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Perspectives on Innovation and Technology Transfer

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Abstract

In an effort to understand development of economics, research fields such as innovation and technology transfer have emerged. Growing competition determines the importance of innovation and technology transfer. The purpose of the Paper is to identify qualitative relationships between innovation and technology transfer. The review of innovation, technology and technology transfer definitions and focus group discussion were used to formulate the research question: What are the relationships between innovation and technology transfer? The qualitative content analysis research approach was used to analyze the obtained data from the focus group discussion. The systematic search of scientific literature was performed to collect the existing review papers on innovation and technology transfer classifications. Another focus group discussion was conducted to confirm the obtained results. This research shows that three different kinds of relationships between innovation and technology transfer may be identified. Perspective of innovation and technology transfer overlap may be considered as the dominant within a society.

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Introduction

The growth of competition forces companies to look for solutions in order to gain competitiveness. Schumpeter (1934) argues that development is the result of the entrepreneur's innovative ability and introduction of new methods of production, but Schumpeter does not explicitly mention where these new methods come from (cited in Antonelli & De Liso, 1997). Transfer of technology may solve this issue. Innovation has been nominated as the driver for the economic growth (see e.g. Van de Ven, 1986; OECD, 2007; Dutta, Lanvin & Wunsch-Vincent, 2014) and is an often used term in economics and management, and other fields of study (Gopalakrishnan & Damanpour,

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1997). Technology transfer has been emphasized as a challenging task (Hossain, 2012; Cohen, 2004) and important driver in innovation and the creation of sustainable growth (Allen and O'Shea, 2014). Technology transfer as an important task in a wider context has been approved within different fields of research (see e.g. Mom, Oshri, & Volberda, 2012; Dasgupta & Taneja, 2011; Morrissey & Almonacid, 2005; Kneller, 2001; Grotz & Braun, 1993) as well as in the regulation and policy planning documents (Association of University Technology Managers, n.d; European Commission, 2010a; European Commission, 2010b). The growing number of innovation and technology transfer studies followed by different kinds of theories and concepts developed, typologies and taxonomies proposed, forming different relationships between these concepts. Taking into consideration the importance of innovation and technology transfer and possible link between these terms, the purpose of the Paper is to identify relationships between innovation and technology transfer. Accordingly, the following research question was developed: What are the relationships between innovation and technology transfer?

1. Innovation and Technology Transfer defined

Schumpeter (1934) defines innovation as carrying out new combinations – launch of a new product or new species; an application of new methods; an opening of a new market; an acquiring of new sources of raw material supply or creation or destruction of a monopoly organization. Innovation is seen as the process of generation, acceptance and implementation of new ideas, processes, products or services (Thompson, 1965) as well as an outcome – any thought, behavior or thing that is new (Barnett, 1953), new ideas (e.g. Van de Ven, 1986), new technology or practice (Nord and Tucker, 1987). Damanpour (1996) encompass a range of outcomes, including a new product or service, new process technology, a new organization structure or administrative systems, or new plans or programmes pertaining to organization members. Important contribution to innovation was made by Altshuller (2007) defining levels of innovation.

Technology transfer has been characterized as adoption of innovation (Rogers, 1962 cited in Sazali & Raduan, 2011), application of technology, technique or knowledge (Melkers, Bulger, & Bozeman 1993 cited in Phillips, 2002) that has been developed in another organization. In simple, an application of technology to a new use or user (Gee, 1981 cited in Sazali & Raduan, 2011). It can also be viewed as production of a new product and more efficient production of existing products (Das, 1987 cited in Sazali & Raduan, 2011) that are moved to the marketplace (Phillips, 2002). The forms of technology embrace physical items such as tooling, equipment and blue prints as well as the information – methods and procedures (Teece, 1977).

2. Methods

The review of innovation, technology and technology transfer definitions, focus group discussions and systematic search of literature were used in this Paper as research methods. Based on practical experience of the authors' and review of definitions the possible research question revealed. The focus group discussions as a qualitative research method were used to confirm the importance and validity of this question as well as to confirm discovered relationships between innovation and technology transfer. Gill, Stewart, Treasure, & Chadwick (2008) argue that the focus group discussions are used for generating information on collective views and the meanings that lie behind those views. In addition, they are useful in generating a rich understanding of participants' experiences and beliefs (Morgan, 1998 cited in Gill, Stewart, Treasure, & Chadwick, 2008). In this case, advantages of the focus group instead of multiple One-on-One interviews are that one focus group meeting uses fewer resources (time and money) and group members can react to and build upon each other's responses to produce information or ideas that they might not think of on their own (Office of Quality Improvement, 2007). The doctoral students are one of the stakeholders involved in developing scientific findings that potentially will be transferred from University to another organization for the purpose of further development or commercialization. Thus, doctoral students from various fields were invited to participate in the focus group discussions. In the first discussion, they were asked to answer following questions: "What is innovation and what characterizes it?"; "What is technology transfer and what characterizes it?" Content analysis of qualitative data obtained from the focus group discussion was processed using NVivo software. Data coding was performed in several rounds independently by both authors of the Paper to ensure

validity of the findings. Moreover, assigned codes were discussed and the results were presented through consensus. In the second discussion, participants were asked to confirm or reject the obtained results in this research.

The researchers may have a specific reason for reviewing literature (Booth, Papaioannou, & Sutton, 2012). Hart (1998) asserts that reasons for reviewing literature include identifying the relationships between ideas and practices as well as synthesizing and gaining a new perspective (cited in Randolph, 2009). Booth, Papaioannou, & Sutton (2012) suggest that every review has to be more or less systematic, but it is only useful where a significant amount of literature is already known to exist. Khan, Kunz, Kleijnen, & Antes (2003) argue that reviews should never been done in any other than systematic way. In this paper the systematic search approach (Grant, & Booth, 2009) was chosen to collect data by means of different kinds of typologies and taxonomies of innovation and technology transfer. Briner & Denyer (2012) argue that the traditional review methods fail to identify clearly what is known and unknown about the given topic and suggest reviews of existing research evidence. Therefore, a research of already done reviews was performed. In the methodology literature this is called as the umbrella review approach or overview of reviews (Pare, Trudel, Jaana, & Kitsiou, 2015) and considered as a relatively new approach (Higgins & Green, 2011). However, it should also be considered that the systematic approach offers objective inference based on available evidence and not a description of everything on the subject (Hansen & Trifkovic, 2013). A draft search before the full systematic search was conducted in order to define and precise the keywords as well as the criteria for inclusion and exclusion of literature. The systematic search was performed in February 2015 and the following databases were used: Scopus, Web of Science, IEEE Xplore Digital Library, ScienceDirect, WILEY Online Library, Taylor & Francis, SAGE Publications. The search was limited to the articles published until year 2014. The following inclusion criteria were used for this review: type of study – 1) literature review reporting innovation typology(ies) or taxonomy(ies), 2) literature review reporting technology transfer typology(ies) or taxonomy(ies); the publication language – English. Literature, that was once already included, was excluded from the review as well as the studies with no full text available. Search strings developed and used for the systematic search are shown in the Appendix A.

3. Results and discussion

The obtained results from the focus group discussion (see Appendix B.) provide the insight from viewpoint of one of the stakeholders involved in the innovation development and technology transfer process. According to those results, both of the terms are described as a system, a process of development (considering that by innovation also an outcome of this process is understood) to improve something, thus forming an overlap between terms as well as showing that innovation as an outcome includes technology transfer as a tool. Both, innovation and technology transfer characterizes development made for the end users, as well as the application of already existing technology – adoption of innovation in case of innovation or inbound technology transfer in case of technology transfer. Innovation also can be considered as an outcome with a certain degree of novelty. Therefore, it may be considered that technology transfer includes innovation in case of an application of already existing innovation (inbound technology transfer). The obtained results from the focus group discussion are in line with the viewpoints provided by scholars (mentioned previously in the article).

The initial systematic search strategy resulted in 360 records. Four articles were found relevant to purpose of this study. The results of the systematic literature search are shown in Table 1.

Table 1. Overview of innovation and technology transfer classification reviews.

Field of study	Source	Classifications presented
Innovation	Garcia & Calantone (2002)	Newness factors (“new to” and “new what”) Categorizations to label degree of innovativeness
	Hang, Neo, & Chai (2006)	Categories of Discontinuous Innovations
Technology Transfer	Zhao & Reisman (1992)	Various taxonomies by discipline and perspectives taken within discipline as well as by perceived role of technology transfer
	Reisman (2005)	A Cross-disciplinary meta taxonomy

Source: Data obtained through systematic search conducted by authors.

Reviews included in this study do not meet the criteria (see Booth, Papaioannou, & Sutton, 2012) to be considered as full systematic reviews. However, they provide us with the insight to classifications of innovation and technology transfer, that allows to discern commonalities and differences between these terms. Different kind of relationships between innovation and technology transfer appear from the review of definitions, results of the first focus group discussion and classifications provided by the systematic search show. The graphical model of these relationships is shown in the Fig. 1.

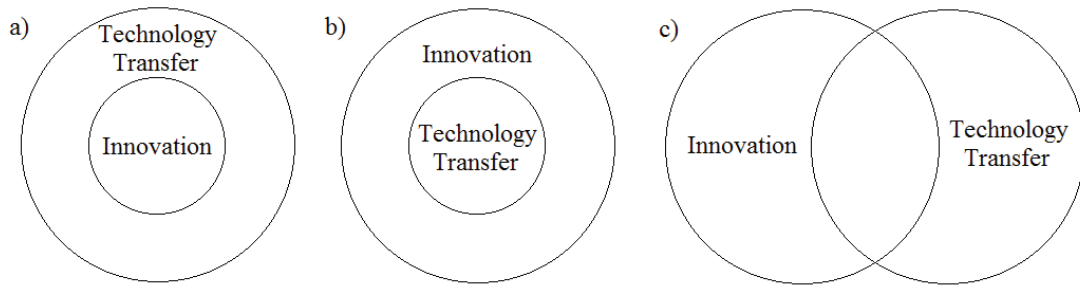


Fig. 1. Relationships between innovation and technology transfer.

Relationships between innovation and technology transfer unveil different kind of perspectives on innovation and technology transfer: a) technology transfer includes innovation; b) innovation includes technology transfer and c) innovation and technology transfer overlap. The results of the second focus group discussion confirm the discovered relationships. The focus group also estimates that the perspective where innovation and technology transfer overlap is dominant and recommends future research on a global level. In addition, there is still a question how strong is the overlap of innovation and technology transfer and which are the points of the contact.

Overlapping of diffusion of innovation and technology transfer has been emphasized by Addiction Technology Transfer Center Network Technology Transfer Workgroup (2011) and Cottrill, Rogers, & Mills (1989). Based on the analysis done, this study complements the previous research on relationships between innovation and technology transfer and gives new perspectives on these divergent fields of study.

Conclusions

In the conducted systematic search relatively small number of reviews of innovation and technology transfer classifications were retrieved. None of them can be considered as a full systematic review. The research results show that there are three different perspectives on innovation and technology transfer. Innovation and technology transfer overlap may be considered as the dominant one. However, further research is required to confirm this on a global level. According to the relationships between innovation and technology transfer, it can be considered that tools, techniques and methods are applicable from one field explored to another. That is also a recommendation for future research. Considering the results of the performed systematic search, the conduction of full systematic review of innovation and technology transfer classifications is recommended.

Further research is needed to provide understanding of technology transfer importance for development of certain degree of novelty. The meta review on relationships between degree of novelty and performance of an organization using the systematic approaches to a literature review is also recommended for future research.

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Appendix A. Search strings

What types of innovation exist within scientific literature?	What types of technology transfer exist within scientific literature?
innovation (title) AND review (title) AND taxonomy (all)	technology transfer (title) AND review (title) AND taxonomy (all)
innovation (title) AND systematic (title) AND taxonomy (all)	technology transfer (title) AND systematic (title) AND taxonomy (all)
innovation (title) AND overview (title) AND taxonomy (all)	technology transfer (title) AND overview (title) AND taxonomy (all)
innovation (title) AND synthesis (title) AND taxonomy (all)	technology transfer (title) AND synthesis (title) AND taxonomy (all)
innovation (title) AND meta (title) AND taxonomy (all)	technology transfer (title) AND meta (title) AND taxonomy (all)
innovation (title) AND state of the art (title) AND taxonomy (all)	technology transfer (title) AND state of the art (title) AND taxonomy (all)
innovation (title) AND review (title) AND typology (all)	technology transfer (title) AND review (title) AND typology (all)
innovation (title) AND systematic (title) AND typology (all)	technology transfer (title) AND systematic (title) AND typology (all)
innovation (title) AND overview (title) AND typology (all)	technology transfer (title) AND overview (title) AND typology (all)
innovation (title) AND synthesis (title) AND typology (all)	technology transfer (title) AND synthesis (title) AND typology (all)
innovation (title) AND meta (title) AND typology (all)	technology transfer (title) AND meta (title) AND typology (all)
innovation (title) AND state of the art (title) AND typology (all)	technology transfer (title) AND state of the art (title) AND typology (all)

Source: Data developed by the authors for purposes of this Paper.

Appendix B. The essence of innovation and technology transfer

Innovation	Technology Transfer (TT)
<ul style="list-style-type: none"> • A process of change <ul style="list-style-type: none"> – Improvement or development of something new with a certain degree of novelty or even a unique outcome – Application of existing technology or system for other purposes (new meaning, qualities, functions) – Solving unsolved problems or topical problems for society (better serving of needs) • An outcome – (new) idea, product, technique, method or technology • A system • May involve different kinds of stakeholders 	<ul style="list-style-type: none"> • A process of change <ul style="list-style-type: none"> – Outbound TT – development and application; creating new technology, as a basis using something existing – Inbound TT – development of technology by improving it; adoption of technology) • A system • Different kind of stakeholders on individual (people), organizational (University – Manufacturing) and macro levels (different sectors; Industry – Science – Society) as well as various geographical locations are involved. • Results as innovation(s)

Source: Data obtained from the focus group discussion conducted by the authors.

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