SOCIAL CAPITAL FORMATION IN CLUSTERS. THE CASE OF LIFE SCIENCE NORD

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ABSTRACT

Social capital formation in clusters recently became a research topic of high interest for many scholars, policy makers and professionals worldwide. This paper proposes a methodological framework based on five indicators that explain the cluster driver Networks and partnerships – ***1.*** number of partnership arrangements, ***2.*** number of co-operation agreements, ***3.*** number of networking events, ***4.*** number of joint research activities and ***5.*** the extent of social capital – and encourages their application in the case of Life Science Nord German cluster. Being essentially a case study-focused paper, this article extends the literature by offering a theoretical perspective on the terminology needed to discover the possibilities of fostering social capital at the cluster level and to bring evidence from the case of a mature life science industrial cluster, which is currently belonging to an emerging industry.

Keywords: cluster, emerging industries, life sciences, social capital, competitive advantage.

INTRODUCTION

According to Bourdieu (1986), there are three forms of capital, economic, cultural and social. Each one is analysed through the possibility of being converted into pecuniary means, and thus in a form of economic capital or institutionalized, in a non-pecuniary form. Social capital is formed of social obligations, called "connections", which can be converted into economic capital in certain conditions and titles of nobility, the institutionalized, non-convertible form. Like Bourdieu, Putnam (2000) refers to social capital from the perspective of the collective, the group. Both authors notice the impact of a new member for the rest of the group. For Putnam, the effect is a revitalization by new members in the communities'

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continuity (Putnam, 2000). For Bourdieu, receiving a new member in the group should be a very well-thought decision, as "through the introduction of new members into a family, a clan, or a club, the whole definition of the group i.e., its fines, its boundaries, and its identity, is put at stake, exposed to redefinition, alteration, adulteration". These contrasting perspectives might be interpreted from the point of view of bridging and bonding social capital model, which Putnam has instituted. On one side, bridging refers to open networks, which are "outward looking and encompass people across diverse social cleavages" (Putnam, 2000, p. 22), it is measured dominantly through quantitative methods and is considered positive social capital through its heterogeneity acceptance (Patulny and Svendsen, 2007). On the other side, bonding social capital is a type of closed network, suitable for "exclusive identities and homogenous groups" (Putnam, 2000, p. 22), qualitative methods and both positive and negative social capital (Patulny and Svendsen, 2007). Bridging and bonding social capital are also named inclusive and, respectively, exclusive social capital (Gittell and Vidal, 1998).

In the emerging industry of life sciences that we are portraing in this article, the networks are born due to cluster initiatives, universities or research institutes. According to this, there can be distinguished three types of networks: networks of cluster initiatives, research networks, and cooperation networks. From Cluster Observatory Report (2011, p. 31) we learn that the leading architect of network intiatives for Europe as a whole has been the European Commission. Also, the location of the members separates networks into national, international and transnational.

For this paper we are going to discuss a national cluster network based in Germany, in Kiel and Hamburg as main branches, called Life Science Nord Gmbh.

The objectives of this article are:

1. to present the theoretical concepts of clusters in the emerging industry of life science and social capital;

2. to analyse the five Networks and partnerships cluster driver indicators for the case of Life Science Nord cluster.

THEORETICAL BACKGROUND

Epistemologically wise, clusters are controversial concepts, which fit very well in the reversed analogy used by Martin and Sunley (2003) – we know what clusters are called, but we cannot provide a precise definition yet. However, attempts in this direction have been made ever since 1890, when Alfred Marshall talked for the first time about "the geographic concentrations of trades and companies" in his chapter about the externalities of specialized industrial locations in Principles of Economics. Later, at the end of the 20th century, Michael Porter provided the currently definition of the clusters which is still in use:

"Geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (Porter, 1998, p. 197).

Porter (2000) understands clusters only in a symbiotic relationship with a theory of competition and competitive strategy in the global economy. Clusters indicate that a great part of the competitive advantage lies outside the companies and of their industries and it is found in the locations where the business units are based. Together with the firm and the industry, clusters can be considered "a new unit of competitive analysis". Clusters are "critical masses of unusual competitive success" (Porter, 2008, p. 214). If managed properly, the potential of interconnectedness of different entities like companies and other institutions in the common field will stir nevertheless competitive advantages.

The question raised by Porter is "Why view economies through the lens of clusters rather than of more traditional groupings such as companies, industries, or sectors, such as manufacturing or services?" The favorable aspects of adopting this view stay primarily in the fact that clusters are more aligned with the "nature of competition and the sources of competitive advantage" (Porter, 2008, p. 221). Secondly, they are structures that allow "mutual improvement in areas of common concern without threatening or distorting competition or limiting the intensity of rivalry" (Porter, 2008). Cluster entities benefit from agglomeration advantages such as "access to specialized human capital, preliminary inputs and information spillovers", because they are spatially concentrated (Koschatzky, K. and Lo, V., 2007). The concentration of technologies and knowledge is also advantageous to finding solutions to similar problems faster, so inside the cluster there is a continuous learning process for the companies, which ensures their survival (Maskell, 2001 cited in Koschatzky, K and Lo, V., 2007).

Clusters can be found in different types, depending on the criteria they are subjected to. For example the clusters might find themselves in different life cycle stages (emergent, mature, stabile and declining). Also, they might be different according to their source of emergence (network of SMEs – small and medium enterprises, anchor firm or university).

In this paper we are going to address a mature cluster, with a network of SMEs as a source of emergence. In its maturity phase, a cluster is recognized through the following features: the existence of a critical mass of actors, with strong synergies created among them and a stable level of cooperation and size that influence the duration of this development stage. Early stage clusters may be more dynamic, but also more vulnerable than mature clusters (Andersson *et al*., 2004).

Due to a various number of fields which investigate the emerging industries (academia, policy, business analysis and that specific emerging industry), in different regions of the world, the concept gained various interpretations and meanings and has not acquired yet a standard definition. Forbes and Kirsch (2011,

p. 591) define the emerging industry as "the intersection of a unit of analysis and a temporal interval". In this case, the unit of analysis stands for the industry and when the time perspective is added, the result is the following: emerging industries are industries found "in the earliest stage of development" (Low and Abrahamson, 1997; Van de Ven and Garud, 1989). The European Cluster Observatory Report (2012, p. 7) offers additional information on the characteristics of these industries, which are "industrial sectors, usually based on new products, services, technologies or ideas, which are in early stage development and are characterized by high growth rates and market potential". The definition indicates that these entities have an important word to say in the "future European competitiveness and prosperity" (Report, 2012). According to EUROSTAT, the higher the values of employment, turnover and value-added are, the higher the growth of these industries is (Report, 2012). The first characteristic of the emerging industries is their high growth potential, as opposed to actual high growth (Report, 2012). The second characteristic refers to their fundamental drive which is a new product, a service or an idea and they form in certain times, when consumer needs change, new technologies replace the old ones and when new socio-economic conditions emerge (Report, 2012). The concepts used in these fields are also innovative, they are based on key enabling technologies (KETs)[1] and the topics currently discussed are, for example, climate change or the aging society. Another characteristic of emerging industries would be the focus on research and knowledge of the industry. They nurture entrepreneurship and an innovative spirit. Last, but not least, emerging industries manifest a high propensity to cluster. Therefore, the cluster organisations and the science parks become landmarks of geographical localization for the newly formed industries and for the small and medium enterprises (Report, 2012).

One emerging industry is the life sciences industry Merriam-Webster (2020) defines life sciences as "a branch of science (such as biology, medicine, and sometimes anthropology or sociology) that deals with living organisms and life processes". The sectors which are part of the life science industry, according KPMG Report (2016) and which are in frequent use of practicians, scholars and policy makers are: Biotechnology, where Biotech Therapeutics is a very relevant branch, Pharmaceutical and Medical Technology. A more recent sector, compared to the others, connected with artificial intelligence, is Digital Health. The German

[1] "Key Enabling Technologies (KETs) enable the development of new goods and services and the restructuring of existing industrial processes. They are of systemic relevance as they enable the modernisation and competitiveness of the EU industry and the transition to a knowledge-based and low carbon resource-efficient economy. They play an important role in the R&D, innovation and cluster strategies of many industries and are therefore key to strengthening the research, development and innovation base in Europe. KETs that have been identified as priority areas for improving European industrial competitiveness by European Commission (EU COM(2009)512) include advanced materials, nanotechnology, micro- and nano-electronics including semiconductors, biotechnology and photonics." (Report, 2012, p. 11)

cluster we are going to present as a case study is specialized in all the three sectors described above, Biotechnology, Medical Technology and Pharmaceuticals.

REVIEW OF LITERATURE

So far there is no consensus in terms of what social capital should include (Aragon *et al*., 2014). Social capital was defined in several, sometimes contrasting ways by sociologists (Bourdieu, 1986; Coleman, 1988), economists (Portes, 2003; Walker *et al*., 1997) and political scientists (Putnam, 2000). At the core of social capital stands an integrated, interrelated structure of three dimensions, structural, relational and cognitive (Nahapiet and Ghostal, 1998). Also, Putnam (2000) perceives social capital as a form of collective capital and offers a model based on the concepts of bridging and bonding.

OECD (2020) defines social capital as "networks together with shared norms, values and understandings that facilitate cooperation within and among groups." Moreover, social capital in industrial clusters is translated through networking, which is considered a "key dynamic, particularly because proximity facilitates face-to-face interactions" (Chen, Haga and Fong, 2016, p. 532). Social capital is useful for the enterprises in order to gain, integrate, restructure and transfer resources.

Social capital is important in cluster context, though little is known about its impact on "the performance of cluster firms, the cluster or the region in which the cluster is located" (Staber, 2007, p. 505). Performance is affected if cluster firms do not align their social capital configuration with their changing resource needs (Maurer and Ebers, 2006). Staber and Sautter (2010, p. 10) argue that "the performance of the clusters varies over time with the evolving knowledge base in the cluster".

In terms of advantages of this resource, Nahapiet and Ghoshal (1998) mention how social capital increases the efficiency of action and of information diffusion (Burt, 1992), reduces the costs of monitoring processes and transactions, and encourages the cooperative behaviour necessary for innovation and value creation (Fukuyama, 1995) (cited in Aragon *et al*., 2014, p. 131). In terms of disadvantages, social capital has its "dark side" (Putnam, 2000) because it encourages "exclusion of outsiders, excess claims on group members, restrictions on individual freedoms, and downward levelling norms" (Portes, 1998, p.15).Literature shows therefore how complex this form of capital is.

Rose (1998), cited in Westlund (2006), distinguishes three approaches to interpret the complexity of social capital having effect on its operationalization, which are put together in the table below (Table 1).

Table 1

Social capital's complex operationalization

Perspectives	Approach	Rose's Explanation
Individual	Social capital is an endogenous phenomenon in social relations that varies with situation. (Coleman, 1990, p.302)	Since both networks and individuals shift with situation, social capital cannot be aggregated to form a single unity.
Micro-	Social capital is a generalized consequence of reciprocal trust and cooperation. (Ingelhart's,1997)	It's not the networks that vary with situation, but the adherence of individuals to networks (due to different trust and cooperation levels). The source of social capital is an individual resource reflected in attitudes, and can be measured.
Societal	Fukuyama (1995) believes society's culture is the source of trust and cooperation.	Different societies have different social capital because of different cultures. Individual access to social capital varies between and not within cultures.

Source: Compiled from Westlund, 2006.

From *Table 1*, we understand that the authors refer to social capital from different perspectives (individual, micro-, societal). Social capital can be internal and external, it is analysed at different levels of aggregation (from individual actors to national cultures scale) and the homogeneity decreases proportionally with advancing in levels. The types of links and their levels indicate how social capital is to be studied. Westlund and Bolton (2003, p. 88) recommend that the attempt to measure social capital should be performed for each level individually and not inter-levels, due to principled differences in the levels of aggregation, since "social capital is the most diversified, least homogenous form of capital." This lack of homogeneity can be seen in some contexts as a disadvantage, since its operationalization becomes difficult.

METHODOLOGY

Presented in DTI&ECOTEC (2004) report, there are three drivers that influence clusters: ***1***. Networks and partnerships (the extent of social capital), ***2***. Innovation and R&D (the extent of innovations and R&D capacity), and ***3***. Skills (the availability and quality of the workforce within the cluster). The outcome of

these three drivers is represented by the Economy and enterprise dimension (the level of employment, number of companies and their performance and the outcomes). In *Table 2* below, the drivers and the outcome of a cluster are displayed in detail.

Table 2

Illustrative monitoring framework for a cluster

Drivers			**Outcome**
Networks and partnerships	**Innovation and R&D**	**Human resources**	**Economy and enterprise**
Number of partnership arrangements	R&D employment	Number of vacancies	Net employment change
Number of co-operation agreements	R&D expenditure	Educational attainment rates	Increase in GVA/GDP
Number of networking events	Number of business spin-outs	Number of defined qualifications	Growth of existing businesses
Number of joint research activities	Number of patents applied for	Extent of measured skills gaps	Number of firm within the cluster
Extent of social capital	Number of innovation awards		Levels of investment
	Number of new products / processes adopted		Levels of profitability
			Value of exports

Source: Based on DTI & ECOTEC, 2004, p. 17.

One of the most relevant drivers that indicate cluster development is related to Networks and partnerships. The indicators that measure this driver are: ***1***. number of partnership arrangements, ***2***. number of co-operation agreements, ***3***. number of networking events, ***4***. number of joint research activities and ***5***. the extent of social capital (see *Figure 1* above).

In the Results and Discussion section, we will analyse each indicator for the case of Life Science Nord Cluster in order to identify the impact of the Networks and partnerships driver for the entire activity of the cluster and for its overall development.

The data collected for the documentation of the case study are the result of preliminary interviews, networking activities and fact-finding visits the author took part in during an Erasmus + traineeship in Germany, in the Working Group Economic Geography, from Cristian-Albrechts University in Kiel (2017–2018), as primary data sources, and company official websites and reports as secondary data sources.

CASE STUDY

Life Science Nord earned the EU Gold Label for its extraordinary network management in 2016 and again in 2018. LSN figures (LSN Report, 2014) show the total gross value added by the cluster in 2014 was 8.1 billion euros, the number of employed persons in the cluster till 2014 was 42,300 (1.7% share in the overall economy of Schleswig-Holstein) and 0.9% annual average growth (for 2004–2014). The cluster's exports in 2014 were worth 5.8 billion euros (8.2% in the overall economy of Schleswig-Holstein). Compared to 2014 figures, in LSN Report (2016), the number of employees increased with 3,300 and also there was a rise of 6 billion euros in the total gross added value, with a 3.5 % average annual growth, which shows the management works on its target.

According to LSN Report for 2016 there were almost 500 companies, research institutions and public institutions in the Life Science Nord cluster, totaling 49,900 employees, a gross added value of €4.3 billion and an export volume of €4.2 billion. Its performance reports show the cluster has a growing number of members-230 (189 SMEs and 18 institutions for research and universities) and employees (49,900, in 2016). Life Science Nord Management GmbH employs 18 people in the management team in Hamburg and Kiel (EU Cluster Collaboration Platform).

In 2018, the gross added value rose to €5 billion and the number of employees in the cluster increased with 2,400, reaching a number of 52,800. What is more, the people employed in the Life Science Nord Cluster secure approximately 16,000 jobs in enterprises, which supply goods and services to the cluster. From 2016 till 2018, the value of exports rose with 5.6%, to a total volume of €6.6 billion.

As far as its networks are concerned, LSN collaborates very well transnationally with Denmark, Finland, Lithuania and Sweden (EU Cluster Collaboration Platform) as member of a bigger network, ScanBalt,[2] the life science network for the Baltic region. Scanbalt was built in 2002[3] to promote research, policy alignment among the participating regions and to have one single point of dialogue for potential partners. Moreover, not only the Baltic area, but also the Arab region is a target for Life Science Nord, as the cluster organization regularly provides a presentation platform for Northern Germany companies at the medical technology trade fair Arab Health in Dubai.

[2] ScanBalt was established in 2002 and comprises more than 3000 companies, 50 health care clusters and networks, 75 health care sector science parks and 60 universities from the member states.

[3] http://www.scanbalt.org/.

RESULTS AND DISCUSSION

There are two types of ties that are relevant for the networking relationships in a cluster, the bridging ties and the strong ties. The bridging ties are the connections which link a social firm to contacts in economic, professional and social circles which are not easily accessible to the firm (McEvily and Zaheer, 1999). The strong ties, however, are the most valuable, as they represent the long term and frequent social relationship between two organizations (Granovetter, 1973). The bridging ties are the inter-cluster ties, whereas the strong ties are the intra-cluster ties.

Ties are the basic component elements of networks and partnerships. They operate, combine and link what we call the five branches of the cluster driver Networks and partnerships, which are going to be analysed below, in their application to the case of Life Science Nord cluster.

I. PARTNERSHIP ARRANGEMENTS (NETWORK AGREEMENTS) OF LIFE SCIENCE NORD CLUSTER

Life Science Nord Cluster has an agenda of partnership arrangements or network agreements and according to the official website of the cluster,[4] these are: InnoCan, HealthCAT, CellTom, FusoSan, Antimic, GRIPS, ACCESS & ACCELERATION and NorDigHealth:

1. InnoCan stands for Innovative High Technology Cancer Treatment. The aim of the project is to establish a test center for testing and making available new innovative solutions for the treatment of cancer. Another goal is to build a cross-border database. The project focuses on research in the treatment of breast cancer, colon cancer, head and neck cancer, prostate cancer and metastases, and cancer treatment in the elderly.

2. HealthCAT signifies Health Care Assisting Technology. Its purpose is to develop a robot prototype that takes on specific tasks on care stations. The development takes place in close cooperation with nursing facilities to ensure long-term safety and suitability for everyday use.

3. CellTom or Molecular cell tomography for improved cancer surgery has the goal to develop a medical imaging process for rapid tumor detection and also to set up a cross-border service center VISION, with which users, also across sectors, gain access to the high-tech imaging process. Furthermore, a strategic network of academic institutions, hospitals and medical technology companies is to be established.

4. FusoSan or health from the sea has the purpose to implement an innovative value chain and innovation platform for the sustainable extraction of fucoidans

[4] https://lifesciencenord.de/de/projekte/netzwerkpartnerschaften.html.

from brown algae. In addition, an innovative network in the field of maritime biotechnology is going to be established.

5. Antimic – Antimicrobial surfaces and hygienic coatings. The socially and economically important task, namely the protection of human beings from infections and their consequences, is to be effectively supported within the framework of a ZIM (Zentrales Innovationsprogramm Mittelsland) competence network.

6. GRIPS – interface analysis in process and quality control. The network's vision is to integrate innovative, cost-effective analytics as an in-line variant, or at least as an online variant, in industrial manufacturing and operating processes across industries.

7. ACCESS & ACCELERATION – A German-Danish Innovation Network for Better Health Care. Demographic trends, rising healthcare expenditures and unmet treatment needs are current challenges in Germany and Denmark. ACCESS & ACCELERATION will meet these challenges by creating better conditions for developing innovative solutions in the field of health technology. In close cooperation, companies, research institutions and health innovation clusters will establish a German-Danish platform that will make it easier for companies to access universities, hospitals, clinical staff and patients, among other things, in order to be able to develop, test and implement new innovative solutions for the health sector.

8. NorDigHealth stands for Novel Regional Digital Solutions for Improving Health. It is a German-Danish health project funded by the EU. In the project, researchers from Denmark and Germany are working with new technologies to improve the health of citizens in Lübeck and Næstved, be they patients or healthcare professionals. Technologies are to be developed which allow certain diseases, such as cancer, to be identified in good time. The project also aims to ensure that diseases such as epilepsy seizures can be prevented.

II. COOPERATION AGREEMENTS OF LIFE SCIENCE NORD CLUSTER

Life Science Nord has in charge many challenging projects and these are: HiHeal, NORTHOPEDICS, BONEBANK, BFCC, BRIDGE 53, ELISE, KICK, MAGIA, PILOT. Further on, we will give some details about some of them:

1. HIHEAL innovation network for hygiene and infectious diseases

The cluster organizations Life Science Nord Management GmbH and Gesundheitswirtschaft Hamburg GmbH joined forces for two projects which target topics like hygiene, infection, health and eHealth under a coordinated strategy. The main goals are to prevent, diagnose, provide acute therapies and areas of clinical innovation for these aforementioned four areas of medical expertise through synergies, by putting together members'expertise, encouraging cooperation and launching innovative projects. The HIHEAL project is financed by the

EUROPEAN Fund for Regional Development and the City of Hamburg for a period of five years (1st April 2016–31st of March, 2021). HIHEAL links companies, scientific institutions, hospitals and funding bodies in Northern Germany.

2. NORTHOPEDICS

This project is very complex and, based on this initiative which so far has proven successful, the plan of the cluster organization is to start organizing conferences and meetings which would have as topic bone healing, and so extending the Northopedics project. On 30th of November 2017 there was an interdisciplinary networking event on this topic hosted by GEOMAR Ostufer in Kiel and the author of the paper participated as part of her fieldwork in Germany, Kiel. The questions were: Which specific requirements do the damaged bone and its environment make on bone and implant materials? What innovative technical solutions and partial contributions do the companies, research and service institutes offer in response to the special material requirements of healing bones?

The target groups for this project are: clinics and production companies (medical technology, IT, project management); research institutions (biomechanics, materials science, basic research, imaging, clinical research, imaging, basic research, nanotechnology, infection research).

3. BONEBANK

Bonebank is a German-Danish joint project aiming to create a biobank (a bank of stem cells) for the treatment of bone fractures either for the own use of the patients or of their relatives or for the use of the general public. Other uses are the development of personalized diagnostics and of medicines and new treatment options. This will operate at the clinic sites of Odense and Lübeck to benefit patients, donors, research and companies alike.

4. Baltic Fracture Competence Center (BFCC) is a pan-Baltic fracture cooperation network between five hospitals in Estonia, Germany, Lithuania, Poland and Sweden, and other partners from Denmark and Finland, aiming to promote cooperation within fracture management. There are three target topics: infections after fractions, bone density measurement after fractures and complication management after fracture treatment. The project is included in the Programme Interreg Baltic Sea Region and funded through the European Regional Development Fund for three years (2016–2019).

5. LSN Academy + Cyber Security Courses is another project of Life Science Nord cluster designed to provide courses and seminars for the members of the cluster to increase their expertise. The newest package of courses is related to the field of Cyber Security (from 1st of January 2017–31st of December 2018). The entire range of the courses has the following topics: IT Security, Research and Technology and Management, with varios resourceful subtopics.

III. NUMBER OF NETWORKING EVENTS OF LIFE SCIENCE NORD CLUSTER

Life Science Nord Cluster e.V., the cluster agency, organizes a series or netwoking events every month which can be grouped into three categories: trainings and seminars, fairs and congresses and regulatory affairs. On 12 of May 2020 one important event "Deutscher EY Biotech Report 2020" – "Good Translational Practice" Welche Hebel reduzieren das Risiko im Innovationsprozess?" has taken place online in German language due to Covid−19 pandemic restrictions. The author of this article took part in the online event as well.

IV. NUMBER OF JOINT RESEARCH ACTIVITIES OF LIFE SCIENCE NORD CLUSTER

Life Science Nord has many innovative joint research projects, but maybe one of the most interesting and worth mentioning is related to the BRIDGE Project initiated in 2016 by a leading company in Biotechnology in Germany, Evotec, which is also a Gold member of the Life Science Nord cluster association. The BRIDGE Project was marketed very well by the CEO of Evotec, Mr. Werner Lanthaler in 2018 in Hamburg at one of the Life Science Nord cluster events occasioned by the EY Biotechnology Report annual presentation. The author was then a participant, due to the fieldwork activity.

We would like to present the Evotec BRIDGE, as an application model of Networks and Partnerships driver.

EVOTEC BRIDGE PROJECT

Evotec is a drug discovery alliance and development partnership company focused on rapidly progressing innovative product approaches with leading pharmaceutical and biotechnology companies. The company operates worldwide with leading scientific experts, state-of-the-art technologies and key therapeutic area expertise, addressing neuroscience, pain, metabolic diseases, oncology and inflammation.[5]

The great achievement of this company is in creating a new paradigm for translating early-stage academic research into pharmaceutical research and development called "BRIDGE" (Biomedical Research, Innovation & Development Generation Efficiency). BRIDGEs are an integrated framework consisting of a fund and an award system to open up pioneering academic sciences, create new

[5] https://lifesciencenord.de/de/mitglieder/mitgliederdatenbank/detail/evotec-se.html and https://lifesciencenord.de/de/news/detail/evotec-se-updates-zur-unternehmensentwicklung.html.

spin-out companies and build partnerships with pharmaceuticals and biotech. Through these efforts, Evotec has defined a new formula for the rapid discovery of early-stage medicines. Since the model was launched in 2016, Evotec has built six BRIDGEs: LAB282, LAB150, LAB591, LAB031, LAB10x and LAB555.

In June 2019 Evotec announced that the company has entered into a new strategic partnership called LAB10x. Evotec is working with the following partners: Sensyne Health plc (LSE: SENS) ("Sensyne"), a UK-based clinical AI technology company, with the University of Oxford, Oxford University Innovation Ltd ("OUI", the university's science marketing company), and with Oxford Sciences Innovation ("OSI", the largest intellectual property investment firm in the world, located at a university), in charge with funding Evotec the new BRIDGE.

The purpose of this BRIDGE is to quickly translate clinical AI and digital health research at Oxford into business startups that are using breakthrough digital solutions, clinical AI algorithms, and faster data-driven drug discovery and development. Under the agreement, OUI Digital Health projects will only be accepted by Oxford University scientists and supported by a Sensyne expert. The technologies developed within the LAB10x BRIDGE are used to generate and evaluate anonymized patient data, to generate digital solutions for improved patient care and to accelerate medical and pharmaceutical research and development. LAB10x is funded by a fund that will initially hold approximately £5m (approximately €5.6m) for three years. If successful, Evotec and Sensyne, together with Oxford University and their researchers, will participate in investments in companies that are spun off from LAB10x.[6,7]

Moreover, in October 2019 Evotec's Academic BRIDGE portfolio has been expanded with LAB555, the first academic BRIDGE partnership in Israel with Integra Holdings and Yissum, the technology transfer company at Hebrew University in Jerusalem. The aim of the partnership is to accelerate drug discovery and development through efficient translation of early-stage research projects by Hebrew University.[8,9]

In conclusion, BRIGDEs as integrated frameworks made up of three members, a drug discovery company (Evotec), a research company and a funding / investment company, are a practical example of a functional partnership inside a cluster that makes innovation and business development possible.

[6] www.evotec.com/de/invest/news/press-releases/p/evotec-sensyne-health-die-university-of-oxford-mit-osi-und-oui-starten-bridge-partnerschaft-im-bereich- digital-health-lab10x-5824.

[7] https://lifesciencenord.de/de/news/detail/evotec-start-bridge-partnerschaft-im-bereich-digital-health.html.

[8] https://lifesciencenord.de/de/news/detail/evotec-se-updates-zur-unternehmensentwicklung.html.

[9] https://www.evotec.com/de/innovate/bridges/lab555.

V. EXTENT OF SOCIAL CAPITAL OF LIFE SCIENCE NORD CLUSTER

As maintained by DTI & ECOTEC (2004) report, what makes networks effective are the following elements: ***1***. *the ability of networks to spread good practice,* ***2***. *the capacity of networks to extend beyond the cluster,* ***3***. *the international nature of the networks.*

Also, the same publication mentions how network bodies such as universities, research institutes, trade associations, public institutions, clinics and hospotals "can play a key part in nurturing the development of the cluster" (DTI & ECOTEC, 2004).

Another important aspect is networking seen along the lifecycle of the cluster. At the beginning, when the fundamentals of the cluster are established, networks and partnerships play a crucial role. But as the cluster grows and matures, networking becomes "with a purpose" (DTI & ECOTEC, 2004) and the practitioners are encouraging to foster the interactions between companies. In the declining stage of a cluster sometimes forming networks and partnerships can represent a desired response to the market conditions or potential threats.

CONCLUSIONS

This article showed from the perspective of a case study how social capital formation in a cluster can stir competitive advantages at the level of the network and for the actors involved in the process. The objectives of this article were to present the theoretical concepts of clusters in the emerging industry of life science and social capital and to analyse the Networks and partnerships cluster driver indicators for the case of Life Science Nord cluster.

The German cluster Life Science Nord is in maturity stage from the point of view of the cluster lifecycle, it has a very well consolidated network based on strong partnerships and cooperation agreements, joint research activities, social capital and networking events and has been innovating in the field of life sciences through the project of BRIDGEs. The competitive advantages are visible through the economic and financial results reported by the cluster organization biennially, through its great market share and national coverage in the land of Schleswig-Holstein and Hamburg and through its very well conducted international links with Denmark, Finland, Lithuania and Sweden as member of a relevant transnational network called Scanbalt.

The cluster has earned a Gold Excellence label since 2018, renewed every two years based on the performance and the great management of the cluster organization and has a good perspective for development even in these difficult times of COVID−19, as the networking activities continue online and a lot of

efforts have been made from the German state to support financially the national, regional and local businesses during the pandemic.

The limitations consist in the lack of enough quantitative results regarding cluster achievements, as there were only used the ones found on the cluster website, so secondary data sources. Also, regarding the theoretical part of the paper, the topic of social capital is complex and its operationalization even more because there is no consensus regarding its measurement tools/indicators and we approached social capital through a networks and partnerships understanding, but this is not an exhaustive study. This is a case study-based paper and should be considered as such with its own limitations regarding this qualitative research method.

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