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ljimenez@jotmi.org

Universidad Alberto Hurtado  
Chile

Benito-Bilbao, Javier; Sánchez-Fuente, Francisco; Otegi-Olaso, José Ramón  
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# Mapping the Connection between Knowledge Transfer and Firm Competitiveness: An Empirical Research in the Basque Country

Javier Benito-Bilbao <sup>1 \*</sup>, Francisco Sánchez-Fuente <sup>2</sup>, José Ramón Otegi-Olaso <sup>3</sup>

**Abstract:** Knowledge transfer (KT) is a wide and complex phenomenon enclosed in the subject of knowledge management which encompasses some related concepts such as knowledge exchange, knowledge sharing, knowledge interfacing and knowledge flow. Presently, KT is one of the most appealing topics in the field of business and economics due to the connection with innovation and business growth that raises the interest and expectancy of diverse institutions and companies on this practice. Many studies about the theme: concept, characteristics and composing elements have been written during the last two decades, and researchers have tried to depict models to represent KT drawing on the different perspectives of the phenomenon, and focused on varied contexts. Connection of knowledge transfer, innovation, and competitiveness has already been revealed, and evidence of a close relationship between effective impact of KT processes, successful innovation, and higher business performance has already been found out. Therefore, identifying the basic keys of the phenomenon of KT which moderate the impact on business competitiveness will become a noteworthy contribution to the business and innovation management field. The aim of this research is to describe the connection between KT and firm competitiveness through the listing of the main business keys to take into account when planning and performing KT operations. For this purpose, firstly, we develop a conceptual framework of the KT phenomenon, drawing upon a distinguished theoretical KT model which links the determining factors and the impact. Afterwards, we elaborate a survey of questions framed in the model, in order to proceed with an empirical fieldwork based on qualitative interviews with companies and institutions sited in the Basque Country and whose KT activities are frequent and heterogeneous. The qualitative research lets us explain the findings, and state the conclusions of the study, bringing to light a direct link between KT impact and the extent of competitiveness of a company, and revealing a set of main success factors to increase business performance: suitable design and implementation of mechanisms to perform KT, effective cooperation between players, skilled management of the mix of knowledge, and propitious organisational culture.

**Keywords:** Knowledge transfer; firm competitiveness; business performance; knowledge transfer impact; innovation success.

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## Introduction

Knowledge transfer (KT) is a topic of current interest and fascination which raises debates among the diverse stakeholders involved in this field. All researchers and experts states that it is a core subject of the political agendas of the major industrial countries when developing public programs related to economic growth, entrepreneurship, third mission of the university, innovation, etc.. This is attributed mainly to the double role of KT in the economy: 1) as the prime facilitator to enable conversion of science and technology outcomes in market innovations; 2) as a key role for the generation, deployment and consolidation of organizational units that leverage knowledge, of all sorts of sources, for the improvement, expansion, and profitability of the investments, by extending best practices, disseminating procedures, exchanging data and information, etc ... (Argote and Ingram, 2000, p.164-165).

KT is a complex phenomenon (Bozeman, 2000, p. 627) which could be broken down into a multiple set of elements (Kumar and Ganesh, 2009, p.165-169), and which requires an analysis under diverse streams of research that approach this topic matter (Graham, 2008,

p-13-15), since the extensive existing literature draws upon theories on engineering, social sciences and business administration. Therefore, KT could be deemed as a multifactor phenomenon, whose study forces to follow a holistic and eclectic perspective of the issue. Likewise, bibliography points at KT as a crucial element in economic and social development (Bozeman, 2000, p. 646-647; Bozeman et al, 2015, p. 6), and as the key to improve the competitiveness of companies, institutions, and communities in general. This term is used to stress that various communities are involved: not only business, but all communities. Entities may turn internal and external knowledge into competences after implementing knowledge management policies and processes.

As well, authors have already found evidence about the influence of KT in achieving successful innovations (Spencer, 2003, p-230-231), and improving business results (Dyer and Nobeoka, 2000, p.364-365). Therefore, KT is a business practice with a direct derivative in sustainability and competitiveness of the companies. In fact, the more dependant on knowledge assets is an organization, the more influence KT events have in its viability. Therefore, thanks to the successful impact of a KT operation, a company could attain a unique im-

1 Business Management and Innovation, University of Basque Country. Spain

2 Department of Business Management, Faculty of Engineering, Basque Country University, Spain.

3 Department of Engineering Projects and Graphic Expression, Faculty of Engineering, Basque Country University, Spain.

\*Corresponding author: jbenito007@ikasle.ehu.es



provement of performance, but when the same company carries out systematic and structured KT activities, which means that this firm underpins knowledge assets as strategic resources (Hoopes and Postrel, 1999, p.838), the competitiveness steadily increases. This theory is particularly appealing for those entities belonging to medium-high and high technological intensity industries, such as biotechnology, information and communication technologies, scientific instrumentation, knowledge-intensive business services, and aeronautics. For all these institutions and firms, the extent of success in their existence and development is closely linked to knowledge assets as principal resources (Grant, 2002, p.145-146)

In parallel, we can find certain business facts described in numerous reports of institutions and associations warning about the existence of a strong elasticity among: the degree of public support for the implementation of research, development and innovation (R&D&i), the recruitment of qualified staff, the creation of added-value capacities in companies, and the degree of internationalization, competitiveness, and resistance to situations of crisis or bearish economic cycles. However, other reports, state a lack of proportionality among: the budgetary dimension of public investment in research, development and innovation (R&D&i), the amount of scientific production, the volume of registration of intellectual and industrial property, and the set of indicators and metrics about: innovative firms, business competitiveness, export figures, and internationalization ratios. That is, while all stakeholders recognize knowledge as a critical resource, mainly when sourced from scientific origin, for the success of organizations, and macroeconomic impact for society is proved, there is no consensus in addressing solutions to mitigate and redirect those causative roots for not obtaining balance between business performance and budget effort allocated. The European Research Area Committee (ERAC) is a strategic policy advisory committee that advises the Council, the Commission and member states on research and innovation issues that are relevant to the development of the European Research Area. A report thereon issued by the ERAC (2014), and delivered to the Ministry of Economy and Finance of Spain, points to several reasons pertaining to: design of suitable public policies, more efficient cooperation between actors, improving current funding system, and evolving the business culture. It is seen, therefore, that too large amounts of public and private funds dedicated to enterprises and operations around business innovation, unfortunately, does not achieve the final desired goal, because a global KT approach may be required to be highly effective in the impact.

In closing, impact is the final target of any entity performing KT activities and operations, because it entails successful innovations, increase of business performance and, consequently, gaining competitiveness. Achieving satisfactory impact of KT is a direct consequence of the management of the set of its influential and determining factors (Comstock et al, 1999, p.23-24). Thus, verifying the connection between KT and competitiveness, and revealing the specific factors which characterise the optimal administration and execution of the whole KT operations within an entity, would become a priceless instrument to enhance busi-

ness performance and firm competitiveness through: a) strengthening business processes; b) overcoming goals and business targets.

The aim of this research is to describe the connection between KT and firm competitiveness, following a theoretical and empirical research. The findings and conclusions will allow us to bring to light the direct link between KT impact and the extent of competitiveness of a company, and to reveal the major success factors to increase business performance, through the listing of the main business keys to take into account when planning and performing KT operations.

## Methodology

The research project is composed by three chained phases. Firstly, through a literature search, a globally recognized model of KT which explains the effect of the impact of a KT event is selected, and a conceptual framework associated is developed. Then, as part of the qualitative research, a survey of questions is designed in order to seek the connection between the elements composing the model and the impact attained. Finally, the empirical qualitative research is carried out by means of an analysis based on interviews with stakeholders of innovation management. The study at field level registers observations to confirm or refute the theory developed in the first stage of the investigation, which is embodied in the form of a framework, as representation of the socio economic phenomenon of KT. The research is conducted in a qualitative way, based on survey design techniques, interview execution guidelines, and handling unstructured materials, in order to obtain narrative registers about the analyzed phenomenon. This strategy permits: the exposure and explanation of the phenomenon, the absorption of all sort of feedback, and the analysis of the data collected from direct observation of the phenomenon under study, according to the paradigm of real and natural environment settings (Patton, 2003, p.6; Patton, 2005). The methodology is defined to let increase knowledge and understanding of the fact, and to depict it as a socioeconomic model of, both, theoretical and empirical nature.

At the first stage of the research, we seek a model representing the phenomenon of KT through the basic elements that moderate the result of the process of transferring knowledge, and which, at the same time, depicts the different goals and effectiveness criteria of the each KT process. This model is needed as a tool of information which supports us to define a survey of questions that fit in the dimensions of factors exhibited in the model, and to connect variables of KT performance, with the KT impact. This way, the survey will be complete and no decisive question about a component affecting KT effect will be ignored. With the aim of being precise in our search, we put a set of conditions to ensure that the chosen model is solid enough for our research purpose: 1) the selected model should have global acknowledgement among the scientific community of KT experts; 2) the selected model should have been reviewed and improved through amendments; and 3) the selected model should have been used for research studies, both theoretical in order to develop conceptual frameworks, and empirical in order to apply or define and execute KT experiments.

We follow the set of recommendations stated by Graham, (2008, p.24-26), in order to spot scientific journals that include KT field among the editorial objectives and thematic priorities. The review and analysis of scientific articles allows us to identify a model accomplishing our conditions and premises. The selected model is the model of technology transfer proposed by Bozeman (2000, p. 636), called “contingency effectiveness model of technology transfer”, (Bozeman, 2000, p.636), which has also be amended later by the author in the “revised contingency effectiveness model of technology transfer (Bozeman et al, 2015, p.3). This is a well-known and globally accepted model which lets researches and practitioners study technology transfer processes in diverse sciences branches. In fact, Bozeman’s model, or the contingent effectiveness model, has been numberless used for researches on the issue, and it has also has been utilized in application, or, as a conceptual framework in a wide variety of articles, ranging from industrial ecology to higher education innovations to transfer of vaccines (Ramakrishnan, 2004; Bailey and Mouton, 2005; Sebastian, 2008; Al-bors et al, 2009; Mohammed et al, 2010; Hendriks, 2012; Kitagawa and Lighttower, 2013). The author himself expresses this fact in the report: Technology Transfer Research and Evaluation: Implications for Federal Laboratory Practice, Final Report to VNS Group, Inc. and the U.S. National Institute of Standards, April 4, 2013. The contingent effectiveness model is representative of the KT socioeconomic phenomenon, and it is showed using a suitable abstraction scale in order to remain represented all types of KT events and potential results.

Thanks to own former research studies carried out, we can explain the main dimensions or master determining factors affecting KT impact (Benito-Bilbao et al, 2015, p. 37-38). These factors, whose characterization has some extent of influence in the celebration of KT and consequently impact on the final outcomes obtained, are (Figure 1):

- Attributes of external context, or characteristics out of the internal framework of a KT event.
- Attributes of the object of knowledge, or characteristics of complexity of the piece of knowledge asset that is subjected to a KT process or operation.
- Attributes of the actors involved in the KT, or senders and receivers of the object of knowledge, who have certain intellectual and emotional features as individuals, and certain organizational and structural features as collectives.
- Attributes of the relationship between actors, or characteristics of the interactions and relations that all the actors play during a KT operation or event.
- Mechanisms of means, as those tools and instruments of all types which carry, support, enable and materialize the operation of a KT event.
- Mechanisms of strategy and corporate management, as those tools and instruments of all types which conduct, guide, handle and steer a KT event.
- Impact, since each KT event leads to a series of results and consequences.

The figure 1, showed below this paragraph, displays a KT phenomenon from the point of view of the dimensions of determinants of impact. Thus, KT is triggered when actors of certain characteristics commence to keep relationships and interactions activities to let flow a specific object of knowledge. These operations are enabled thanks to a bundle of internal mechanisms which conduct and support the event. All the stated elements distinguish a particular KT phenomenon complemented by the characteristics of the external environment where they are framed. The result of the dynamic of the set of elements is the specific outcomes or impacts of KT phenomenon, and its extent of success is particularly affected due to the interaction of the multiple factors composing each element, denoting KT is a large, complex, multifactor and tangled event (Bozeman, 2000, p.637; Grant, 2002, p.136; Kumar and Ganesh, 2009, p. 165-169; Bozeman et al, 2015, p.1-2).

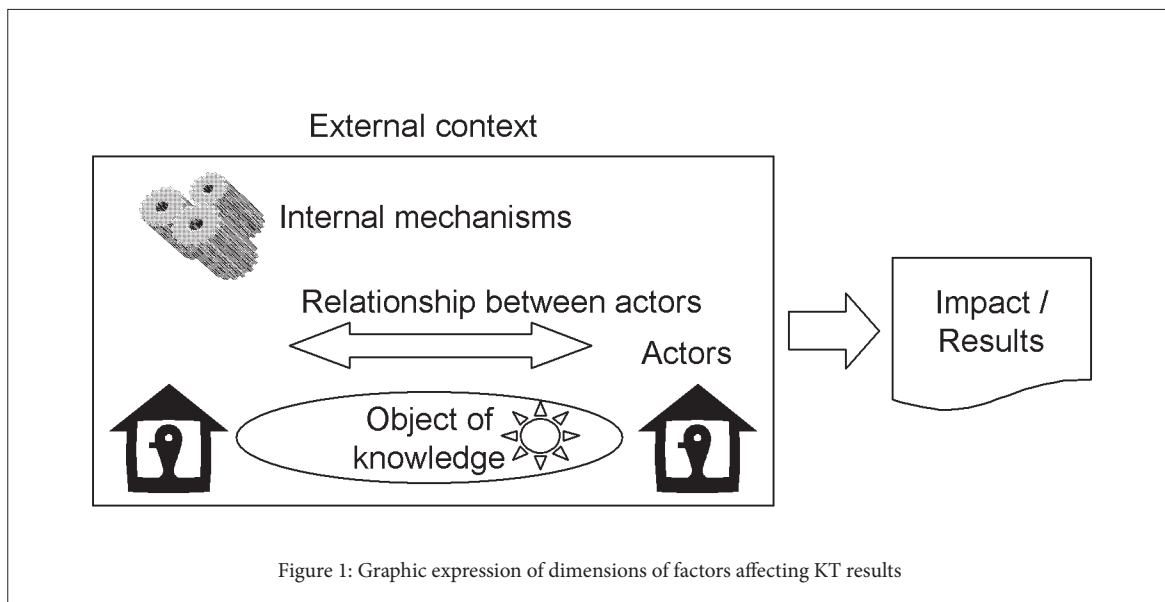
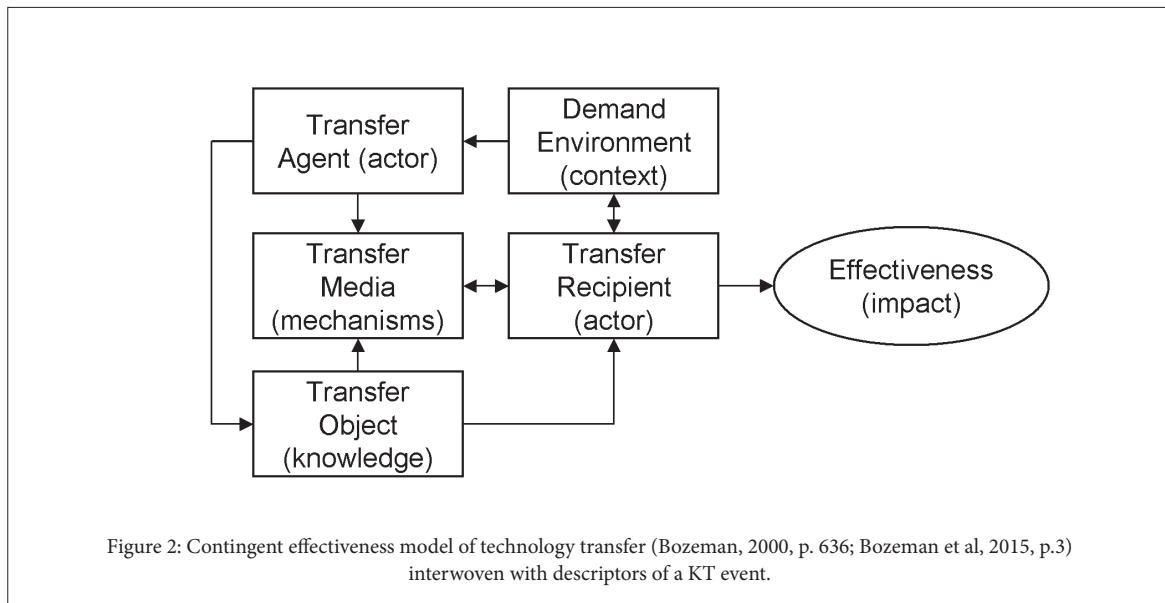


Figure 1: Graphic expression of dimensions of factors affecting KT results

As stated above, the major descriptors of a KT event are: knowledge, actors, mechanisms, context, and impact. We can interweave Bozeman's model and the descriptors as displayed in Figure 1.



We compare and match the contingent effectiveness model (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3) with our researches on the topic (Table 1), and we display the conceptual framework that we will use for the empirical research (Table 1). This framework, or set of dimensions of determinants which moderates KT impact, is constant to any industry or sector in which the phenomenon happens, because

its formulation is characterized by a theoretical nature. It gathers the features defining a KT event: knowledge, actors, mechanisms, context and impact, and also the diverse kinds of impacts for a KT event. Always, the results are consequence of some of the myriad factors included in those dimensions. In conclusion, the qualitative research will be powered by the conceptual framework which is composed by a set of managerial factors comprehensible for the interviewees.

Table 1: Conceptual framework of dimensions for empirical research

Matching Bozeman’s model with factors determining KT impact			
Transfer Object	Transfer Agent	Transfer Media	Demand Environment
	Transfer Recipient		
KT Effectiveness			
KT Impact			
Attributes of the object of knowledge	Attributes of the actors	Mechanisms of means	Attributes of external context
	Attributes of the relationship between actors	Mechanisms of strategy and corporate management	
Conceptual framework for the empirical research			
Object of knowledge	Actors and relationships	Internal mechanisms	External context
Impact			

At the second stage of the research, we develop the questions to use during the interviews with the entities involved in the qualitative study. We match each question to the dimension in the conceptual framework

in order to ensure that every dimension is fully covered by the inquiring process. The tactic to explore the KT phenomenon is based in the contrast between theoretical dimensions obtained during the first stage of

the research, and the behavioural characteristics in the real context (Patton, 2002, p.5, p. 11). Interviews are considered social interactions whose aim is to retrieve data for later processing and drawing conclusions (Roulston, 2013, abstract) and the results are descriptions of observed situations and manifestations described by the actors. In order to leverage the power of the interview, the array of questions of the survey should

be open enough to let the interviewee explain the details of the empirical experience of the entity when transferring knowledge, but close enough to get the interviewer collect real data of the phenomenon at all levels. So, face-to-face interviews will be aided by a semi-structured survey guide (DiCicco-Bloom and Crabtree, 2006, p.315), in the same environment where KT events happen intensively.

Table 2: Survey of questions for qualitative research interviews

Question	Dimension
Which is the role of KT within the institution/company?	Impact
Why is KT a strategic activity for your institution/company?	Impact
Which extent of success is the institution/company currently achieving when performing KT events and operations?	Impact
Which set of factors are affecting the results of KT? Remark the most influential factors.	All
Which are the critical assets of knowledge for the sustainability and competitiveness of the institution/company?	Knowledge
Which is the complexity of the knowledge assets and how do you manage it?	Mechanisms
Do you develop internal knowledge and capabilities? Do you capture external knowledge and capabilities?	Mechanisms
How do you ensure a successful knowledge transfer inter- and intra organizational? Both?	Mechanisms
Which mechanisms does the institution/company use to manage and govern KT events and operations?	Mechanisms
Which tools and instruments does the institution/company use to implement and perform KT events and operations?	Mechanisms
Do you effectively observe better business performance (measured through any kind of indicator) when KT is successfully performed?	Impact
Do you consider KT results are adding value to the institution/company? How do you perceive the value addition?	Impact
Which is the attitude and behaviour of the people of the institution/company towards KT activities?	Actors and relationships
Does the company/institution belong to collaborative or cooperative networks with the aim of exploring and exploiting knowledge?	Mechanisms
How are the interactions and relationships between you institution/company and other entities when operating KT activities?	Actors and relationships
Which concrete improvement, if exists, is KT procuring?	Impact

At the third stage of the work, the empirical qualitative research is carried out by means of an assessment and analysis based on interviews with stakeholders of innovation management. The objective of this step is to disclose the connection between the dimensions of factors moderating KT, and the extent of business performance and competitiveness attained. Given that the conceptual framework is simple in appearance but complex in its real content, a qualitative research interview (Flick, 2014) is considered as the most appropriate technique for this stage.

The selection of the group of institutions and companies is done: 1) following the guidelines stated by DiCicco-Bloom and Crabtree (2006, p.316-319) in order to get a homogeneous sample of individuals; and 2) taking into consideration the scope proposed by Etzkowitz

and Leydesdorff (2000, p. 111-113) to ensure that the full spectrum of the topic is covered from the diverse approaches, and a heterogeneous vision is achieved. Thus, the panel of respondents exhibits all the social, economic and business environments affected. We select 9 institutions with large empirical and practical KT background, and deeply immersed in an intense KT atmosphere: 3 high-tech clusters representing knowledge-intensive and high technology industries; 2 universities representing the higher education environment and science system, 2 non-profit technology corporations representing research and technology system, and 2 public institutions in charge of fostering innovation representing public policies system. For each institution or company we invite a interviewee, who should be a person of the board of directors (chief executive officer, dean, managing director, etc...)



## Results

We proceed to the empirical research through a scheduled set of qualitative research interviews with institutions and companies in charge of performing a systematic range of KT events and operations. The aim of the work is to reveal the details of the major keys enabling KT effectiveness, innovation success, and competitiveness of the organisations. The table 3 shows the results obtained after summarizing, processing and tabulating the information captured during the interviews, once allocated according to the dimensions of the framework previously established: object of knowledge, actors and relationships, external context, internal mechanisms, and impact.

Finally, as final fruit of the research process, we reveal the list of empirical factors moderating KT impact, the innovation success and the extent of competitiveness attained by an organisation (Table 4). The factors are classified and categorized according to each dimension of the framework and, also, according to Bozeman's model (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3). Thus, we integrate the results of the research with the theoretical model proposed by Bozeman, conceiving a richer model in terms of lower abstraction of the busi-

ness terms described as drivers for KT effectiveness. As Bozeman states (Bozeman, 2000, p. 644-648; Bozeman et al, 2015, p.4-8), effectiveness criteria are dispersed, and could be accomplished due to: market impact, economic development, political reward, public value, and scientific and technical skills, and human capital. Regarding the empirical impact observed by the interviewees, the research results cover the different criteria set by the expert. Thereby, traceability of the complete process is exhibited: from key factors moderating KT effectiveness until competitiveness. The business terms are, indeed, the keys to enable higher business performance and competitiveness for those entities in which knowledge assets act as strategic resources. The competitiveness is attained thanks to successful innovation, and originally, thanks to effectiveness in KT activities. The scheme represented in Figure 3 is the contribution that our study claimed to obtain, along with the empirical evidence brought to light about a close relationship between KT, innovation, business performance, and competitiveness (Hoopes and Postrel, 1999, p.839; Dyer and Nobeoka, 2000, p.364-365; Argote and Ingram, 2000, p.165; Spencer, 2003, p.230-231; Easterby-Smith and Lyles, 2012, p. 15; Ding, 2013, p.101). Therefore, this depiction may become a useful and practical instrument for corporative business management.

Table 3: Results of the qualitative research tabulated according to the conceptual framework

Type of institution/ company	Object of knowledge	Actors and relationships	External context	Internal mechanisms	Impact
High-Tech Cluster	Highly specialized knowledge. Complex knowledge.	Commitment with KT. High-tech facilities required. Attitude towards innovation and internal/external collaboration. Partnership-based strategy. Long-term collaboration. Bidirectional flows of knowledge with partners. Joint ventured relationships. Culture of common understanding. Culture of industrialization.	Support of public policies. Involvement of public entities.	Open innovation strategy. Large networks and multi-profile actors to enhance cooperation. Outsourcing strategy for partnerships and relations. Contributions structured, systematized and long-term addressed. Inter industrial flows of knowledge. Knowledge value chain rules the internal organisation. Intellectual property management.	Increasing individual and collective capabilities of the actors. Increasing overall business performance of the institution/company. Increasing internal process efficiency.
High-Tech Cluster	Knowledge and technology specialized.	Management of human capital and talent of people. Knowledge embodied in people. Culture of technology transfer.		Strategy to exploit commercially the scientific knowledge. Management of intellectual and industrial property. Structured and intensive R&D activities at corporate level. Integration of KT into innovation system.	Increasing collaborative and cooperative capacities. Increasing innovation success. Increasing organisational capabilities. Increasing value creation for the market.
High-Tech Cluster	Knowledge structured and codified for transferring.	Culture of transfer. Attitude and aptitude of individuals. Motivation and commitment to transfer and innovation. Hierarchical organization. Organisational culture to cooperate.	Socio-economic value of KT activities, innovation and R&D.	Science-industry strategy. Alignment of R&D and business operations. Mechanisms to incentive attitude. Technology resources to structure and tangibilize knowledge. Suitable collaborative models for KT. Mechanisms to manage KT and innovation. Methodologies to measure impact and extent of KT success.	Increasing organisational capacities and business efficiency.

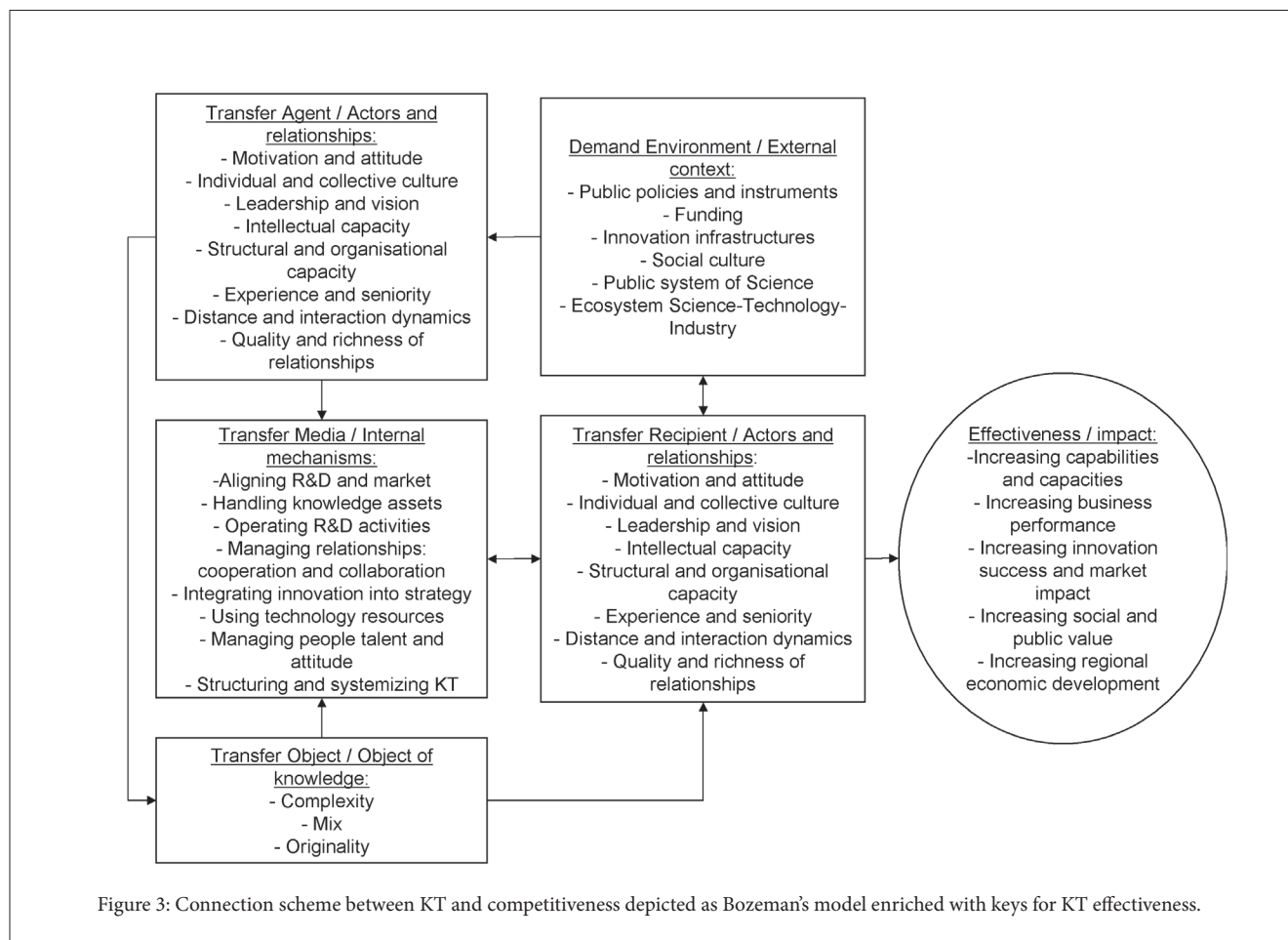
Research & Technology Corporation		Size of the institution. Background and former successful experiences of KT. Structured and systematic R&D and innovation activities. Organisational culture and commitment to innovation. Closeness and fluent interactions with partners. Climate of reliance and confidence between actors.		Cooperation based on partnerships and long-term relationships. Scientific-technological cooperation of actors with diverse capabilities and expertises. Planning of R&D and innovation strategy commonly designed. Achieving excellent highly specialized R&D outcomes. R&D strategy oriented to market and business needs.	Increasing political and social culture towards innovation. Increasing innovation success. Increasing quality of R&D outcomes applied to new goods development. Increasing competitiveness of the institution/company.
Research & Technology Corporation	Complex knowledge assets due to be composed by scientific-technological and socioeconomic elements.	Strategy to share knowledge. Open innovation and co-creation approach. Characteristics of sender and receiver organizations involved in KT.	Characteristics of all KT ecosystem: public policies; R&T system; industry	KT works as a business strategy tool. R&D addressed to procure value to the market. Cooperative and collaborative approach. Knowledge management systems.	Increasing social concern for innovation. Increasing economic development. Increasing sustainability of firms.
University		Culture of transfer. Aligning academic research plans and industry needs. Companies with capacity to absorb scientific and technological knowledge. Mutual knowledge and understanding between companies and research groups. Scientists to join companies.	Public science system structured and competitive. Diffusing the capabilities of the public science system. Improvement and professionalization of the entities supporting KT.	Knowledge generation focused on business needs. Mobility of researchers and scientists to industry. Intellectual and industrial property management. Enabling dynamic relations science-industry.	Increasing robustness of public science systems. Increasing collaborative capabilities between science and industry. Increasing base of knowledge about succeeding in KT and innovation.
University		Understanding and liaison between science production and industry needs. Capabilities and business acumen to leverage results of internal and external scientific research.	Interfacing structures to foster innovation and to enable knowledge flows. Harmonic and rich context of basic and applied knowledge. Balanced system of science, industry and innovation infrastructures. Scientific outcomes available and accessible to the industry. Public instruments to support KT activities.	Strategy of innovation and knowledge management. Implication and commitment to R&D and innovation. Abilities and capacities to operate knowledge-based activities. Intellectual and industrial property management. Systematic and structured management of KT. Mobility of scientists to companies. Corporate strategy to take into account and adopt scientific research results	Increasing social commitment and public awareness for knowledge development and innovation. Increasing management capabilities. Increasing effectiveness of application of R&D outcomes into new marketable products. Increasing organisational efficiency.
Public Policy Institution	Managing the complexity of knowledge through being tangible	Organisational culture of transfer and innovation. Size of the institution/company. Motivation and attitude of human resources. Business acumen and leadership of the top management. Fluent and common understanding between actors involved in KT.	Funding system for KT. Programmes and instruments developed by public institutions supporting KT. Ecosystem of KIBS to enable, foster and enhance KT. Stimulation of KT by means of shared activities among all stakeholders.	Commitment of the company/institution to innovation and KT. Consistency between business model and market opportunities/needs. Corporate strategy focused on developing products and services based on knowledge. Incentive mechanisms to get people involved and implicated. Mechanisms to get effective cooperation between actors. Knowledge management in the organization. Management of intellectual and industrial property. KT activities structured and systematized.	Increasing diffusion of best practices for innovation success and competitiveness. Increasing regional economic development. Increasing organisational capabilities to perform more successful innovations. Increasing socioeconomic awareness about innovation and knowledge. Increasing competitiveness.



Public Policy Institution		Culture of knowledge transfer. Relationships and links between scientific entities and companies. Bidirectional interactions between science-industry arenas		R&D results to be converted into market goods. Structuring KT activities. Cooperation based on business needs and market opportunities. Collaborative networks encompassing science-industry. Intellectual and industrial property management	Increasing individual capabilities of the actors. Increasing cooperative capabilities of the actors. Increasing business performance in: efficiency, profitability, and competitiveness. Increase organisational capabilities to achieve better innovations for the market. Increase competitiveness. Increasing organisational capacities for efficiency.
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Table 4: List of empirical factors moderating KT impact, innovation success and competitiveness.

Object of knowledge	Actors and relationships	External context	Internal mechanisms	Impact
Complexity	Motivation and attitude	Public policies and instruments	Aligning R&D and market	Increasing capabilities and capacities
	Individual and collective culture	Funding	Handling knowledge assets	
	Leadership and vision	Innovation infrastructures	Operating R&D activities	
Mix	Intellectual capacity	Social culture	Managing relationships and interactions: cooperation and collaboration	Increasing business performance
	Structural and organisational capacity		Integrating innovation into strategy	
	Experience and seniority		Using technology resources	
Originality	Distance and interaction dynamics	Public system of science	Managing people talent and attitude	Increasing innovation success and market impact
	Quality and richness of relationships	Ecosystem science-technology-industry	Structuring and systemizing KT	



## Discussion and implications

The purpose of the research is to revalidate the evidence of the direct relationship existing between KT, innovation and competitiveness, and also, to disclose the existence of a solid connection between the systemic and steady phenomenon of KT being performed inside a company or institution, and the extent of competitiveness achieved. The aim of the work is also to make available to stakeholders in the field of innovation, a scheme containing the major keys for KT effectiveness, successful innovation and better business performance. The major findings of the research are: ratification of the relationship KT-competitiveness; empirical evidence of that linkage discovered, and furthermore, connection mapped through key business management factors for KT effectiveness. Likewise, we observe that the link is revealed from a qualitative perspective, and thus, the quantitative extent of the relationship between KT and competitiveness should be tackled in future researches.

We have also elaborated a framework of dimensions of KT determinants which is based on characterizing factors of the phenomenon and theoretical evidence of factors moderating the KT impact for high-tech institutions and companies (Benito-Bilbao et al, 2015,

p.38). The framework is conceptually analogous to the contingent effectiveness model of technology transfer (Bozeman, 2000, p.636; Bozeman et al, 2015, p.3), showing, therefore, a concordance on the results of both schemes. This finding drives to the fact that the frame of dimensions of determinants covers the same spectrum of KT as the scope represented by the model of characterizing factors for KT. Implication is clear: we can address to the phenomenon of KT from both perspectives as a similar approach. Indeed, the possibility of analyzing and researching on KT from the perspective of dimensions of determinants is more appropriate to define a model for optimal KT, since it allows us to analyze the elements influencing the impact of the phenomenon.

The qualitative research confirms that all the empirical factors responsible of leading a company or institution to innovation success and increasing grade of competitiveness can be allocated among the dimensions of the conceptual framework designed to classify, process and analyze the results of the interviews. Therefore, another finding is that the frame exhibits properly the socio-economic phenomenon of KT, and each KT event is moderated by such mapped factors, so every element has decisive influence on the KT impact, and the extent of effectiveness is dependent on the conditions and circumstances of each

event or KT operation. As well, there is a short list of factors which are remarked by interviewees as the stronger keys for successful innovation and better business performance when operating KT processes: handling the complexity and the mix of knowledge assets; fostering systematic and intense interactions between actors; deploying a set of internal mechanisms to conduct the phenomenon, and define the KT strategy taking into account of all the perspectives of the situation.

The finding about the relationship between KT and competitiveness is confirmed in the research by all respondents. They all acknowledge that all KT event carried into effect has positive impact in terms of: increasing capabilities, capacities and skills of the individual and collective actors involved; increasing business performance by improving efficiency, reducing costs, etc; increasing innovation success and market impact thanks to the development of new goods fulfilling customers needs; increasing social and public value by means of enhancing awareness of culture of innovation and enlarging stock of knowledge; and increasing regional economic development thanks to the confluence of all benefits in the territory.

The discovery about the set of factors mapping the connexion between KT and competitiveness is a detailed outcome extracted from the empirical research. According to this finding, we could present these business keys as the dashboard to guide and enable organizations to adopt concrete measures and to optimize events of KT. The major keys detected to increase business performance and gain competitiveness are: 1) steering the organisation with leadership and hybrid vision science-business with the innovation and knowledge as fundamental pillars; 2) managing the talent and the motivation of the people to set a prone attitude and innovation culture; 3) structuring and systematizing KT to create the suitable scenario with resources and skills; 4) increasing the awareness of the organization with R&D activities and knowledge management to create goods, to develop further individual and collective capabilities, and to store experience and expertise; 5) managing interactions and relationships around the collaboration and cooperation to extend the scope of possibilities; 6) handling the complexity and the mix of knowledge assets; and 7) harnessing the external context of instruments and policies for the self benefit.

## Conclusions

KT is a phenomenon strongly linked to innovation and competitiveness which can be studied under two different approaches: characterizing factors, or determinants of its impact. The last is a most suitable technique to reveal the key elements which more influence have on the effectiveness of the KT events, and, thus, more intensely affect on the achievement of better business performance and increase of competitiveness. These key factors can be classified in accordance with the dimensions characteristics of KT and its effectiveness: knowledge, actors, mechanisms and external context. We disclose empirical evidence about a positive relationship between KT effectiveness and better business performance, and we present a scheme with the levers liable to turn KT activities into competitiveness: leadership and vision in innovation, talent of the people, organisational culture, systematic

R&D and knowledge management activities, capabilities and experience, collaboration and cooperation complexity and mix of knowledge assets, and external instruments and policies.

Multiple stakeholders in the field of innovation and business management may take advantage of the findings and implications. KT is a crucial management practice linked to competitiveness which should be seriously adopted by all companies and institutions living inside a knowledge-based atmosphere. Corporations and SMEs should gain awareness about KT, and particularly knowledge-intensive business services companies should lead the implementation of systems related to the set of key factors. Public institutions and policy makers should develop instruments and programmes in order to ensure that the key factors are understood and customized according to each reality. Innovation infrastructures should promote partnerships and networks to explore and exploit knowledge. Science system and universities should align R&D activities with market needs and trends, balancing basic and applied research. Finally, researchers on business management might progress in the study of KT issue and conduct empirical studies of statistical nature to validate of the extent of influence of each factor.

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