

COOPERATION BETWEEN KNOWLEDGE-BASED INSTITUTIONS AND BUSINESS: EMPIRICAL STUDIES AND NETWORK THEORIES

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ABSTRACT

The issue of broadly-understood ties and collaboration between business and science is one of the key issues constituting the foundations for the modern knowledge-based economy, which relies on innovations and competitiveness in technically and scientifically advanced branches. The article outlines the theoretical perspective for studies on the effects of this cooperation. Taking into consideration the richness of the aspects and sub-issues of the problem which should be analysed, the paper implicitly prepares the "groundwork" for more detailed empirical studies based on the overview of different approaches and methods used in the literature, concluding - not only from the literature but mainly from the special characteristics of the "start-up world" - that the most suitable theoretical approach for properly constructed empirical studies is the network theory in general and the social capital perspective in particular. The subject of "hard" forms of cooperation between science institutions and business (start-ups in particular) requires more insight into the network approach to entrepreneurship. Secondly, the article presents an overview of the literature, concentrating on studies which analyse cooperation between knowledge-based entities (universities) and business in practice, as well as a detailed example of one such case study. The case study which was discovered in the literature, namely cooperation between Ericsson and ITU, is related to network concepts discussed in the theoretical part.

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Introduction

The issue of broadly-understood ties and collaboration between business and science is one of the key issues constitut-

ing the foundations for the modern knowledge-based economy, which relies on innovations and competitiveness in techni-

cally and scientifically advanced branches. Thus, the rapid rise in commercial knowledge transfers from universities to the market, usually referred to as “university–industry technology transfer”, is considered one of the basic factors of the international competitiveness of today’s economies. As Bodas et al., (2013) aptly sum up: “since the economies and indigenous technological capabilities of the new industrialised countries improve, national universities and public research organisations are expected to become increasingly important for supporting indigenous firms to move into more dynamic and high-opportunity industries”. Taking a wider perspective, it is especially interesting to find out whether, how and to what extent knowledge institutions and knowledge networks are embedded into the business world and market relationships.

Building and supporting relationships between science institutions and business practitioners considerably contributes to the fulfilment of the main goals and tasks of the actual key strategic policies of the European Union, such as the *EU Research and Innovation Program Horizon 2020*. Thus cooperation between knowledge-based institutions (universities, science centres, scientific think-tanks, and other scientific entities) plus the real economy (business, industry etc.) not only constitutes an important research problem but is also very much “in fashion” at the moment: lively discussions and debates in the public forum and in policy on different levels (domestic, regional, international). There are also a number of strategic reports and institutional documents (prepared by/for different ministries and governmental agencies) in Poland highlighting the importance of innovative potential and internationalisation perspectives of small innovative firms for the future of the Polish economy. Among others, most of those documents accentu-

ate the role of the ties between business and academia/scientific institutions and networks in contributing to upgrading the innovativeness of the economy. They involve e.g. the National Development Strategy 2020 [*Strategia Rozwoju Kraju 2020*], “Poland. 2030, the Third Wave of modernity” [Polska. 2030 *Trzecia fala nowoczesności* MAiC, 2013] and the “Strategy for Responsible Development” [*Strategia na Rzecz Odpowiedzialnego Rozwoju*].

The issue of cooperation between knowledge-based institutions and business is part of my research project on the effectiveness of cooperation between knowledge-based institutions and start-up companies in the EU countries, and the associated scores on the innovativeness rankings. It seems very interesting to concentrate on a chosen aspect of the issue as a whole, namely start-up companies, and to analyse the perspectives for their collaboration with academia and other knowledge-based entities, because those companies constitute relatively new “market phenomena” in Poland¹. To date there have not been many publications or scientific studies on different aspects of this special type of small and micro firms in Poland; we have only fragmentary wisdom and information on them at our disposal, with practically no statistical data (the existing few reports have been prepared by private companies, or institutions use data mainly from their own surveys and interviews). On the other hand, the rapid growth of those firms has been observed; they are presented in the media and in public debate as well as in official strategic documents concerning future economic

¹ The first such publications and reports were published no earlier than 2015 with the “Polish Startups Report” (*Raport Polskie Startupy 2015*) elaborated and edited by the *Fundacja Startup Polska* foundation as the first comprehensive document presenting the definition of Polish startups.

development (not only on a European, but also on a global scale) as “at the top” or “in fashion”. Thus, cooperation between them and knowledge-based institutions in Poland (universities, scientific institutes, research centres etc.) constitutes a promising and perspective-opening field for more detailed studies.

The goal of the article is two-fold. Firstly, it attempts to find, outline and develop the theoretical background for future empirical work on the subject. I will briefly outline the network theory, as in my opinion network theory will be the most suitable perspective (considering the peculiarity of the start-ups as companies, characteristics of their business existence and activity as well as start-up ecosystems' specificity) for analysing the problem. I then choose two concepts: *the social capital perspective* (part of the general network concept) and the *network approach to entrepreneurship*, and will attempt to relate the general characteristics of the system of relations between start-up companies and knowledge-based institutions in Poland to those two theoretical concepts².

Secondly, the article presents an overview of the literature, concentrating on studies which analyse cooperation between knowledge-based entities (universities) and business in practice, as well as a detailed example of one such case study. The article concludes with a schedule which I devised to constitute the framework for my future work on the subject.

1. Relations between knowledge-based institutions and start-up ecosystems: network theory

The issue of relations between business and knowledge-based institutions theoretically lies in a cross-section of different research domains, such as knowledge, business, entrepreneurship and innovations. Thus it can be tackled from different perspectives and on various problematic levels.

At the very beginning, it should be pointed out that knowledge-based institutions can be treated more concretely as part of the business environment, potentially providing the business with the infrastructure in a physical sense, and moreover with their representatives (individual researchers, teams of scientists, entire institutes/departments/chairs etc.) in a social sense, playing the role of important actors on the business scene. Thirdly, we can see them in a more “intangible” sense when we refer to the spillover of ideas, knowledge and information - coming from e.g. universities - within the studied ecosystems. Moreover, their impact might refer to different domains of the start-ups' environment and can be realised at different stages of those business entities' emergence and development. It should also be pointed out that, as many authors highlight, building relationships between scientific institutions and business practitioners is not easy in practice, since they represent two different “worlds” in a cultural, social (mentality) as well as economic sense.

Taking such a multi-dimensional attitude to analysing the issue which is the subject of research is consistent with a holistic approach in tackling and covering the various analytical problems of start-up ecosystems, commonly accepted in the literature (partly

² The search for the proper framework for analysing the cooperation between knowledge-based (e.g. research/academia) institutions and business (industry) in general, and start-up companies in particular, constitutes a necessary step and plays - in my opinion - an important role in some of the middle-phase in devising the best model to put this collaboration into practice and ensure its greatest possible effectiveness.

as an effect of a kind of consensus among researchers). Indeed, start-ups – as well as the environment they exist in – represent the typical “network society” with tens and hundreds of entities combined through the network of synopsis called “financing”, “meetings”, “workshops”, “hackathons”, “clusters”, “summits”, “incubators”, “mentoring”, “knowledge bases” and so on. The channels and fields where cooperation between knowledge-based institutions and start-ups really exist (or can potentially exist) in practice can be identified and defined in the network theory perspective.

The network itself is a concept which emerged from the mathematical and physical sciences and is commonly analysed under the auspices of such disciplines as sociology, management and economics (each taking its own perspective). In sociology the network research focuses on strong and weak social ties from outside of the individual's contacts and interrelations with friends and family providing heterogeneous information (Granovetter, 1973). The networks consist of defined actors who bring about new information, knowledge and resources. The disciplines of Management and Sociology maintain that social networks are beneficial to entrepreneurs, constituting an important ingredient in the entrepreneurial process at different stages such as founding the company, mastering business, success, profits etc. (Granovetter 1973; Jack 2010; Zimmer and Alrich 1987; Knoke and Yang 2008; Scott, 1994). However, it seems that so far consensus among them as to the role of networks in entrepreneurship, and more specifically the relationship between knowledge spillovers and entrepreneurship, has not been reached. An attempt to find a conceptual framework and combine the different disciplines in studying the issue was made by Hayter (2013), who distinguished three main perspectives, namely the network

approach to entrepreneurship, the social capital perspective and the relational view perspective – the first of which emerged from management science, the second from sociology and the third representing the dynamic approach. Currently the author underlines that there are not many differences in the way those perspectives perceive networks, and all of them appreciate the role of networks as an important framework and condition for entrepreneurship as well as business success at each stage of the company's lifecycle.

From the empirical observations concerning the relations between start-up companies and knowledge-based institutions in Poland, it should be noted that those ties can occur in two main forms which also have to do with the level of formality of such cooperation. The first refers to personal contacts with the exchange of soft skills and knowledge; the second is “hard cooperation” realised in a more tangible way, such as working on projects together, common financing, transferring the results of scientific research into business practice or converting them into real products and services on the market.

Those two “forms” of science-business networking, and particularly the studies on them, should be considered from the perspective of the first two theoretical approaches mentioned respectively. More specifically, soft networking should be analysed from the social capital perspective, whereas “hard forms” of cooperation between knowledge-based institutions and start-up companies should rather be related to the network approach to entrepreneurship.

The social capital perspective of network theory (under which the first, “soft” variety of relations should be analysed) derives from sociology and is represented in literature, e.g. by Scott (1994) or Hayter (2013). According to this approach, the network

is a conceptual framework entailing a set of actors and ties representing certain relationships (or a set of relationships) between the actors who, in practice, play the role of the source of resources which are, or can potentially contribute, to the success of the given business entity. This approach suits start-up problematics particularly well due to the specific characteristics of those companies because, according to practitioners, it is not only the organisation looking for its optimal, effective and scalable business model; good start-up means above all the people who create it and are its most precious production factor. Teams which combine people with different interdisciplinary education and skills (business, technical, design, marketing etc.) are indispensable when it comes to creating innovative solutions able to conquer the market.

However, this can sometimes be difficult, since academia and industry usually represent a different "mentality" and viewpoints as to "relevance, rigor, home horizons, planning practices and predictability" (as characterised by Sandberg and Arts 2011: 60). The social perspective is indispensable when looking for means of effective collaboration between academia and industry, i.e. that which ensures the real effects of the knowledge transfer from the researchers to business (product or service implementation). The improvement of the collaboration process is subject to "collaborative practice research" - the approach implemented by Mathiassen (2002) which is based on both teamwork (practitioners and researchers) and methods such as practice studies, experiments and action research.

Another conceptual problem emerges when we try to establish or identify the special place which the knowledge-based institutions occupy in the start-up environment in Poland and when attempting to

refer them correctly to theory; namely, to state whether the "start-up ecosystem" itself is a kind of "sole" sphere or whether in practice it constitutes a part of the "normal" market system consisting of the market entities normally functioning in the "local" economy which are "accidentally" also involved in the start-up ecosystems. At this stage of reasoning, it could be assumed that the start-up ecosystem is in fact embedded in the usually functioning schedule of market ties between actors who are or can occasionally be engaged in emerging, establishing and/or the activity of start-ups (which happens mainly in the high-tech, communication or Internet-related branches) – thus the start-up ecosystem is nothing more than a subset of the model market system.

Taking the perspective which focuses mainly on the intensiveness and quality of social networks (for more see Aarstad et al., 2010; Lechner et al., 2006; Bechky 2003) the key concept here is obviously the "ties" or relations between the actors, plus their density, meaning in fact the density of networks themselves (Hayter 2013). Thus, in the empirical study I will try to identify the social relations specific to start-up ecosystems in Poland by denoting the "places" or "structures" where those relations "come into existence", accentuating where and in which ways knowledge-based institutions are embedded or can find a place in those networks. Later in the empirical study, I will focus specifically on the mechanisms and practical effects of the ties identified here (a comprehensive database of the actors of start-up ecosystems in Poland will be constructed).

I have presented some notes on how to relate the study on relations to the social capital perspective theory. The subject of "hard" forms of cooperation between those two "worlds" of science and business requires more insight into another theoretical

approach, namely the network approach to entrepreneurship. Considering the expected volume of this paper, only a general outline of this perspective will be included.

The network approach to entrepreneurship comes from management science and assumes that "the company is embedded into the social, professional and other relations with the web of actors". By studying the real connections of the company to a network, the authors suppose a wide array of benefits for the company may result from networking, as information and resources derived from the networks are said to be important for the company's functioning and performance. Among them are mitigating the costs of setting up a new firm and the cost of obtaining and providing information at the stage of establishing the new start-up. The importance of the links and networking with science institutions such as universities in general is laid out in the works of Grandi and Grimaldi (2003) and Hagedoorn and Schakenraad (1992). According to their studies, contact, networking and partnerships with trusted organisations including universities are a positive signal to other resource providers (Wright et al., 2007; Aldrich and Zimmer 1986).

When analysing the existing and potential benefits resulting from the cooperation among start-up companies and representatives of knowledge-based institutions concerning its real, i.e. practical, effects, a number of benefits should be taken into consideration. Thus, the empirical studies should be put into the framework of the "network approach to entrepreneurship". For this reason, I am going to refer my analysis of the Polish ecosystems to the chosen issues covered under this concept (Wright et al., 2007; Baum and Silverman 2004; Lee et al., 2001), among them technological aspects, as well as the mutual exploitation of human and financial re-

sources in projects undertaken by science start-up teams and consortiums. Another focus of the current study will be how and to what extent knowledge exploitation improves the firms in question, as well as how it contributes to accelerating the growth of firms, gaining competitive advantage through e.g. professional management, product development, sales effectiveness and technical assistance.

2. Literature review

The literature overview herein concentrates on studies which analyse cooperation between knowledge-based entities (especially universities) and business in practice. Additionally, to demonstrate how case studies in particular are tackled by researchers, I presented one detailed example of a study analysing the collaboration between the Information Technology University and Ericsson (Goteborg, Sweden).

Transferring basic research from knowledge-based institutions (academia in particular) to practitioners (the market) through commercial applications via start-ups or research joint ventures has always involved a few of the traditional forms and methodologies such as innovation diffusion, value chains or collaborative research with industry (Rombach and Achatz 2007). Also, one of the basic channels for the direct commercialisation of academic research is patenting innovations worked out or invented by university scientists or other researchers (licensing agreements). Moreover, many authors highlight the relevance of collaborative research, contract research, consulting and informal relationships for university–industry knowledge transfer as discussed here.

As long ago as 1998, Meyer-Krahmer and Schmoch (1998) carried out studies on co-operation between industrial firms and universities in Germany and the patterns of the interaction between the two

sides in different technological fields. The authors concluded that "(...) in science-based fields, university departments have a distinct focus on basic research and the major interest of industry is the observation of science. In less science-based fields, the solution of technical problems is a major concern of industry. In all fields, the exchange of knowledge in techno-scientific communities is a crucial element of interaction". Valentin and Jensen (2007) studied the contribution made by university scientists to inventions patented by dedicated biotech firms (DBFs) specialising in the discovery of new drugs in Denmark and Sweden (in terms of comparing the new law on university patenting in Denmark with unchanged regulations in Sweden) based on original data on all 3640 inventor contributions behind the 1087 patents filed by Danish and Swedish DBFs in 1990-2004 (Valentin and Jensen, 2007). A highly interesting case study on industry-academia collaboration was conducted by Münch et al. (2013). Using this database, they analysed cooperation with the goal of creating a minimum viable product (MVP) in order to identify the strengths and weaknesses of such an approach and to provide practical recommendations for improvement. The authors concluded that the process is suitable for creating MVPs, as it contributes to reducing company-specific risks when testing customer value, as well as upgrades university education.

Siegel et al (2003) analyse the process of "university-industry technology transfer" (UITT) and its outcomes based on 98 structured interviews of key stakeholders, such as university administrators, academic and industry scientists, business managers, and entrepreneurs at five research universities in two regions of the US. One of the crucial observations of this research, as also evidenced in many other publications, is that those stakeholders in fact rep-

resent two "different worlds" because they have different perspectives on the desired outputs of collaboration. The authors also identified numerous obstacles to effective technology transfer, e.g. bureaucratic inflexibility, ineffective management at academic institutions and mentality (cultural) discrepancies, and formulated a set of recommendations to improve the situation. Other authors who focused on the issue in their studies are e.g. Collinson and Quinn (2010), Etzkowitz et al., (1998) and Perkmann et al., (2013). For example, Perkmann et al undertook a comprehensive review of the literature on the involvement of academic scientists in cooperation with industry (referred to as "academic engagement"). They highlighted the crucial differences between "traditional" academic activity and commitment (which is "pursued by academics to access resources supporting their research agendas") defined as "intellectual property creation" versus commercialisation, i.e. academic entrepreneurship. They concluded by identifying future research needs, opportunities for methodological improvement and policy interventions (Etzkowitz 1998). Etzkowitz writes on the "second revolution" when universities incorporated economic and social development as part of their mission. The author discusses numerous forms of the "capitalisation of knowledge".

Among other authors who researched the issue, Abramson et al., (1997), Agrawal and Henderson (2002), Bray and Lee (2000), Breschi et al., (2005), Meyer-Krahmer and Schmoch (1998), Davis and Lotz (2006), Owen-Smith et al., (2002), Rosenberg, (1994), Valentin (2003), Feldman et al., (2002), and Feller (2002) may be mentioned.

3. Business-academia co-operation: a case study analysis

To open the section devoted to presenting the chosen case study from research on academia-business cooperation in practice, it is worth noting that such analyses are usually aimed at finding the ways to improve the effects of such cooperation, which can be undermined e.g. by the insufficient ability to efficiently convey innovations from researchers to business practice³.

One of the best examples of collaboration between knowledge-based institutions and business is between Ericsson (a global developer of telecommunication equipment and services) and ITU University (Information Technology University) in Gothenburg (Sweden) which succeeded in integrating the ITU's research and teaching activities with the company's goals and led to the creation of the collaborative research centre for software architecture and quality (SAQC) in 2006. This case has been analysed finely and in much detail by Sandberg and Arts (2011) who - based on the Collaborative Practice Research method - comprehensively analysed eight years' experience of CPR between a telecommunications company and an academic research institute, and subsequently elaborated the model for successful cooperation.

The authors presented all the stages and activities taken up throughout the years of cooperative practice, dividing the whole process into several stages. The stages

were as follows: initialisation (2001–2004) involving the selected team's networking and start-up projects; alignment (2005–2006) consisting of activities to align the academic and research goals and tasks with Ericsson's global strategies; formalisation (2007–2008), which formally secured and refined the collaboration structure, providing it with e.g. a long-term financial perspective; and utilisation (2009–present), in which management is upgraded with the real effects which have been realised (knowledge commercialisation). In the last, i.e. utilisation phase, more attention was directed toward research into the impact on Ericsson's practices and the diffusion of knowledge throughout the company and on advancing academic knowledge. The central point of interest has always been how the project addresses needs on both general and unit levels and what the real impact of the project on deployments and industry practices is. All the concepts were tested in practice, and implementing improvements to the process was related to benefits for Ericsson (industry needs and goals) (Sandberg and Arts 2011).

Both the way the Ericsson-SAQC co-operation looked in practice, i.e. the way its activity developed, the character of the projects undertaken based on strict relations between representatives of both sides by e.g. creating teamwork systems, as well as the whole concept of CPR (the resulting method of analysis of the SAQC processes *per se*) unambiguously relates to the network concepts presented in the previous point of this article. Moreover, the entire "system", constituting the framework and logic of the Ericsson-SAQC collaboration, combines the views and points of interest characteristic of the concepts of both the *social network* and the *network approach to entrepreneurship*. Namely, it attempts to detect the soft social aspects of building the academia-industry cooper-

³ In response to certain imperfections, the so-called Collaborative Practice Research (CPR) was elaborated in the work of Lars Mathiasen, inspired by the method devised by Donald Schön. Collaborative Practice Research is generally intended to bring acting practitioners and "... researchers together to obtain desired improvements by using methods such as action research, experiments, and practice studies".

ation frameworks through showing competences, abilities and contributions at each stage of the SAQC's existence (together with differences between them pertaining to the viewpoints of those two professional groups with reference to "relevance, rigor, time horizons, planning practices and predictability"). The network perspective involves issues such as an exchange of both sides' skills, expertise, positioning themselves and each side's opinions on strategies for building cooperation (visions, goals and focus areas combined together and related to the needs of Ericsson) which in the Sandberg study and those of other authors serve the analysis of the project's outcomes and results in view of the main goal of the study: finding success factors for collaboration management. A practical issue that was to be resolved in the study was an organised way to communicate research activities and build effective communication structures (Sandberg and Arts 2011).

Relating the case study of the SAQC research centre to the two main types of cooperation between knowledge-based institution (academia) and business, it should be noted that the "hard aspects" of the issue involve the establishment of SAQC at Information Technology University and creating all the formal projects together with securing their financing. Those projects were established and realised at each stage of SAQC's existence, starting from e.g. *Software Process Improvement* (SPI) project, *Common Criteria Project* (CPR project) or *Flawless* project in the **initiation phase**; *Quick Check* project, *Consistency Project*, *Project to evaluate adapted software performance evaluation* (SPE) or metrics project in the **alignment phase**. Then, after formally making the Ericsson-ITU collaboration part of the SAQC and connecting it to Ericsson's global software research activities, there were a number

of advanced initiatives initialised and put into practice, among them: *Quality assurance-in-modelling* project, *Model-driven architecture* (MDA) roadmap project, *Agile software development project* as well as continuation (later phases) of the metrics project in the **formalisation phase**; and more mature phases of the *Agile software development project*, *Infrastructure utilisation* or *Viewpoint engineering project* in the **utilisation phase**. Most of the undertakings mentioned were completed. The goals of the projects were different: some are of a more typically engineering character and aimed at elaborating software or commercialising concrete solutions – the outcomes of scientific research. Others are "softer", i.e. they concentrated on team-building and delegating responsibilities within formed working groups. It is worth mentioning the third type: projects exclusively directed at academic activities such as conducting studies, courses and lectures, and organising visiting professors' stays at SAQC (Sandberg and Arts 2011).

To give some examples of the above-mentioned "types" of initiatives: the trace analysis project was a kind of proof-of-concept research aimed at developing a tool to visualise execution traces in an Ericsson product; the metrics project (part IV) had the goal of establishing quantitative early-warning systems in practice and resulted in new practices for the quality assurance of metrics. There are also a few examples of soft, academic-type undertakings, among them e.g. *Innovative teaching setup* where ITU focused on problem-based learning and organised project classes similar to industry work; *Guest lecturing SPI courses* within which Ericsson employees start giving the main part of lectures at SPI University courses at ITU (initiation phase); the formation of reference groups and group work sessions (Ericsson employees present their needs in a work-

shop); researchers engaged in group work sessions; or university courses held from 2006 to 2009 where senior line and project managers from Ericsson participated in courses and training on modern software development processes (alignment phase) and many others as well (Sandberg and Arts 2011).

Those “soft effects” of the SAQC, such as creating the teaching environment, organising courses, guest lectures (i.e. guest lecturing SPI courses in 2004-2010, model-driven development course and other ITU University courses in 2006-2009, practitioner integrated learning (PIL) projects, as well as e.g. system management training in the alignment phase) and other forms of education, are very important when viewing the discussed “case study” from the perspective of social network theory.

Special attention should be paid to the fact that teamwork within the framework of ITU-Ericsson collaboration was developed and undertaken in increasingly advanced forms. For example, during the alignment phase, there were 10-minute presentations made to enable participants to identify the prioritised problems and turn them into project proposals with predefined value to stakeholders and industry. During the formalisation stage, the steering groups (made of representatives from Ericsson’s software division and ITU) started to meet more regularly, i.e. quarterly. Get-togethers became quarterly reference group meetings led by a member of Ericsson’s global software research board. Reference and steering groups divided the work into three core research areas: metrics, modelling and agile software development. A more mature prioritisation of research themes and projects helped facilitate projects which increased the planning horizon.

Conclusions

The article outlines the theoretical perspective for studies on the effects of co-operation between science and business. Taking into consideration the richness of the aspects and sub-issues of the problem which should be analysed, this paper implicitly prepares the “groundwork” for more detailed empirical studies based on an overview of the different approaches and methods used in the literature. Secondly, the article presents an overview of the literature, concentrating on studies which analyse cooperation between knowledge-based entities (universities) and business in practice, as well as a detailed example of one such case study. The case study which was discovered in the literature, namely cooperation between Ericsson and ITU, is related to network concepts discussed in the theoretical part.

It is possible to draw a conclusion, not only from the literature but mainly from the special characteristics of the “start-up world”, that the most suitable theoretical approach as a base for the proper construction of the empirical studies is the network theory in general, and the social capital perspective in particular. The subject of “hard” forms of cooperation between science institutions and business (start-ups in particular) requires more insight into the network approach to entrepreneurship.

When viewing the cited study from a network theory perspective, a deep analysis of the process of elaborating teamwork within the ITU-Ericsson collaboration should be underlined. As the authors showed, it evolved from informal get-togethers and brainstorming discussions connected with presenting the expertise required and the fields of the potential contributions for a more formally organised exchange of knowledge and skills and executing common tasks.

The article brings about certain conclusions pertaining to the desired structure of my intended future studies. Namely, the entire logic of the study process on collaboration between knowledge-based institutions and start-up companies in Poland should be divided into the following phases:

- 1) identification of the institutions potentially engaged in cooperation between knowledge-based institutions and industry,
- 2) description of the existing institutional framework, i.e. special institutions designed for supporting such cooperation, such as (using Poland as an example) Technology Transfer Centres, Innovation Incubators etc. as well as financial programmes, financing institutions (Polish National Centre for Research and Development NCBR), all formal legal and financial institutions, tools and documents comprising the supporting framework for this collaboration.
- 3) analysis of the real impacts and results (soft and, above all, the hard, tangible ones, i.e. commercial applications) of this cooperation based on particular case studies identifying its strengths and weaknesses in order to build the most effective, successful and efficiently functioning ways, channels and forms of this cooperation.

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