R&D alliances and university-industry links; focus on university-industry links may be obtained adapting the Bolzeman’s contingency elements to this kind of alliances. Data concerning variables on Table 2 may be obtained through a survey, directed to CTOs (chief technology officers) in industry and senior technology managers in academia.

**4 Final Considerations**

In 2015, the United Nations has stablished 17 Sustainable Development Goals (SDGs) which are the main basis for a set of targets to shape development agenda in the term 2015-2030. SDG 17 aims to strengthen the means of implementation and revitalize the global partnership for sustainable development; some of the targets are to enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, among others (UNITED…, 2015, p. 1, 26).

Keeping in mind the necessity to foster sustainable development, we expect at the end of this study to be able to identify and analyse the transaction costs arising from international academy-industry alliances, in order to minimize them and foster these global partnerships, lowering international inequalities.

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