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COOPERATION BETWEEN KNOWLEDGE-BASED INSTITUTIONS AND START-UP COMPANIES IN POLAND: AN OVERVIEW OF THE THEORETICAL BACGROUND FOR ANALYSING THE ECOSYSTEMS

Abstract

Start-up companies constitute a very "representative" phenomenon of the global economy and are its special "product", since they act mainly in the Internet-related and high-technology branches and they are usually seen as *born globals*. Thus, the type of their activity, implemented business models, products and services offered are "embedded" into the networks, i.e. not only of the local, but rather international and global markets. The same concerns the relations of those firms with other actors of the ecosystems, among others: institutions of science.

The problem of relations between start-ups (and business in general) and the knowledge-based institutions theoretically lies in the cross-section of different research domains and can be tackled from different perspectives and on various problematic levels. Taking such a multi-dimensional attitude in analysing the issue is consistent with the holistic approach in tackling and covering the various analytical problems of start-up ecosystems, commonly accepted in the literature (partly as an effect of a kind of consensus among the researchers).

Taking into consideration the richness of the aspects and sub-issues which should be analysed when studying the problem of the cooperation between start-up companies in Poland and knowledge-based institutions, the hereby paper implicitly prepares "the ground" for more detailed empirical studies basing on the overview of the chosen literature from the behavioural economy and social network theories. Then, there was the Polish ecosystem characterized with special attention put to the knowledge-based institution.

Keywords: start-up firms, network theory, social network theory, cooperation between science and business

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1. Introduction: general concept of the study

Start-up companies constitute relatively new "market phenomena" in Poland. However, considering the rapid growth of those firms and the fact that their activity complies with the desired economic goals and priorities of the "strategies for development" formulated by the official economic policy programmes in Poland[1] and the European Union, many aspects of the start-up ecosystems in Poland and Polish start-ups themselves constitute a promising and perspective-opening field for more detailed studies.

One of such themes concerning the activity of those firms which deserve more research attention is the cooperation between them and knowledge-based institutions in Poland (universities, scientific institutes, research centres, etc.). This problem is actually part of a wider issue of the broadly-understood ties and collaboration between business and science – very much desired and discussed in the public debate and in policy on the different institutional levels (domestic, regional, international).[2]

Considering the above, it seems to be an interesting research challenge to conduct broader studies on the potential, prospects, mechanisms and actual effects of the cooperation between the business represented in this particular case by start-up companies in Poland (as embodying some of the desired features of the high-potential small "companies of the future") and science – represented by knowledge-based (public) institutions like universities and research centres as well as individual researchers. Taking a wider perspective, it is especially interesting to find out whether, how and to what extent the knowledge institutions and the knowledge networks are embedded into the business world and the market relationships.

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[1] Polish strategic development reports and institutional documents highlight the innovative potential and internationalization perspectives of start-ups as small innovative firms (active mainly in modern high-tech sectors) being crucial for e.g. enhancing the technological progress and international competitiveness of the Polish economy. They accentuate the importance of the strong ties between the business practice and academia/scientific institutions and networks in contributing to upgrading the level of the Polish economy's innovativeness. See more in. e.g. National Development Strategy 2020 [*Strategia Rozwoju Kraju 2020],* [Polska. 2030 *Trzecia fala nowoczesności*] or the "Strategy for the Responsible Development" [*Strategia na Rzecz Odpowiedzialnego Rozwoju*]. See more in A. Domańska, *Start-up ecosystems as a framework for the cooperation between start-up companies and knowledge-based institutions in Poland*, Research Papers of the Wrocław University of Economics, *Alert dla polityki spójności,* E. Pancer-Cybulska (Ed.), Wrocław 2018 (in print).

[2] See more on goals, assumptions and tasks of the *Horizon 2020* EU Research and Innovation Programme especially within the subjects like "removing barriers to innovation and making it easier for the public and private sector to work together in delivering innovation", "supporting research infrastructures, stimulating innovation in SMEs", "helping to better integrate the knowledge triangle – research, researcher training and innovation" as well as "support the development and implementation of research and innovation agendas through public-private partnerships".

Within the subject there should be analysed in particular the issues like:

1) The special place science institutions take in the structure of so called start-up ecosystems in Poland (the ecosystems entail a set of entities cooperating/engaged/connected to or involved with the activities of start-up companies at any stage and any aspect of their market functiononing and development).
2) Availability of cooperation possibilities for start-ups, for example under public projects or EU programmes, common projects offerings, collaboration in the projects elaborated or realized by universities, any common business undertakings and/or developing the actual established cooperation. The variety of such possibilities created by the scientific institutions and other knowledge-based entities in Poland (and in many other countries as well), e.g. universities, high education centres, laboratories, academic advisory centres, academic entrepreneurship incubators should be characterized and researched under such a study. On the other hand, it is necessary to find out what kind of role is (or can potentially be) played by the science institutions in supporting or accompanying the small technological firms in their buisness development and improving their market performance.

The hereby article constitutes the first stage of the intended research as it attempts to outline the theoretical background for the future empirical work on the subject issue. The methodology I have used bases on the overview of the existing literature with the special insight into the behavioural economy and social network theories. I decided to put the attention to this part of the economic theory since, while analysing the characteristics of start-up companies, their business models and – most importantly – the very special features of the business environment they exist in, I am convinced the "network" concepts should be the core of the research perspective. An insight into other studies on start-ups helped to formulate some introductory conclusions about what problems and issues taken up by other researchers covering small business issues "suit" particularly well the analysis of start-up companies (also the Polish ones). Then I characterise the Polish ecosystem with special attention put to the knowledge-based institution.

2. Literature overview

The start-up companies constitute a very "representative" phenomenon of the global economy and are its special "product", since they act mainly in the Internet-related and high-technology branches and they are usually seen as *born globals.* Thus, the type of their activity, realized business models, products and services offered are

"embedded" into the networks, i.e. not only in the local markets, but on the international and global "scene". The same concerns the relations of those firms with other actors of the ecosystems, among others: institutions of science.[3]

Indeed, the variety of problems which can be covered in the analysis of start-ups is very rich and they can also be seen as any other micro and small firms. For example, following the studies on "traditional" small firms there can be researched the factors of start-ups' survival and market expansion (Compare e.g.: Doutriaux, 1992;[4] Huyghebaert 2000;[5] Gatewood et al. 1995;[6] Reid, 2000;[7] Holger et al. 2000;[8] Mata et al. 1995;[9] Robinson, 1990;[10] Santarelli et al., 1995;[11] Görg 2000[12]). However, taking into consideration the very special nature of those firms, it seems they should be analyzed mainly in the context of internationalization *(born globals),* innovations (modern technologies) as well as from the network economy perspective. The last field of research concerns especially the start-up ecosystems which consitute the widely-understood business environment for those firms (with pecuralities of their geographical, cultural and economic dimensions). The first two subjects, i.e internationalization and innovations, are themselves very wide and since they do not directly consider the title-issue of the article, the attention will be put to the ecosystems and networks obviously related to the covered subject.

The origin of the term "ecosystem" can be dated back only to the first decade of the 21st century. In that stream of research authors examined the market role of

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[3] The problem is that the term "start-up" does not solely concern the "modern start-up" meaning as it is understood in the subject literature, i.e micro and small companies in the high technology branches. See more on this in other works of the author.

[4] J. Doutriaux, Emerging high-tech firms: How durable are their comparative start-up advantages? "Journal of Business Venturing" July 1992, Vol. 7, Iss. 4, pp. 303–322.

[5] N. Huyghebaert, A. Gaeremynck, F. Roodhooft, L.M. Van de Gucht, New Firm Survival, *The Effects of Start-up Characteristics,* "Journal of Business Finance & Accounting" 2000, 27 (5-6), pp. 627–651.

[6] E.J. Gatewood, K.G. Shaver, W.B. Gartner, *A longitudinal study of cognitive factors influencing start-up behaviors and success at venture creation*, "Journal of Business Venturing" September 1995, Vol. 10, Iss. 5, pp. 371–391.

[7] G.C. Reid, J.A. Smith, *What makes a New Business Start-Up Successful?* "Small Business Economics" May 2000, Vol. 14, Iss. 3, pp. 165–182.

[8] G. Holger, E. Strobl, F. Ruane, *Determinants of Firm Start-Up Size: An Application of Quantile Regression for Ireland*, "Small Business Economics" May 2000, Vol. 14, Iss. 3, pp 211–222.

[9] J.P. Mata, P. Portugal. Guimarães *The Post-Entry Performance of Firms, The survival of new plants: Start-up conditions and post-entry evolution,* "International Journal of Industrial Organization" December 1995, Vol. 13, Iss. 4, pp. 459–481.

[10] W.T. Robinson, *Product Innovation and Start-Up Business Market Share Performance,* School of Business Administration, University of Michigan 1990.

[11] E. Santarelli, R. Piergiovanni, *The determinants of firm start-up and entry in Italian producer services*, "Small Business Economics" June 1995, Vol. 7, Iss. 3, pp. 221–230.

[12] H. Görg, E. Strobl, F. Ruane, *Determinants of Firm Start-Up Size: An Application of Quantile Regression for Ireland,* "Small Business Economics" 2000, Vol. 14, Iss. 3, pp. 211–222.

institutions, availability and asymmetry of information and other resources, market openness and demand for technologically advanced products and services (often in respect to regional and international diversity). In the recent years, the new approach which emphasized the role of local "networks" has gained momentum. This term tends to be understood in various ways, which include among other things: quality of the local environment, material infrastructure, financial system, access to high quality advisory services, density of formal and informal ties between individual and public agents. An important line of research emerged with its primary objective to explore innovativeness of start-ups measured by the number and quality of patents. (Compare: e.g. Lynskey, Almeida and Kogut, 1997[13]).

The network itself is a concept emerged from mathematical and physical sciences and commonly analysed under such disciplines as sociology, management and economics (each taking its own perspective). Understanding the economy as a network is rooted into and forms part of the theory of the network society, mainly developed by J. van Dijk (1991)[14] and M. Castells (1996).[15] J. van Dijk presents the network society as a social order in which the infrastructure of social and media networks shapes the prime mode of the organization and the most important structures of modern society on different levels: individuals, groups, institutions. M. Castells refers to social networks which process and manage information and use micro-electronic based technologies, as well as to a new networking logic that substantially modifies the operation and outcomes in processes of production, experience, power, and culture. The network society concept refers also to A. Toffler's *Third Wave Society*[16] characterized by knowledge and information as the primary determinant of power and its distribution; knowledge-production and information-processing as the primary economic activityand; the emergence of various high technologies, such as global communications networks. The main characteristics of the network society and economy were addressed by J. Rifkin[17,18,19] in a number of books (see also Barney, 2004[20] and Benkler

[13] P. Almeida, B. Kogut, *The exploration of technological diversity and geographic localization in innovation: Start-up firms in the semiconductor industry*, "Small Business Economics" February 1997, Vol. 9, Iss. 1, pp. 21–31.

[14] J. van Dijk, *The Network Society. Social Aspects of New Media,* SAGE Publications, London 1999.

[15] M. Castells, *The rise of the network society*, Blackwell Publisher, Oxford 2000.

[16] A. Toffler, *The third wave*, Bantam Books, New York 1981.

[17] J. Rifkin, *The age of access: The new culture of hypercapitalism, where all of life is a paid-for experience*, J.P. Tarcher/Putn, New York 2000.

[18] J. Rifkin, *The third industrial revolution: How lateral power is transforming energy, the economy, and the world*, Palgrave Macmillan, New York 2011.

[19] J. Rifkin, *The zero marginal cost society: The internet of things, the collaborative commons, and the eclipse of capitalism*, Palgrave Macmillan, New York 2014.

[20] D.D. Barney, *The network society*, Polity, Cambridge, UK 2004.

2006[21]). The issue of the network economy characteristics is also the core element of "The Digital Economy" by D. Tapscott (1996),[22] D. Tapscott and A.D. Williams (2006 and 2010). To this list, one should add a series of publications on creativity that may be perceived as complementary to the issues of start-ups, ecosystems and network economy by R. Florida (2002 and 2005),[23,24] as well as on the open innovation being a vital element connecting innovativeness with the new, network environment (see e.g. Chesbrough 2003 and 2011[25,26]; Roszkowska-Menkes 2015)[27].

An attempt to find some conceptual frameworks and combine the different disciplines in studying the issue was made by Ch.S. Hayter (2013)[28], who distinguished three main perspectives: network approach to entrepreneurship, social capital perspective and relational view perspective – the first one emerged from management science, the second coming from sociology and the third – representing the dynamic approach. Concurrently the authors underline that there are not many differences in the way those perspectives see networks and that all of them appreciate the role of networks as an important framework and condition to entrepreneurship as well as business success at each stage of the company's lifecycle.

The social capital perspective of the network theory (under which the "soft" kind of the relations between start-ups and science insitutions should be analyzed – see below) derives from the sociology and is represented in literature by. e.g. Aldrich and Zimmer, (1986);[29] Aldrich et al. (1987);[30] Balconi et al. (2004);[31] Granovetter (1973)[32]

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21 Y. Benkler, *The wealth of networks: How social production transforms markets and freedom*, Yale University Press, New Haven 2006.

22 D. Tapscott, *The digital economy: Promise and peril in the age of networked intelligence*, McGraw-Hill, New York 1996.

23 R.L. Florida, *The rise of the creative class: And how it's transforming work, leisure, community and everyday life*, Basic Books, New York 2002.

24 R.L. Florida, *Cities and the creative class*, Routledge, New York 2005.

25 H.W. Chesbrough, *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business School Press, Boston, Mass. 2003.

26 H.W. Chesbrough, *Open services innovation: Rethinking your business to grow and compete in a new era*, Jossey-Bass, San Francisco, CA 2011.

27 M. Roszkowska-Menkes, J. Karpacz, *Otwarte innowacje: w poszukiwaniu równowagi*, Oficyna Wydawnicza SGH, Warszawa 2015.

28 Ch.S. Hayter, *Conceptualizing knowledge-based entrepreneurship networks: perspectives from the literature,* "Small Business Economics" 2013, Vol. 41, pp. 899–911.

29 H. Aldrich, C. Zimmer, Entrepreneurship through social networks, [in:] D. Sexton, R. Smiler (Eds.), *The art and science of entrepreneurship*, Ballinger, New York 1986, pp. 3–23.

30 H.E. Aldrich, B. Rosen, W. Woodward, The impact of social networks on business foundlings and profit: A longitudinal study, [in:] N. Churchill, J. Hornaday, O.J. Krasner, K. Vesper (Eds.), *Frontiers of entrepreneurship research*, Babson College, Wellesley 1987, pp.154–168.

31 M. Balconi, S. Breschi, F. Lissoni, *Networks of inventors and the role of academia: An exploration of Italian patent data*, "Research Policy" 2004, No. 33(1), pp 127–145.

32 M. Granovetter. *The strength of weak ties*, "The American Journal of Sociology" 1973, No. 76(6), pp. 1360–1381.

or Walker et al. (1997).[33] According to this approach, the network is a conceptual framework entailing a set of actors and ties representing some relationship or a set of relationships between the actors playing in practice a role of the pool of resources which are or can potentially contribute to the success of a given business entity. This approach suits the start-up problematics particularly well due to to the specific characteristics of those companies because, according to practioners: As it is underlined in the literature, start-up is not only the organization looking for its optimal, effective and scalable business model; but first of all, it is created by people who are its most precious production factor.

The authors representing the social capital perspective put the accent (drawn from the social closure theory) to the great value for individuals coming from close or densely connected networks and the social capital embedded into them. Social capital comes in turn from the trust among the actors (a threat of ostracism and a loss of reputation. See Hoang and Antoncic, 2003[34]) and the resulting willingness for mutual assistance when needed (Coleman, 1998[35]) and is considered as "in opposition" to legal enforcement and legal frameworks.

Taking the perspective which focuses mainly on the intensiveness and quality of social networks (for more see e.g. Aarstad et al. 2010;[36] Lechner et al. 2006;[37] Bechky 2003[38]) we can see the key concept here is obviously "the ties" or relations between the the actors plus their density meaninig in fact the density of networks themselves (Hayter 2013[39]).

Putting the empirical observation on the start-up ecosystems in Poland into this specific perspective should be firstly preceeded by answering to the question what this specific social framework consists of. Then there is a need to find out what place in this framework is taken by the "academia" institutions and – more precisely – what relations the academia is involved into.

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33 G. Walker, B. Kogut, W. Shan, *Social capital, structural holes and the formation of an industry network*, "Organization Science" 1997, No. 8(2), pp. 109–125.

34 H. Hoang, B., *Network-based research in entrepreneurship: A critical review*, "Journal of Business Venturing" 2003, Vol. 18, Iss. 2, pp. 165–187.

35 J.S. Coleman, *Social capital in the creation of human capital*, "The American Journal of Sociology" 1988, Vol. 94, pp. 95–120.

36 J. Aarstad, A. Haugland, A. Greve, *Performance spillover effects in entrepreneurial networks: Assessing a dyadic theory of social capital,* "Entrepreneurship Theory and Practice" 2010, No. 34(5), pp. 1003–1019.

37 C. Lechner, M. Dowling, I. Welpe, *Firm networks and firm development: The role of the relational mix*, "Journal of Business Venturing" 2006, No. 21(4), pp. 514–540.

38 B. Bechky, *Shared meaning across occupational communities: The transformation of knowledge of a production floor,* "Organizational Sciences" 2003, Vol. 14, pp. 312–330.

39 Ch.S. Hayter, *Conceptualizing knowledge-based entrepreneurship networks: perspectives from the literature,* "Small Business Economics" 2013, Vol. 41, pp. 899–911.

Thus, in the next point I will try to identify the social relations specific for the start-up ecosystems in Poland by denoting the "places" or "structures" where those relations "come into existence", accentuating where and in which way the knowledge-based institutions are embedded or can find their place in those networks. Later in the empirical study I will focus on the mechanisms and practical effects of the ties identified here (there will be a comprehensive database constructed involving a comprehensive list of the actors of the start-up ecosystems in Poland).

3. The structure of the start-up ecosystems in Poland

The startup ecosystem in Poland consists of all entities – both private and public – that the start-ups have relationships with. Among them we can specify three types of subjects: other firms (from micro and small, through medium-sized companies to the big international corporations), then so called "business environment institutions" and thirdly – public (local, governmental, etc.) institutions. Whereas the first category does not need special clarification, it is worth presenting, at least in a general way, the remaining two other groups building the start-up environment in Poland (not forgetting the ecosystems put in question could be seen as "part" of the business environment). The public entities involved in the start-up ecosystems in our country are represented by a number of different institutions – most of them being the agencies of Polish ministries and other central bodies responsible for managing and distributing public funds (European Union grants, subsidies, governmental subventions and other financing) and implementing a number of different national programmes, like National Centre for Research and Development (*Narodowe Centrum Badań i Rozwoju*, *NCBR*), National Centre for Science (*Narodowe Centrum Nauki, NCN*) or the Polish Agency of Enterprise Development (*Polska Agencja Rozwoju Przedsiębiorczości. PARP).* Since there is actually a great number of public institutions (both on the local and central level) whose activity is crucial from the point of view of the analyzed problems, it is impossible (considering the required volume of the paper) to present and discuss all of them. I would like just to point out in particular at some programmes realized by the National Centre for Research and Development (*NCBR*) which are directly dedicated to supporting the cooperation between business and knowledge-based institutions. The first one is the NCBR *Gospostrateg* Programme (150 m PLN) which is solely and mainly targeted at supporting the existing mechanisms of the transfer of knowledge from the research centres, universities and any other scientific bodies to the

business practice as well as triggering the new, competitiveness- and innovativeness-enhancing mechanisms crucial for the development of the Polish economy and involving it into the global knowledge networks. Another programme worth mentioning in the context of the problems analyzed here is the one called "BRIdge: Research, Development, Innovations", continuing the previous Project "Commercilization of the results of scientific research and development works – testing the new mechanisms of support". BRIdge is aimed at asissting the commercialization of the results of the scientific works in its broad sense, i.e through developing, testing as well as putting the new intervention tools into practice. It is going to contribute, among others, to detecting the existing gaps in the offer of public institutions in supporting the commercialization of R&D results in Poland. Another NCBR Programme devoted to servicing and improving the cooperation between business and knowledge-based institutions through commercialization of the works and achievements of the latter is called "Innovativeness Creator". This particular programme is focused on elevating the number of the commercialized technologies and innovative solutions, expanding the network of organizations supporting the entrepreneurship of scientists and addittionally raising the effectiveness of the cooperation between science and business.

The activity of the local authorities in the field of interest is another broad subject worth presenting and deeply analysing in the later stages of the studies on the cooperation between science and business.

The third group I have enumerated involves Institutions of the Business Environment (in Polish: *IOB*s), representing numerous and diversified entities which are potentially engaged into the start-up ecosystems in Poland. According to the commonly accepted definition, IOBs involve the entities offering all services in the field of broadly-understood support for business. The Polish system of IOBs is very rich, considering both the large number of institutions and their diversity. We can specify three types (groups) of them: entrepreneurship centres (in Polish: *ośrodki przedsiębiorczości*), innovation centres (in Polish: *ośrodki innowacji*) entailing technological parks, entrepreneurship incubators and centres of the technology transfer (in Polish: *centra transferu technlogii*) and thirdly – financial institutions. According to the PARP, in Poland there exist 42 technological parks, 23 entrepreneurship incubators, 41 centres of the technology transfer as well as 24 academic incubators of entrepreneurship: all together there are 130 institutions serving a crucial role in the process of the diffusion of knowledge and technology and supporting the development of innovativeness. Taking into consideration the title issue of the article, the special attention in the research will be attached to the innovation centres functioning in Poland. The IOBs and their activity will be presented in the table below.

Table 1. Institutions of the Business Environment (IOBs) in Poland

Type of Institution	The role played in start-up ecosystem (potentially)
Entrepreneurship centres	wide promotion and incubation of entrepreneurship (mainly in the discriminated or unprivileged social groups) through providing support services to small and micro firms as well as at activating development of the peripheral regions touched with structural problems
Innovation centres: – technological parks – technological incubators – technology transfer centres	– promotion and servicing the incubation and development of the innovative entrepreneurship. – transferring technologies from science to market and activating the academic entrepreneurship and cooperation between knowledge-based institutions and business.
Technological parks or scientific parks	– supporting the development of enterprises based on innovative modern technologies, in particular small and medium-sized firms in the way of providing them with real estate sites like offices or coworking space (sometimes free of charge) or technical infrastructure. – advisory and mentoring on company management, technology transfers and transforming the results of the scientific research and work in progress into technological innovations.
Entrepreneurship incubators	– entity disposing of the real estate premises and some infrastructure which can provide the complex support program for the companies in their initial stage, i.e. from the idea for a business until gaining the stable position on the market. (so called *program inkubacji przedsiębiorczości*)
Centres of technology transfer	– special departments in the structure of the University or one of the Polish Academy of Science institutes (*Polska Akademia Nauk*) established in order to sell or give in a free-of-charge manner the resuls of the scientific work. – wide-understood commercialization and transfer of technology (know-how) to the market and promotion of the scientific work's results and creating the cooperation between business and academic institutions.

Source: Own elaboration based on the information from PARP and NCBR.

Apart from the above-mentioned entities, there can also be mentioned some "intangible" structures like clusters (for example *Netcamp*) or associations (formal or informal) functioning in different Polish ecosystems.

Numerous institutions creating the start-up ecosystems in Poland contribute to building the intangible part of the system by organizing a large number of events of different categories. They involve mainly managerial meetings, congresses, conferences, for example *ITCorner Summit, InfoTrendy, World Usability Day Tour 2009, Dni Informatyki, Konferencja e-commerce*, *Startup Jam Baltics, Trinity Capital Business Network, hackathon NetHack, Startup Weekend Szczecin*, and many more), training (*Startup Shaker Junior, acceleration programmes, Szkoła Młodego Przedsiębiorcy*), fairs and competitions (*Startup Challenge, Festiwal Przedsiębiorczości BOSS, European Enterprise Award).* They serve a role of support for the new-emerged ideas or nascent firms, as well as a source of knowledge and inspiration, giving among others an opportunity for developing professional contacts between the representatives of the knowledge-based institutions and start-up businesses.

4. Conclusion

The hereby article is part of awider study intended by the author on the influence of the broadly-understood scientific (mainly institutional) environment on the activity and innovation potential of start-up companies in Poland with the special focus on the possibilities for the cooperation between those two types of entities and prospects in this field from a short- and medium-term perspective.

The problem of relations between business and the knowledge-based institutions theoretically lies in the cross-section of different research domains, like knowledge, business, entrepreneurship and innovations. Thus, it can be tackled from different perspectives and on various problematic levels. Taking such a multi-dimensional attitude to analysing the title issue is consistent with the holistic approach to tackling and covering the various analytical problems of start-up ecosystems, commonly accepted in the literature (partly as an effect of a kind of consensus among the researchers). Indeed, start-ups as well as the environment they exist in represent the typical "network society" with tens and hundreds of entities combined trough the net of synapsies called "financing", "meetings", "workshops", "hackathones", "clusters", "summits", "incubators", "mentoring", "knowledge bases", etc.

Concluding the overview of the relations between start-up companies and the knowledge-based institutions in Poland, it should be noted that those ties can take place in two main forms which also have to do with the level of formality of this cooperation. First of all, they can be treated "physically" as part of the business environment disposing of (and potentially providing) the infrastructure in a physical sense. Further we take into consideration the science institutions (individual researchers, teams of scientists, whole institutes/departments/chairs etc.) playing the role as important actors cooperating with start-ups. This "hard cooperation" is realized in a more tangible way like working on projects together, common financing, transferring the results of the scientific research into business practice or transferring them into real products and services on the market. Thirdly, we can see them in a more "intangible" sense when we refer to 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 realize itself at different stages of those business entities' emergence and development. In the more detailed empirical analysis of the issue of the cooperation between start-up firms and knowledge-based institutions in Poland it will be neccessary to find out what is the representation of the academia institutions in those events: whether the scientists actively participate there and whether e.g. those contacts result in further cooperation and

common projects with the startups. There will be also surveyed the activity of the academia-institution in the field of advisory on e.g. product managemet/lean start-up, marketing (Internet marketing), strategy of sales, creating a proper business model and public relations as well as in legal issues and technology.

Taking into consideration the richness of the aspects and sub-issues which should be analysed when studying the problem, the hereby paper implicitly prepares "the ground" for more detailed empirical studies basing on the overview of the chosen literature from the network theories.

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