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A Literature Review on Barriers and Enhancers of Knowledge Transfer

1. Introduction

The present paper results from a literature review carried out as part of COTRANS (Conditionings of Knowledge Transfers and Innovative Activity of Enterprises). COTRANS is an international research project including partners from Portugal and Poland (Faculty of Management at University of Gdansk, Faculty of Finance and Management at Torun School of Banking and School of Management and Technology of the Porto Polytechnic). The project aim is the development of a conceptual model on Knowledge Transfer.

Knowledge constitutes the basis of the learning process at any organization. “Knowledge and the way how organizations work with it directly influences their readiness for action and success, especially in knowledge society” (Mládková, 2014)¹⁰. According to Drucker (1993)¹¹, knowledge is a management resource and power. In turn Wiig (1997)¹² argues that knowledge is a form of belief.

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¹⁰ Mládková, L. (2014). Knowledge Strategy: Key Player or Relict of the Past? *Procedia – Social and Behavioral Sciences*, 150, 628–636.

¹¹ Drucker, P.F. (1993). *Post-Capitalist Society*. New York, 232.

¹² Wiig, K.M. (1997). Knowledge Management: An Introduction and Perspective. *J. of Knowledge Management*, 1(1), 6–14.

Knowledge can be analyzed from the tacit and explicit perspectives (Nonaka & Takeuchi, 1996; Polanyi, 1966)¹³. For Nonaka & Takeuchi (1996), most western managers understand that useful knowledge is “hard” or quantifiable (Explicit). However, knowledge also depends on tapping the tacit and often highly subjective insights, intuitions, and ideals of employees (Tacit). Knowledge as argued by Davenport & Prusak (2005)¹⁴ is present in organizations’ documents or repositories, but is also in organizational routines, processes, practices, and norms. For Argote & Darr (2000)¹⁵, knowledge resides in the individuals, technology, structure, routines and coordination processes within organizations.

In order to improve organizational knowledge, it is possible to use many different strategies, however, it is important to learn, first from the inside. “Both knowledge and project management literature suggests that in practice lessons learned processes rarely happen, and when it does, it is concerned with lessons identification rather than organizational learning” (Duffield & Whitty, 2015)¹⁶. This capacity of firms to learn from their past experiences is closer to the tacit knowledge concept.

Whether tacit or explicit, in a dynamic competitive environment, knowledge becomes the key source of constant advantage over the competition and the main condition for reaching success. Both development and an organization’s ability to survive are largely dependent on its ability to gain knowledge and use it effectively.

Despite the fact that knowledge is a crucial factor for organizations, knowledge does not appear by law. It is mainly a matter of organizational culture and strategy. Because knowledge is a key factor for success, a strategy for knowledge creation must be implemented. So, the first step depends on firms’ management. Knowledge creation strategies may help the manager in the creation of value and knowledge in the organization. In order to successfully implement knowledge strategies, there are several suggested models (Brookes, 2014; Duffield & Whitty,

¹³ Nonaka, I., & Takeuchi, H. (1996). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. *Long Range Planning*, 29(4), 592; Polanyi, M. (1966). *The Tacit Dimension. Knowledge in Organizations*. IL: The University of Chicago Press.

¹⁴ Davenport, T.H., & Prusak, L. (2005). Working Knowledge: How Organizations Manage What They Know. *IEEE Engineering Management Review*, 31(4), 301.

¹⁵ Argote, L., & Darr, E. (2000). Repositories of Knowledge in Franchise Organizations: Individual, Structural, and Technological. *The Nature and Dynamics of Organizational Capabilities*.

¹⁶ Duffield, S., & Whitty, S.J. (2015). Developing a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects. *International J. of Project Management*, 33(2), 311–324.

2015; Oyemomi, Liu, Neaga, & Alkhurajji, 2016; Wang, Sharma, & Cao, 2016; Yang, Fang, & Lin, 2010)¹⁷ but in general those models focus on three main steps (with some variations): (1) Knowledge Exploration; (2) Knowledge Acquisition; (3) Knowledge Exploitation.

Due to their dimension, some firms may explore knowledge through their own R&D departments, while others may be in an R&D network. Or it may even be a stakeholder within a logistic process benefiting from upstream or downstream R&D activity results. In fact, “the effectiveness of knowledge transfer between a firm and a supplier has a significant impact on profit and should be considered before implementing supplier development activities” (Clemons & Slotnick, 2016)¹⁸.

Even though firms recognize knowledge as a crucial factor for development, profits, and innovative activities, most firms do not undertake R&D activities due to a lack of resources or competences. Since knowledge has become the most important source of competitive advantage, this leads to the importance of the role of universities as producers of knowledge (Anatan, 2015)¹⁹. “As universities gradually become the center of society’s knowledge production system, their role in innovation becomes more diverse. In the pursuit of such a role, universities are encouraged to establish a university–industry collaboration (UIC) context that supports faculties and students to engage in entrepreneurial activities” (Huang & Chen, 2015)²⁰.

Firms that find themselves in a weak position in terms of knowledge creation and have a desire for innovation may start with knowledge exploration “on the outside”, in particular partnering with the higher education system.

¹⁷ Brookes, M. (2014). The Dynamics and Evolution of Knowledge Transfer in International Master Franchise Agreements. *International J. of Hospitality Management*, 36, 52–62; Duffield, S., & Whitty, S.J. (2015). Developing a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects. *International J. of Project Management*, 33(2), 311–324; Oyemomi, O., Liu, S., Neaga, I., & Alkhurajji, A. (2016). How Knowledge Sharing and Business Process Contribute to Organizational Performance: Using the fsQCA Approach. *J. of Business Research*; Wang, Z., Sharma, P.N., & Cao, J. (2016). From Knowledge Sharing to Firm Performance: A Predictive Model Comparison. *J. of Business Research*; Yang, C.W., Fang, S.C., & Lin, J.L. (2010). Organisational Knowledge Creation Strategies: A Conceptual Framework. *International J. of Information Management*, 30(3), 231–238.

¹⁸ Clemons, R., & Slotnick, S.A. (2016). The Effect of Supply-Chain Disruption, Quality and Knowledge Transfer on Firm Strategy. *International J. of Production Economics*, 178, 169–186.

¹⁹ Anatan, L. (2015). Conceptual Issues in University to Industry Knowledge Transfer Studies: A Literature Review. *Procedia – Social and Behavioral Sciences*, 211, 711–717.

²⁰ Huang, M.H., & Chen, D.Z. (2015). How Can Academic Innovation Performance in University-Industry Collaboration Be Improved? *Technological Forecasting and Social Change*.

Upstill & Symington (2002)²¹ *apud* Nilsen & Anelli (2015)²² argued that there are three basic modes for technology transfer from public research to the business sector:

- Non-commercial transfer: seminars, informal contacts, publications, secondments and staff exchange and training;
- Commercial transfer: collaborative research, contract research, consulting, licensing and sale of intellectual property and technical services;
- New company generation: direct spin-offs, indirect spin-offs and technology transfer companies.

Knowledge transfer or exchange occurs when stakeholders are able to identify advantages. Knowledge exchange goes beyond the concept of knowledge transfer (Ankrah & AL-Tabbaa, 2015; Salleh & Omar, 2013)²³. Knowledge exchange presents a wider perspective for University-Industry Collaboration (UIC) as it implies a bi-directional exchange of knowledge. From this perspective, the customer's role is no longer a passive recipient of value at the end of a transaction, but is co-creating value with the supplier during an exchange (Canhoto, Quinton, Jackson, & Dibb, 2016)²⁴.

Scholars have argued that both university and industry actors are motivated to build relationships with one another to take advantage of their complementary organizational strengths (Mueller, 2006; Siegel, Waldman, Atwater, & Link, 2003)²⁵ *apud* (Ankrah, Burgess, Grimshaw, & Shaw, 2013)²⁶.

In the next chapter we will briefly explore the concept and processes of knowledge transfer identifying later the main barriers and enhancers for knowledge transfer.

²¹ Upstill, G., & Symington, D. (2002). Technology Transfer and the Creation of Companies: The CSIRO Experience. *R&D Management*, 32(3), 233–239.

²² Nilsen, V., & Anelli, G. (2015). Knowledge Transfer at CERN. *Technological Forecasting and Social Change*.

²³ Ankrah, S., & AL-Tabbaa, O. (2015). Universities–Industry Collaboration: A Systematic Review. *Scandinavian J. of Management*, 31(3), 387–408; Salleh, M.S., & Omar, M.Z. (2013). University-Industry Collaboration Models in Malaysia. *Procedia – Social and Behavioral Sciences*, 102 (Ifee 2012), 654–664.

²⁴ Canhoto, A.I., Quinton, S., Jackson, P., & Dibb, S. (2016). The Co-Production of Value in Digital, University–Industry R&D Collaborative Projects. *Industrial Marketing Management*.

²⁵ Mueller, P. (2006). Exploring the Knowledge Filter: How Entrepreneurship and University-Industry Relationships Drive Economic Growth. *Research Policy*, 35(10), 1499–1508.

²⁶ Ankrah, S., Burgess, T., Grimshaw, P., & Shaw, N.. (2013). Asking Both University and Industry Actors about their Engagement in Knowledge Transfer: What Single-Group Studies of Motives Omit. *Technovation*, 33 (2–3), 50–65.

2. Knowledge Transfer

Knowledge and technology transfer could be defined as “the movement of know-how, technical knowledge, or technology from one organizational setting to another” (Roessner, 2000)²⁷. “As a process, knowledge is exchanged ‘between two agents, during which one agent purposefully receives and uses the knowledge provided by another” (Foss & Pedersen, 2002)²⁸.

Knowledge transfer is a process which puts knowledge into practice. It relies on the flow by which largely tacit knowledge, not technology per se, is transmitted among people from one unit (the source: a single person, group or organisation) to another (the recipient), with all kinds of feedback loops (Formica, Mets, & Varblane, 2008)²⁹.

Knowledge Transfer may occur in many different ways: National or International Franchise Agreements [(Brookes, 2014; Minguela-Rata, López-Sánchez, & Rodríguez-Benavides, 2010; Sorenson & Sorensen, 2001)]³⁰; Joint-ventures [(Becerra, Lunnan, & Huemer, 2008; Park & Vertinsky, 2014)]³¹; Along the supply chain/or stakeholder interactions [(Clemons & Slotnick, 2016; Ugolini, Massetti, Sanesi, & Pearlmutter, 2015)]³²; From project management and lessons learned

²⁷ Roessner, J.D. (2000). *Technology Transfer* (Sci Techno). London: A Time Chang, Longman.

²⁸ Foss, N.J., & Pedersen, T. (2002). Transferring Knowledge in MNCs: The Role of Sources of Subsidiary Knowledge and Organizational Context. *J. of International Management*, 8(1), 49–67.

²⁹ Formica, P., Mets, T., & Varblane, U. (2008). Knowledge Transfer Mechanisms in the European Transition Economies. In: *Entrepreneurship and Higher Education* (J. Pottter). OECD Publishing.

³⁰ Brookes, M. (2014). The Dynamics and Evolution of Knowledge Transfer in International Master Franchise Agreements. *International J. of Hospitality Management*, 36, 52–62; Minguela-Rata, B., López-Sánchez, J.I., & Rodríguez-Benavides, M.C. (2010). Knowledge Transfer Mechanisms and the Performance of Franchise Systems: An Empirical Study. *African J. of Business Management*, 4 (April), 396–405; Sorenson, O., & Sorensen, J.B. (2001). Finding the Right Mix: Franchising, Organizational Learning, and Chain Performance. *Strategic Management J.*, 22 (6–7), 713–724.

³¹ Becerra, M., Lunnan, R., & Huemer, L. (2008). Trustworthiness, Risk, and the Transfer of Tacit and Explicit Knowledge between Alliance Partners. *J. of Management Studies*, 45(4), 691–713; Park, C., & Vertinsky, I. (2014). Reverse and Conventional Knowledge Transfers in International Joint Ventures. *J. of Business Research*. Elsevier Inc.

³² Clemons, R., & Slotnick, S.A. (2016). The Effect of Supply-Chain Disruption, Quality and Knowledge Transfer on Firm Strategy. *International J. of Production Economics*, 178, 169–186; Ugolini, F., Massetti, L., Sanesi, G., & Pearlmutter, D. (2015). Knowledge Transfer between Stakeholders in the Field of Urban Forestry and Green Infrastructure: Results of a European Survey. *Land Use Policy*, 49, 365–381.

(Carayannis, Popescu, Sipp, & Stewart, 2006; McAdam, Miller, McAdam, & Teague, 2012; Salleh & Omar, 2013)³³.

Considering the importance of knowledge and the limitations of most businesses in developing these activities, the higher education system is an important player in this *game*.

The cooperation between industry and university is an important strategy for technological innovation [(Anatan, 2015; EU, 2007; Formica et al., 2008; González-López, Dileo, & Francesco, 2014; Lai, 2011; Maietta, 2015; OECD, 2012), ...]³⁴. According to Gupta & Barua (2015)³⁵ “the collaboration of university and industry leads to mainly two types of transfers from university to industry, these are R&D results transfer and technology transfer. The R&D results transferred lead to innovative ideas in the industry which leads to a new product development with the help of technology transfer from university to industries (Guan, Yam, & Mok, 2005)³⁶. Linkages with R&D institutions and long standing experience with respect to a particular technology tend to facilitate SME innovations” (Krishnaswamy, Subrahmanya, & Mathirajan, 2015)³⁷.

³³ Carayannis, E.G., Popescu, D., Sipp, C., & Stewart, M. (2006). Technological Learning for Entrepreneurial Development (TL4ED) in the Knowledge Economy (KE): Case Studies and Lessons Learned. *Technovation*, 26(4), 419–443; McAdam, R., Miller, K., McAdam, M., & Teague, S. (2012). The Development of University Technology Transfer Stakeholder Relationships at a Regional Level: Lessons for the Future. *Technovation*, 32(1), 57–67; Salleh, M.S., & Omar, M.Z. (2013). University-Industry Collaboration Models in Malaysia. *Procedia – Social and Behavioral Sciences*, 102 (Ifee 2012), 654–664.

³⁴ Anatan, L. (2015). Conceptual Issues in University to Industry Knowledge Transfer Studies: A Literature Review. *Procedia – Social and Behavioral Sciences*, 211, 711–717; Formica, P., Mets, T., & Varblane, U. (2008). Knowledge Transfer Mechanisms in the European Transition Economies. In: *Entrepreneurship and Higher Education* (J. Pottter). OECD Publishing; González-López, M., Dileo, I., & Francesco, L. (2014). University-Industry Collaboration in the European Regional Context: The Cases of Galicia and Apulia Region. *J. of Entrepreneurship Management and Innovation*, 10(3), 57–87; Lai, W.H. (2011). Willingness-to-Engage in Technology Transfer in Industry-University Collaborations. *J. of Business Research*, 64(11), 1218–1223; Maietta, O.W. (2015). Determinants of University-Firm R&D Collaboration and its Impact on Innovation: A Perspective from a Low-Tech Industry. *Research Policy*, 44(7), 1341–1359; OECD. (2012). Commercialisation of Public Research.

³⁵ Gupta, H., & Barua, M.K. (2015). Identifying Enablers of Technological Innovation for Indian MSMEs Using Best-Worst Multi Criteria Decision Making Method. *Technological Forecasting and Social Change*. Elsevier Inc.

³⁶ Guan, J.C., Yam, R.C., & Mok, C.K. (2005). Collaboration between Industry and Research Institutes/Universities on Industrial Innovation in Beijing, China. *Technology Analysis & Strategic Management*, 17(3), 339–353.

³⁷ Krishnaswamy, K.N., Subrahmanya, M.H.B., & Mathirajan, M. (2015). Technological Innovation Induced Growth of Engineering Industry SMEs: Case Studies in Bangalore. *Asian J. of Innovation and Policy*, 4(2).

For Fernández-Esquinas, Pinto, Yruela, & Pereira (2015)³⁸ firms interact with universities through a variety of channels, ranging from collaborative research projects, patents, spin-off creation, consultancy and specialized training, to informal relationships. The same authors found evidence that university–industry links can be grouped into five latent dimensions (knowledge generation and adaptation, involvement in new organizations, training and exchange of human resources, intellectual property rights, and facilities and equipment) which are mainly based on exploitation or exploration activities.

Even recognizing the major importance of UIC Garcia-Perez-de-Lema, Madrid-Guijarro, & Martin (2015)³⁹ in their research about different university–firm governance styles, the authors concluded that only contractual university–firm relationships have a direct and significant effect on innovation, whereas *relational* activities promote and support contractual activities.

Dryl et al. (2015)⁴⁰ argue that knowledge transfer is about identifying knowledge that already exists (**Exploration**), acquiring it (**Acquisition**) and subsequently applying this knowledge to develop new ideas or enhance the existing ideas to make a process/action faster, better or safer than they would otherwise be (**Exploitation**). So, basically knowledge transfer is not only about exploiting accessible resources, i.e. knowledge, but also about how to acquire and absorb it well to make things more efficient and effective. In other words, knowledge transfer is crucial for most firms in order to promote innovation (Product, Process, Marketing or Organizational (OECD, 2005)⁴¹).

The most common definitions of innovation regard the creation of something new, inventing and introducing change. Innovation in turn spurs economic development (Kontolaimou, Giotopoulos, & Tsakanikas, 2016)⁴² that

³⁸ Fernández-Esquinas, M., Pinto, H., Yruela, M.P., & Pereira, T.S. (2015). Tracing the Flows of Knowledge Transfer: Latent Dimensions and Determinants of University–Industry Interactions in Peripheral Innovation Systems. *Technological Forecasting and Social Change*.

³⁹ Garcia-Perez-de-Lema, D., Madrid-Guijarro, A., & Martin, D.P. (2015). Influence of University–Firm Governance on SMEs Innovation and Performance Levels. *Technological Forecasting and Social Change*.

⁴⁰ Dryl, W., Dryl, T., Duarte, N., Dziadkiewicz, A., Niezurawska, J., Niezurawski, L., ... Santos, V. (2015). Knowledge Transfer in Network Organization. An Example of the Polish-Portuguese Network of Researchers. *Torun Business Review*, 14(1), 37–46.

⁴¹ OECD. (2005). *Oslo Manual Guidelines for Collecting and Interpreting Innovation in Communities* (The Measurement of Scientific and Technological Activities). (Array, Ed.) Eurostat (Vol. Third edit). OECD Publishing.

⁴² Kontolaimou, A., Giotopoulos, I., & Tsakanikas, A. (2016). A Typology of European Countries Based on Innovation Efficiency and Technology Gaps: The Role of Early-Stage Entrepreneurship. *Economic Modelling*, 52, 477–484.

results as well from entrepreneurial activity and entrepreneurship (Acs, 2009; Audretsch & Thurik, 2001; Block, Thurik, & Zhou, 2013)⁴³. If universities, industry and government are able to work aiming at the same objectives, there is a greater chance to get better results.

In the next chapter, based on a literature review, we will identify some important factors that can promote or inhibit the knowledge transfer process, mainly at the university-industry level.

3. Enhancers and Barriers to Knowledge Transfer

After a brief overview of the concept of knowledge transfer and its importance for firms' development, following the main factors identified in the literature review than can work as an enhancer or barrier to knowledge transfer will be presented.

In order to identify what could determine the success of knowledge exchange Ankrah & AL-Tabbaa (2015)⁴⁴ presented a list of factors. In the research it was found that if those factors were correctly managed, they would have a positive effect on the perceived success of knowledge and technology exchange. On the other hand, where the same factors were neglected or mismanaged, it tended to have a corresponding negative impact on the perceived success of knowledge and technology exchange.

The fact that the same factor can work both as a positive or negative impact on knowledge transfer, has led to the search of important factors, not taking into consideration if it is a barrier or an enhancer. Depending on the situation and the conditions under which knowledge transfer is (or is not) occurring the same factor can promote or block the transfer process.

⁴³ Acs, Z.J. (2009). Knowledge Spillover Theory of Entrepreneurship. *Small Business Economics*, 32(1), 15–30; Audretsch, D.B., & Thurik, R. (2001). What's New about the New Economy? Sources of Growth in the Managed and Entrepreneurial Economies. *Industrial and Corporate Change*, 10(1), 267–315; Block, J.H., Thurik, R., & Zhou, H. (2013). What Turns Knowledge into Innovative Products? The Role of Entrepreneurship and Knowledge Spillovers. *J. of Evolutionary Economics*, 23(4), 693–718.

⁴⁴ Ankrah, S., & AL-Tabbaa, O. (2015). Universities–Industry Collaboration: A Systematic Review. *Scandinavian J. of Management*, 31(3), 387–408.

Table 1. Categories and Factors that Affect Knowledge Exchange Success

Main categories	The factors
Capacity and Resources	Adequate resources (funding, human and facilities)
	Incentive structures for university researchers
	Recruitment and training of technology transfer staff
	Capacity constraints of SMEs
Legal Issues, and Contractual Mechanisms	Inflexible university policies including intellectual property rights (IPR), patents, and licenses and contractual mechanisms
	Treatment of confidential and proprietary information
	Moral responsibility versus legal restrictions (research on humans)
Management and Organization Issues	Leadership/Top management commitment and support
	Collaboration champion
	Teamwork and flexibility to adapt
	Communication
	Mutual trust and commitment (and personal relationships)
	Corporate stability
	Project management
	Organization culture (cultural differences between the world of academia and of industry)
	Organization structure (university administrative structure and corporate structure)
	Company size (size of an organization)
	Absorptive capacity
	Skills and role of both university and industry boundary spanners
Human capital mobility/personnel exchange	
Issues Related to Technology	Nature of the technology/knowledge to be transferred (tacit or explicit; generic or specialized; academic rigor or industrial relevance)
Political Issues	Policy/legislation/regulation to guide/support/encourage UIC (support such as tax credits, information networks and direct advisory assistance to industry)
Social Issues	Enhancement in reputation/prestige
Other Issues	Low level of awareness of university research capabilities
	Use of an intermediary (the third party)
	Risk of research
	Cross-sector differences/similarities
	Geographic proximity

Source: Ankrah & AL-Tabbaa (2015).

The original table, according to the authors, was constructed by adopting the first two headings (i.e. Capacity and Resources and Legal Issues, Institutional Polices and Contractual Mechanisms) from Fairweather (1991)⁴⁵, and creating the remaining five headings to suit the emerged sub-themes.

As previously mentioned, most firms do not undertake innovation activities due to a lack of resources or competences. Under this scenario, universities play a major role in supporting innovation under knowledge transfer activities. However, firms do not reach out to universities to buy some existent technology or just to check if there is something interesting on the shelves. Firms define their own strategy for interaction with a university after having reflected on their present and future knowledge needs (Bekkers & Freitas, 2008)⁴⁶.

Bekkers & Freitas (2008) observed two major patterns of interaction for firms that aim at being innovators or early adopters in their market. "One strategy more focused on collaborative and contract research...; the other more reliant on patents, licensing and specific organized activities to support access and adoption of systemic knowledge... In both cases, as firms need to engage in the application of scientific published knowledge to the specific needs of their products and of the markets' needs, firms also need to rely on scientific publications, informal contacts with university researchers and students". These informal contacts lead us to the concept of communication. In this case, we are talking about informal communication, or trust relations.

According to Plewa et al., (2013)⁴⁷ "the critical nature of trust, or a willingness to rely on an exchange partner in whom one has confidence (Moorman et al., 1992, p. 315), for relationship success has been confirmed in many streams of literature, including UIs (Mora-Valentin, Montoro-Sanchez, & Guerras-Martin, 2004) and (Plewa, 2009)..., in line with commitment – trust theory (Morgan & Hunt, 1994). According to social exchange theory, trust "allows firms to move from discrete transactions to relational exchange (Lambe, Wittman, & Spekman, 2001 p. 21). Some authors argue that trust develops at a slow pace through investment, experience, and repeated interactions (Collins & Hitt,

⁴⁵ Fairweather, J.S. (1991). Managing Industry–University Research Relationships. *J. of Higher Education Management*, 11, 1–7.

⁴⁶ Bekkers, R., & Freitas, I.M.B. (2008). Analysing Knowledge Transfer Channels between Universities and Industry: To What Degree Do Sectors Also Matter? *Research Policy*, 37(10), 1837–1853.

⁴⁷ Plewa, C., Korff, N., Johnson, C., Macpherson, G., Baaken, T., & Rampersad, G.C. (2013). The Evolution of University–Industry Linkages—A Framework. *J. of Engineering and Technology Management*, 30(1), 21–44.

2006) and (Dahl & Pedersen, 2005); others note that trust can be built and evaluated quickly and intensely through negotiation, shared vision, and fast appreciation of the value contributed by the partner (Blomqvist, Hurmelinna-Laukkanen, Nummela, & Saarenketo, 2008). Trust as a relational characteristic also has varying levels of relevance in various phases (Grayson & Ambler, 1999)". From this citation it is possible to acknowledge the significant number of studies focusing on trust. Many others such as (Bruneel, D'Este, & Salter, 2010)⁴⁸, (Hemmert, Bstieler, & Okamuro, 2014)⁴⁹ or (Dooley & Kirk, 2007)⁵⁰ also present trust as an important factor.

Still Plewa et al., (2013) citing other authors, argues that communication facilitates the development of understanding, and understanding drives a relationship evolution and success (Barnes, Pashby, & Gibbons, 2002)⁵¹, in all phases of the relationship. Understanding developed through the prior interaction can reduce transaction costs and improve the ease of knowledge transfer (Kim, 2009)⁵².

Other issues frequently quoted as important factors for UIC are geographical proximity (D'Este, Guy, & Iammarino, 2013)⁵³. Maietta (2015)⁵⁴ also suggests geographical proximity along with university, firm and territory characteristics.

University, company and territory characteristics are not the only ones that must be taken into consideration; as argued by D'Este & Patel (2007)⁵⁵, also researchers' characteristics must be taken into account. These last authors suggest that policies that are mainly targeted towards universities are likely to have

⁴⁸ Bruneel, J., D'Este, P., & Salter, A. (2010). Investigating the Factors That Diminish the Barriers to University-Industry Collaboration. *Research Policy*, 39(7), 858–868.

⁴⁹ Hemmert, M., Bstieler, L., & Okamuro, H. (2014). Bridging the Cultural Divide: Trust Formation in University-Industry Research Collaborations in the US, Japan, and South Korea. *Technovation*, 34(10), 605–616.

⁵⁰ Dooley, L., & Kirk, D. (2007). University-Industry Collaboration: Grafting the Entrepreneurial Paradigm onto Academic Structures. *European J. of Innovation Management*, 10(3), 316–332.

⁵¹ Barnes, T., Pashby, I., & Gibbons, A. (2002). Effective University – Industry Interaction: A Multi-Case Evaluation of Collaborative R&D Projects. *European Management J.*, 20(3), 272–285.

⁵² Kim, Y. (2009). Choosing between International Technology Licensing Partners: An Empirical Analysis of U.S. Biotechnology Firms. *J. of Engineering and Technology Management – JET-M*, 26 (1–2), 57–72.

⁵³ D'Este, P., Guy, F., & Iammarino, S. (2013). Shaping the Formation of University-Industry Research Collaborations: What Type of Proximity Does Really Matter? *J. of Economic Geography*, 13(4), 537–558.

⁵⁴ Maietta, O.W. (2015). Determinants of University-Firm R&D Collaboration and its Impact on Innovation: A Perspective from a Low-Tech Industry. *Research Policy*, 44(7), 1341–1359.

⁵⁵ D'Este, P., & Patel, P. (2007). University-Industry Linkages in the UK: What Are the Factors Underlying the Variety of Interactions with Industry? *Research Policy*, 36(9), 1295–1313.

a limited impact on encouraging university–industry interactions, unless they take a better account of the characteristics of the individual researchers engaged in such interactions.

Along with the stakeholders' characteristics, organizational operation factors for knowledge sharing are also to be considered: Leadership support; Learning and Training; and Communication were the factors identified by Oyemomi et al., (2016)⁵⁶.

All the factors presented up to now are indeed relevant factors, but one cannot forget that, in general, firms are profit oriented. Anatan (2015)⁵⁷ presented a literature review of conceptual issues in University to Industry knowledge transfer and identified three major theories: Transaction Cost Economic, Theory, Resource-based View, and Knowledge-based View. In this research, the author pointed out another important issue discussed in the literature that is the “alliance dilemma” focusing on aspects such as costs and time needed for this cooperation.

The cost factor leads us to another one that seems to be an important contribution to promoting knowledge transfers: funding (Berbegal-Mirabent, Sánchez García, & Ribeiro-Soriano, 2015)⁵⁸. “Three things seem to be important for the capability of universities to attract private funding. First, the experience of departments in building relations with businesses: departments that obtained private funding in the past are more likely to continue to be able to attract private finance. Second, the ability to achieve a critical mass of research in a given sector, in terms of visibility and results is important. Third, the proximity of the university to an ID increases the capability obtain business funding” (Muscio, Quaglione, & Scarpinato, 2012)⁵⁹.

Osabutey & Jin (2016)⁶⁰ identified four contextual factors that could influence knowledge and technology transfer. Those factors are: (1) less congestion of firms

⁵⁶ Oyemomi, O., Liu, S., Neaga, I., & Alkhurajji, A. (2016). How Knowledge Sharing and Business Process Contribute to Organizational Performance: Using the fsQCA Approach. *J. of Business Research*.

⁵⁷ Anatan, L. (2015). Conceptual Issues in University to Industry Knowledge Transfer Studies: A Literature Review. *Procedia – Social and Behavioral Sciences*, 211, 711–717.

⁵⁸ Berbegal-Mirabent, J., Sánchez García, J.L., & Ribeiro-Soriano, D.E. (2015). University–Industry Partnerships for the Provision of R&D Services. *J. of Business Research*, 68(7), 1407–1413.

⁵⁹ Muscio, A., Quaglione, D., & Scarpinato, M. (2012). The Effects of Universities' Proximity to Industrial Districts on University-Industry Collaboration. *China Economic Review*, 23(3), 639–650.

⁶⁰ Osabutey, E.L.C., & Jin, Z. (2016). Factors Influencing Technology and Knowledge Transfer: Configurational Recipes for Sub-Saharan Africa. *J. of Business Research*.

(foreign and local), (2) government policy incentives, (3) effective intermediate industry institutions, and (4) educational effectiveness. As regards intermediate institutions, these are the “departments” that the higher education system has created to facilitate UIC. According to Villani, Rasmussen, & Grimaldi (2016)⁶¹, Technology Transfer Offices (TTOs), University Incubators (UIs), and Collaborative Research Centers (CRCs) have been established to mitigate the existent barriers to knowledge transfer.

Even with many different studies presenting the factors to enhance or factors that can inhibit knowledge transfer, there is always an issue that is crucial at all inter-institutional relations: the organizational culture. According to Bjerregaard (2010)⁶², firms and universities face major challenges when attempting to work together due to the existence of different institutional cultures. While firms are typically result-oriented, universities are driven by cultures that emphasize scientific performance unrelated to profit or market considerations (Partha & David, 1994)⁶³.

Up to now there have been presented several factors related to knowledge exchange success or failure. Following there will be presented a table summarizing the most important concepts that can be evaluated under a questionnaire (future research). The main goal is to identify the most relevant factors to knowledge exchange success.

Table 2. Main Factors for Knowledge Transfer Activities

Factor	Authors
Communication / understanding	(Oyemomi et al., 2016); (Ankrah & AL-Tabbaa, 2015); (Bekkers & Freitas, 2008); (Barnes et al., 2002); (Plewa et al., 2013); (Hooff & Ridder, 2004)
Existence of intermediate institutions (TTOs, Collaborative Research Centers, University Incubators,...)	(Osabutey & Jin, 2016); (Ankrah & AL-Tabbaa, 2015); (Villani et al., 2016)
Financial support	(Ankrah & AL-Tabbaa, 2015); (Muscio et al., 2012); (Osabutey & Jin, 2016)

⁶¹ Villani, E., Rasmussen, E., & Grimaldi, R. (2016). How Intermediary Organizations Facilitate University – Industry Technology Transfer: A Proximity Approach. *Technological Forecasting & Social Change*.

⁶² Bjerregaard, T. (2010). Industry and Academia in Convergence: Micro-Institutional Dimensions of R&D Collaboration. *Technovation*, 30(2), 100–108.

⁶³ Partha, D., & David, P.A. (1994). Toward a New Economics of Science. *Research Policy*, 23(5), 487–521.

Factor	Authors
(In) existence of cultural differences between the world of academia and of industry	(Ankrah & AL-Tabbaa, 2015); (Bjerregaard, 2010); (Partha & David, 1994)
Information networks	(Ankrah & AL-Tabbaa, 2015)
Leadership support / Management involvement	(Oyemomi et al., 2016); 2015)
Learning and training	(Oyemomi et al., 2016)
Level of university research capabilities	(Ankrah & AL-Tabbaa, 2015); (Maietta, 2015)
Nature of the knowledge exchange (explicit or tacit)	(Ankrah & AL-Tabbaa, 2015)
Policy; legislation; regulations	(Ankrah & AL-Tabbaa, 2015); (Osabutey & Jin, 2016)
Previous experience in exchange activities	(Blackman & Segal, 1991); (Dahl & Pedersen, 2005); (Muscio et al., 2012)
Proximity	(Maietta, 2015); (D'Este et al., 2013); (Ankrah & AL-Tabbaa, 2015); (Muscio et al., 2012)
Resources:	
Human (team work, flexibility, personal exchange)	(Ankrah & AL-Tabbaa, 2015); (D'Este & Patel, 2007)
Cost	(Anatan, 2015); (Kim, 2009); (Plewa et al., 2013)
Time	(Anatan, 2015)
Territory characteristics	(Maietta, 2015)
Trust (Personal relations)	(Ankrah & AL-Tabbaa, 2015); (Bekkers & Freitas, 2008); (Plewa et al., 2013); (Bruneel et al., 2010); (Dooley & Kirk, 2007); (Hemmert et al., 2014)

Source: The authors' own work.

Table 2 presents a summary of the factors that must be considered to implement and analyze the success of knowledge transfer. The factors presented here may be of different importance per the activity sector. However, the main purpose of this paper was the identification of the factors that can influence knowledge transfer regardless of the activity sector. For specific purposes, in future research, particular characteristics of activity sectors must be considered.

4. Conclusion

From this research, some main conclusions can be drawn in order to better understand the conditions for knowledge transfer, in particular from higher education institutions (directly or through their intermediaries) to industry.

The first conclusion is related to the major role that the higher education system plays in supporting innovation under knowledge transfer activities. However, it is important to mention that the same factor can be identified as a barrier or as an enhancer, depending on the context and stakeholders involved. For instance, past successful experiences among the stakeholders will decrease the costs of collaboration/cooperation.

The process for knowledge transfer takes most of the times three main steps: Exploration, Acquisition and Exploitation. Depending on the maturity in knowledge transfer of the institutions involved, each interaction may start at a different step. For a firm that is just starting to engage in innovation activities, knowledge transfer is the recommended approach to explore the market. However, for a firm and knowledge producer (Higher education) that have been working together, for a new project, knowledge transfer may not be the only option. It can start immediately with the exploitation of knowledge for both stakeholders.

The factors that are most frequently referred to in the literature as determinants for an effective knowledge transfer or exchange are: Communication, Funding, Organizational issues (organizational culture), Previous experience, and Trust. However, despite the fact that these are the most important factors, it does not mean that others (see Table 2) should not be considered. A deeper literature review may unfold other factors, but according to this research, the factors presented at Table 2 were considered the most frequent, thus most relevant.

Following this paper, the project (COTRANS) will go on with the design of a semi-structured interview to assess companies' perceptions regarding the transfer of knowledge before a number of factors. This will allow us to test the factors that were now identified in different industries in an effort to understand the main differences between the factors depending on the industry.

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Stymulanty i bariery w procesie transferu wiedzy – przegląd literatury

Streszczenie

Celem artykułu jest wskazanie motywatorów i barier w procesie transferu wiedzy. Punktem wyjścia jest fakt, że obecna współpraca pomiędzy biznesem a środowiskiem akademickim jest niezwykle istotna dla rozwoju biznesu i tworzenia w jego ramach wartości. Zarówno przedsiębiorstwa, jak i organizacje B + R uznają rolę tej współpracy, niezbędnej do tworzenia zróżnicowanych produktów i usług, a także budowania przewagi konkurencyjnej. Praca została oparta na krytycznej analizie literatury przedmiotu i pokazuje wstępne rezultaty trwającego projektu, którego celem jest zbudowanie pojęciowego modelu transferu wiedzy. Pierwszym rezultatem było zidentyfikowanie czynników, które uznano za bariery i motywatory transferu wiedzy oraz – konsekwentnie – za działania innowacyjne. Dla przedsiębiorstw (poziom mikro), regionów i krajów (poziom makro) są to kluczowe elementy wzrostu i rozwoju. Metodologia wykorzystana w artykule bazuje na przeglądzie literatury przedmiotu, który pozwolił zidentyfikować główne aspekty transferu wiedzy – zarówno pozytywne, jak i negatywne – oraz umożliwił stworzenie kwestionariusza, wykorzystanego jako narzędzie w badaniu przedsiębiorstw w wybranych krajach (służyło to pokazaniu motywów działania w różnych kulturach). Wśród czynników wpływających na transfer wiedzy respondenci najczęściej wymieniali współpracę nauki i biznesu. W artykule wskazano też kilka czynników, które dla pewnych badanych przedsiębiorców okazały się stymulantami, a jednocześnie dla interesariuszy stanowiły bariery. Wśród nich były: koszt współpracy, komunikacja, kompetencje, dostępność centrów transferu technologii.

Słowa kluczowe: transfer wiedzy, stymulanty transferu wiedzy, destymulanty transferu wiedzy, uwarunkowania transferu wiedzy

