Entrepreneurial culture in innovative Bioclusters:
towards a success factors model

"The great paradox of the 21st century is that, in this age of powerful technology, the biggest problems we face internationally are problems of the human soul"

(Ralph Peters)

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PREFACE

This study is the result of my master thesis project based on the data collected during the internship in PricewaterhouseCoopers, Adviesgroep Subsidie Innovatie & Beleid.

This master thesis was a part of my graduation assignment of the study Master Business Administration, International Management at the University of Twente. Taking the opportunity to study here was one of the best decisions of my life, unblocking the door to flourishing world of breathtaking challenges, shaping my mind to be always curious and open. My heart is now full of melancholy, because this fantastic year is finished; but now the new life-stage is waiting. .

I would like to thank the following persons: Professor Huub Ruël for being my Master thesis supervisor and for all his help and advice during my studies, Prof. Dr. Aard Groen for his supervision and feedback on my report, Drs. Kristina Dervojeda for being my company supervisor and all the colleagues at PricewaterhouseCoopers Den Haag who helped me during my research.

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ABSTRACT

This paper presents a study on the determinants of entrepreneurial culture in innovative biotech clusters. A literature review led to the identification of nine determinants. For the empirical study four clusters in Western Europe with a high entrepreneurial culture were selected. Cluster participants were invited to fill out a questionnaire. In addition semi-structured interviews were held with selected participants in order to get in-depth information from cluster participants. Social networks, role model companies, and funding seemed to be the most important determinants of an entrepreneurial culture in biotech clusters. Moreover, the findings suggest that determinants are interrelated, and that some are indirectly influencing entrepreneurial culture – institutes, governmental bodies and the cluster organizations, while others are directly determining entrepreneurial culture.

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1. Introduction

This study was inspired during my internship in *PricewaterhouseCoopers*, Adviesgroep Subsidie Innovatie & Beleid. The assignment I was helping to carry out was aiming to get a better understanding of emerging and promising biotechnology clusters phenomenon, to find out the success factors of their development by studying the interconnection between bio cluster performance and elements of the following driving forces – scientific, industrial, cultural, financial and supporting. On the stage of data gathering (online survey and telephone interviews) the concept of entrepreneurial culture, which was perceived to be one of the elements of the cultural driving force, attracted my special attention, as far as the majority of respondents emphasized well-developed entrepreneurial culture to be a crucial driver of the whole cluster performance, highlighted the need for its improving. Thus, the question arose – which factors determine entrepreneurial culture within an innovative cluster.

1.1. Background

An industrial cluster is a phenomenon, referring to a geographical concentration of actors in vertical and horizontal relationships, showing a clear tendency of co-operating and of sharing their competencies, all involved in a localized infrastructure of support" (Chiesa and Charoni, 2002). Clusters include firms working in related or supporting technologies, and an infrastructure of institutions and social relationships that provide resources and promote the interests of the whole cluster (Boschma, 1999). Clustering as a phenomenon has been a subject of academic discussion since 1920, when Marshall noticed the importance of industrial localization studying development of English industrial regions in 19th century. The reasons behind this phenomenon can be found in the work of Porter (1998), who points out the following advantages of clustering:

(1) Productivity advantages due to the use of better and cheaper specialized inputs (components or services)

(2) *Innovation advantages*: proximity between customers and suppliers facilitates the transfer of tacit knowledge and therefore enables innovation. Proximity to knowledge centers offers a strong potential for innovation, allowing critical mass to be gained, particularly for pre-competitive activities (for example basic research). Finally, localized benchmarking among actors in the cluster and the great availability of a qualified labor market can strongly improve the capacity to innovate.

(3) *New business advantages* because of availability of information on market opportunities and potential, barriers and risks for new firms.

Following the assignment carried out by PricewaterhouseCoopers, our study is devoted to a specific type of industrial clusters – to *innovative biotechnology clusters*. Generally, the term '*innovative*

cluster' refers to a geographically confined collection of related firms operating in a knowledge-intensive industry. These innovative or knowledge-intensive industries incorporate new advances that may originate in scientific discoveries, as in the biotechnology (or nanotechnology industries), or in the application of know-how developed through practice, as in industrial equipment manufacturing or specialty foods (Feldman et al, 2005).

According to European Commission[1], life sciences and biotechnology are widely recognized to be, after information technology, the next wave of the knowledge-based economy, creating new opportunities for [member states] societies and economies. Therefore, European Commission presented the Strategy for Europe on Life Sciences and Biotechnology, proposing a comprehensive roadmap up to 2010, bringing the sector to the forefront of the frontier technologies and making innovative biotechnology clusters the topic of interest.

1.2. The role of entrepreneurial culture within an innovative cluster.

The assignment carried out by PwC aimed to get better understanding of biotechnology cluster performance – the nature of the critical success factors and the link between those and the overall cluster performance. The outcomes were to help policy makers and cluster organization in their decisions. Five driving forces were considered to be the critical success factors of the cluster – based on the normative model o a cluster by Chiesa and Chiaroni (2005) – Scientific, Supporting, Financial, Industrial and Cultural.

The representatives of named-above groups of cluster stakeholders were approached during the study by the means of an on-line questionnaire, and, in several cases, telephone interviews. During the interviews, the respondents were asked to elaborate on their responses in the questionnaire in order to provide a more complete picture and to find out the reasons behind out-of-standard answers. On this stage of the PwC study the concept of entrepreneurial culture, one of the elements of mentioned above cultural driving forces, was highlighted by the respondents, and, therefore, attracted our attention.

Following Gibb (1999) entrepreneurial culture can be defined as a set of "values, beliefs and attitudes commonly shared in a society which underpin the notion of an entrepreneurial 'wayof life' as being desirable and in turn support the pursuit of 'effective' entrepreneurial behavior by individuals or groups" (p. 28). In the literature claims exist that entrepreneurial culture is related to national and regional economic success (c.f Beugelsdijk, 2007). We take this line of reasoning further and assume that for innovative biotech clusters to be successful the existence of an entrepreneurial culture is crucial. However, establishing an entrepreneurial culture in a biotech cluster is something that has hardly been a

[1]Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee of the Regions, *Commission's Action Plan for skills and mobility*; *Life sciences and biotechnology – A Strategy for Europe*. Brussels, 23.1.2002, COM(2002) 27 final

subject of study and needs further investigation. We perceive entrepreneurial culture in an innovative region to refer to the atmosphere motivating an individual to become an entrepreneur – more specifically, to start a business. The reasons behind this definition and detailed explanation of it are to be found in the following chapter, devoted to the literature review.

Moreover, the importance of understanding success factors of entrepreneurial culture development is supported by the introduction of an EC special program on better understanding of the links between culture, creativity, innovation, economic performance and wider economy.

The concept of entrepreneurship is closely related to the entrepreneurial culture concept - as the desired outcome process of such an atmosphere and refers to the creation of something new. The issue is to consider different types of entrepreneurial culture success factors – not only individual, but especially region and country specifics. The desired contribution of this study is to create a model presenting a multi-level observation of success factors of entrepreneurial culture in an innovative biotechnology cluster. Theoretical relevance of our explanatory findings is getting a better understanding of the success factors of entrepreneurial culture, variety in their nature and importance, interconnection. Practical relevance refers to a future possibility to use these findings on order to, firstly, compare the level of entrepreneurial culture development in different clusters and, secondly, for the usage of cluster management in order to understand whether entrepreneurial culture needs to be increased, which elements are lagging behind.

1.3. Research question and objectives

The abovementioned results in the following research question:

What are the main determinants of entrepreneurial culture in an innovative biotechnology cluster?

This research aims to contribute to our understanding of interconnection between personal, regional and country aspects influencing entrepreneurial culture. It will result in a model which allows the description of the entrepreneurial culture in a given innovative cluster, taking into account the main determinants of the entrepreneurial culture.

1.4. Method

This research combines exploratory and explanatory nature as it aims to develop and describe the model helping to get better understanding, which regional and country factors determine entrepreneurial culture. We opt for a research design of a qualitative nature as it gives the opportunity to get deeper understanding of the specific national traits that influence entrepreneurial culture.

This study gets into analysis at the cluster level; therefore we will implement the multiple case-study method. Having the dataset from 16 clusters, we selected 4 of them for further consideration in our study.

The research method is a mix methodology, as it combines qualitative and quantitative data. An on-line questionnaire will be used as a quantitative data collection means, while semi-structured interviews will be conducted for qualitative data collection. The data will be taken from the questionnaire and interviews hold during the regional biotechnology study, as far as almost every respondent was asked to elaborate on the topic of entrepreneurial culture.

The focus population of the study is the members of innovative biotechnology clusters, studied during mentioned above assignment. Originally, about 140 respondents were approached by the means of a telephone interview, and more than 200 cluster participants filled out the online questionnaire. However, for our study we selected the results of four clusters referring to about 40 interviewees and 50 on-line questionnaire respondents. We went for best practices approached digging into those cluster showing the better developed entrepreneurial culture.

Although this sample may not be sufficient in size to result in findings that can be generalized to the population at large statistically, we believe that this sample is sufficient in terms of providing findings, that can be convincing or at least strongly indicative towards the theoretical assumptions adopted in our study.

1.5. Outline

First chapter of the present work provides a general description of innovative clusters phenomena and the need to study the entrepreneurial culture concept for better understanding them. Secondly, we will conduct a literature review, to find out the exact definitions of crucial concepts and resulting in a model of the success factors of the entrepreneurial culture in an industrial cluster. The third chapter will be devoted to the methodology and describe the calculation of each input element of the model. The fourth chapter will be a case study presentation – 4 clusters from different parts of Europe will be described, using the suggested model. The last chapter will contain the discussion of the model and possible improvements for it, as well as suggest a number of topics for the future research.

2. Literature review

The original aim of the following review is to find out, which success factors of entrepreneurial culture in an innovative cluster were detected by scholars, which of them were perceived to be crucial.

Our method of literature review falls into the category of dealing with a mature topic, where an accumulated body of research exists, that needs analysis and synthesis (Webster & Watson 2002). As far as our aim is to propose a conceptual model synthesizing and extending the existing research, we need a thorough review of existing literature (Toracco, 2002). The first section of the following literature review is devoted to the introduction to the phenomenon of innovative biotechnology clusters. Secondly, we will review relevant literature to set a clear of entrepreneurial culture and to find out its success factors, decompiling the concept itself. Finally, we will come up with a model of crucial aspects in order to answer the research question - *what are the main determinants of entrepreneurial culture in an innovative biotechnology cluster*.

2.1. Innovative Biotechnology clusters.

To get a better understanding of the success factors influencing entrepreneurial culture development in biotechnology clusters, the latter phenomenon should be studied first. To do so, we studied European Commission documents related to the topic (e.g. development of Innovative clusters) – for instance, Cleverbio Project analysis, resulting in a book “Industrial Clusters in Biotecnology” (Chiesa and Chiaroni, 2005).

The term ‘*innovative cluster*’ refers to a geographically confined collection of related firms operating in a knowledge-intensive industry. These innovative or knowledge-intensive industries incorporate new advances that may originate in scientific discoveries, as in the biotechnology (or nanotechnology industries), or in the application of know-how developed through practice, as in industrial equipment manufacturing or specialty foods (Feldman et al, 2005).

Biotechnology means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use[2].

Biotechnology clusters include firms working in related or supporting technologies, and an infrastructure of institutions and social relationships that provide resources and promote the interests of the whole cluster (Boschma, 1999). Clustering as a phenomenon has been a subject of academic discussion since 1920, when Marshall noticed the importance of industrial localization studying

[2] "*The Convention on Biological Diversity (Article 2. Use of Terms).*" United Nations. 1992.

development of English industrial regions in 19th century. The reasons behind this phenomenon can be found in the work of Porter (1998), who points out the following advantages of clustering:

(1) Productivity advantages due to the use of better and cheaper specialized inputs (components or services)

(2) *Innovation advantages*: proximity between customers and suppliers facilitates the transfer of tacit knowledge and therefore enables innovation. Proximity to knowledge centers offers a strong potential for innovation, allowing critical mass to be gained, particularly for pre-competitive activities (for example basic research). Finally, localized benchmarking among actors in the cluster and the great availability of a qualified labor market can strongly improve the capacity to innovate.

(3) *New business advantages* because of availability of information on market opportunities and potential, barriers and risks for new firms.

Cluster participants involve the following categories of stakeholders:

- Cluster organizations – various forms of organizations, joint efforts to manage cluster activities;
- Universities and other Higher Educational Institutions and public/semi-public research institutes;
- Companies (large and SMEs, including start-ups and spin-offs);
- Supporting organizations, such as Technology Transfer Offices, Advisors, Business Incubators;
- Policy makers – various levels, including regional or even supra-level (e.g. country or EU) governmental bodies.

2.2. Entrepreneurial culture and its formation

The method of data gathering for this section of the literature review was mostly adopted from “National Culture and Entrepreneurship: A Review of Behavioral Research” by Hayton et al (2002). We chose this approach as far as the review is also to refresh understanding, using an existing amount of the literature and due to the subjects, and, consequently, sources, relation. Their study, focusing on the empirical, rather than the extensive conceptual literature (Hayton, 2002), covered the journals, which most frequently published the entrepreneurship and cross-cultural behavioral research, and the authors used only those articles published in journals or book chapters, not in working papers or conference presentations.

Therefore, our review focuses on the empirical literature, published mostly over the last decade. Initially, the matching magazines of Financial Times Top-40 Journals (2006)[3] were examine, then - those academic journals containing peer-reviewed articles. JSTOR, EBSCO, SpringerLink, PiCarta databases and google.scholar were scanned using the following keywords: entrepreneurship, entrepreneurial spirit/culture, industrial/high-tech/technology/innovative cluster, national culture, innovativeness.

Abstracts of those articles, book chapters and academic papers, being up-to-date and coming from a reliable data source were studied in order to reveal, whether they are topic-relevant (Saunders et al, 2009). Initially we found about 45 resources (all to be found in the literature annex). We excluded those articles, which focused only on particular cases and could not be used for a general theory creation. Neither the chapters from teaching textbooks were used. To study the remaining articles, we used a concept-centric matrix method: a table which reflecting the findings on the topic of our interest and giving the opportunity to systemize different opinions on it (Salipante et al, 1982). We compiled the table[4] as we read each abstract and marked, whether the concepts of our interest were discussed in the following manner:

Table 2-1. Concept review matrix

	Concepts			
	Entrepreneurial culture	Industrial clusters	Differences in national culture	Entrepreneurship
Article				

Thus, about 70 articles from 14 journals[5] formed the basis of our literature review. The majority of them were published in the last decade, though we included those which were published before but were referred to mostly often.

Later, for analyzing applicable articles, we added another dimension on the concept matrix to handle the levels of features, suitable for our analysis (Te'eni, 2002; Webster and Wantson, 2002), identifying whether the factors we found imply to personal, cluster or country level. We intentionally did not include the regional level of variables, although not doubting it to be applicable for innovative regions studying and were used in several works, e.g the study of German regions by Graf & Henning (2008). The reason behind this choice is that, first, some clusters in the study exceeded the region boundaries;

[3] To be found in the Annex A.
[4] The filled in matrix to be found in Annex B
[5] See Annex A

secondly, there is not enough data available on region variables, especially on those touching upon individual perceptions and characteristics; thirdly, there are cases when there are several innovative clusters (bunch connected firms) within one geographical region, e.g. biotechnology and information technology.

At this stage of our work it became obvious, that scholars still lack the common understanding of some core concepts for our study - for instance, we found a lack of generally accepted definition of entrepreneurial culture, the most important concept of our study. Furthermore, entrepreneurship itself, which we perceive to be an outcome process of favorable entrepreneurial culture within an innovative biotechnology cluster, was claimed to become a buzz world in public debate without a clear definition (Iversen et al, 2008). Thus, the first step of our review became to set the clear definitions of these crucial concepts, in order to be consistent and coherent in our following study. The second step was to dig into the concept of entrepreneurial culture to find out its building blocks and success factors, decompiling the concept itself. Finally, we will come up with a model of crucial aspects in order to answer the research question - *what are the main determinants of entrepreneurial culture in an innovative biotechnology cluster*.

2.2.1 Whom are we studying?

The first step was to get the better understanding of the individuals, who form entrepreneurial culture and emerge from it. This sub-study applies to our original aim – to get the better understanding of the three levels of entrepreneurial culture success factors, and refers to the personal level:

Table 2-3. Towards personal level of entrepreneurial level of success factors

Articles	Factors influencing entrepreneurial culture:		
	Personal level	Cluster level	Country level
	x		

Aiming to answer the question “who is an entrepreneur?” we enlarged the time frames of the literature reviewed. Various opinions and definitions have been presented by researches over time. Monitoring these changes it is as well possible to track the shift in entrepreneurial roles in the history. Though scholars tend to more describe what entrepreneurs do instead of what they are (Licht, 2007). Despite the term “entrepreneur” itself was presented by Cantillon more than 250 years ago as the ‘someone who identifies the willingness to bear personal financial risk of a business venture” (1755) , the features, role and nature of an entrepreneur was continuously rethought and discussed again and again, e.g. Schumpeter saw an entrepreneurs as a pioneers, “catalysts of change who continuously do things that have not been done before and who do not fit established patterns” (Schwartz and Malach-Pines,

2007). Schumpeter's entrepreneur is more an innovator, carrying out specific tasks all aimed on creation/taking a new approach (Schumpeter, 1949). Even before that, Marshall emphasized this trait of an entrepreneur, in that case seeking the opportunities for cost-minimizing (Marshall, 1890). This view as well as those supporting Austrian approach (Kirzner, Schultz, Leibenstein, Baumol and others) is more corresponds with the role of entrepreneurs within economy and presents entrepreneurship as an ability to deal with the situation if economic disequilibria (Schultz, 1975). As far as our research aims to find the success factors of entrepreneurial culture development and, in this stage, aims to find the description of an entrepreneur, not its impact of the economy, we will not dig deeper into the findings of the followers of the second approach.

Following Gartner (1990) we argue, that there are two conceptually different approaches in understanding entrepreneurship, either discussing its outcomes (added value) or the process, situation itself – involving innovative approach, uniqueness. Followers of the latter address an entrepreneur as an individual with unique personality characteristics and abilities (Gartner, 1990). More specifically, Bygrave and Hofer (1991) saw an entrepreneur with regard of desire and process of new venture creation. Harper (2008) describes entrepreneurship as a profit-seeking problem solving process that takes place under conditions of structural uncertainty. Again, our goal is to focus on these internal characteristics of the process, not the outcomes. This approach falls into social psychologists' one (Beugelsdijk, 2007) and is more suitable for the present work, as far as we are obviously interested in the origins of the entrepreneur – what motivates people to start an enterprise, not how it would influence the economy itself or how much value would be added. To a certain extend we are following the concept of 'entrepreneurial mindset' as the ability to sense, act, mobilize under certain circumstances (Haynie et al, 2010) arose. The findings in this specific, more psychology-oriented field were reviewed by Cromie (2000) and presented in seven characteristics distinguishing entrepreneurs.

"Although there seems to be no generally accepted definition of entrepreneurship, many assessments are unified by the notion that entrepreneurship is about creating something new" (Reynolds et al, 2005). This postulate correlates with the statement of Cromie (2000) who argued entrepreneurship to be not only associated with formation of new businesses, but with action in the sense of starting. Morisson (1998) argued that entrepreneurship is not just an economic function, but represents a composite of material and immaterial, pragmatism and idealism, the essence of which is an application of the processes of innovation and the acceptance of risk-taking, directing at changing either society or economy. Therefore at this stage we postulate, that for us entrepreneur would be seen as an individual involved in the process of innovation and business-creation, being its initiator and catalyze; and in our specific case they are a bridge between academia and industry.

Therefore, an entrepreneur possesses specific character aspects. Scholars (McGrath, 1992) argue that these features distinguish entrepreneurs from non-entrepreneurs and can be studied

empirically. Our next step is to figure out these traits of an entrepreneur. *Although digging into the entrepreneurial mind is not the preliminary subject of our research (which is entrepreneurial culture success factors), understanding of those, who we perceive to be entrepreneurs and their internal traits gives us the overview of the personal level inputs*. Cromie's (at least) seven characteristics included McClelland's 'need for achievement' (1961) – willing to work hard in order to achieve success (Beugelsdijk 2007). This trait has been used in various studies and researches of entrepreneurial culture because of its high validity (Spengler, 1992), e.g. a recent Suddle's correlation between country's rate of nascent entrepreneurship, its level of economic development and entrepreneurial culture with world values survey. Another characteristic is locus of control (Rotter, 1966, Brockhaus, 1982) which reflects the ability to be in charge of the situation, highlighting the person's actions to determine its outcome, not the fate, third party or environment (Rotter, 1966). This concept was in-depth studied by Mueller and Thomas (2000), whose study we will address later, and proved to be essential for the new venture creation action (Shapero 1975, Krueger 1993). Beugelsdijk empirically proved entrepreneurs are likely to characterize themselves by preference to their own responsibility (2007). The third Cromie's trait, risk-taking (or risk-failure acceptance) is another common aspect of entrepreneur's description (Hisrich 1990). Creativity as a an ability to recombine existing inputs in a new outcome by that adding value (Leibenstein 1968), need for autonomy as a will and personal capacity to fight for the goals without third force (Lumpkin and Dess 1996), tolerance for ambiguity as dealing with controversial or incomplete information, willingness to face uncertainty (Wennekers et al 2007, Sheré 1982, Kihlstrom and Laffont, 1979) are other distinguishing traits of an entrepreneur (Cromie, 2000). Finally, self-confidence which is related to self-efficacy (Chen et al 1998, Mcgee et al 2009) – self-estimation of capabilities to mobilize internal resources and skills when needed (Wood and Bandura 1989). Rule-breaking (Brenkert 2009) - either moral or legal - corresponds with the general feeling of dare and willingness to change, achieve, and create.

2.2.2 Entrepreneurial culture – buzz concept moving the progress?

The aim of the present work is to find out the variables determining entrepreneurial culture in a innovative biotechnology cluster. Therefore, the term "entrepreneurial culture" should be specified. The literature studied showed a lack of generally accepted definition of this concept, the same counts for so-called entrepreneurial spirit. Even though these concepts became relatively popular and are discussed among researchers, scholars, academics - even included into the must-list of a descriptive model of the whole innovative cluster (Chiesa, Chiaroni, 2005) - common understanding of entrepreneurial culture as such does not (yet) exist, even Wikipedia, which would be addressed by any student first, doesn't provide with the explanation of entrepreneurial culture! Consequently, our preliminary task is to define entrepreneurial culture and spirit, especially in our framework – innovative cluster.

Gibb (1999) defined entrepreneurial culture as a set of "values, beliefs and attitudes commonly shared in a society which underpin the notion of an entrepreneurial 'way of life' as being desirable and in

turn support the pursuit of 'effective' entrepreneurial behavior by individuals or groups" (p. 28). By replacing the world society for cluster this definition fits very well. Though, the concept of entrepreneurial culture is not considered as clear-cut. Indeed, this concept was mostly posed in discussions related to economic success as one of an entrepreneurial action enabler. It was argued by the followers of Austrian school6, that those scarce individuals with willingness to take risk enable economy to grow, thus enlargement of the number of people with these entrepreneurial traits would lead to growth and development (Davisson 1995, Uhlaner et al 2007). Gilder (1971) described a specific feeling of enterprise which wells up from wisdom of ages and the history, infuses the most modern technological advantages, connected to aspiration and courage. And this spirit is the key initiator of entrepreneurial process, lying inside the individuals within society (Kirzner, 1979). Leibenstein argued that for the growth of (regional) economy, the set of individuals with gap-feeling and input-completing capacities is exogenous and highlighted the importance of their personal characteristics. As far as culture itself is a historically evolved learned set of values, attitudes and meanings shared by the members of a given community that influence individuals' way of life in this society (Tayeb, 1988), or, even more simple, pattern of taken-for granted assumptions about how the community should think (Hall, 1959), entrepreneurial culture is the set of those values, attitudes and meanings, influencing the attitude towards entrepreneurship in the given community. Following Colin and Slevin (1989), entrepreneurial orientation is a complex construct combining innovative, proactive and risk-taking behaviors.

Not to mislead the reader, this work is not only to study those mentioned pro-entrepreneurial environments, but to understand WHY they are (or not) such. In other words, entrepreneurial culture is the atmosphere leading an individual to become an entrepreneur. We will stick to this definition - by a developed entrepreneurial spirit we will consequently mean the positive attitude towards entrepreneurship. Those works, emphasizing the influence of entrepreneurial culture on economic performance (Shane 1993, McClelland, Freeman 1976 etc), could not, by definition, be the preliminary basis of our study, as far as they are concerned with the outcome, not the defining, description and digging into the concept of entrepreneurial culture itself – what we are aiming to do.

Concerning innovative clusters, entrepreneurial culture in an innovative biotechnology cluster would refer to a cluster participants' attitude to expand beyond scientific side of research, to go for commercialization of gained knowledge. Such commercialization is reflected by, for instance, establishing new ventures exploiting tacit knowledge obtained (Chiesa & Chiaroni, 2005).

2.2.3. De-composition of entrepreneurial culture

In the previous section we studied, which characteristics could an entrepreneur be described with, therefore the question arises, how do those form? Such attributes explaining the visible features of an entrepreneur and his activity from inside, on a personal level, are important, although not all-

[6] As mentioned before, the followers of the Austrian School of Economic Thought viewed entrepreneurship as the driving force in economic development

pervading determinates of behavior (Cromie, 2000). Therefore, we have to understand now, which external factors form entrepreneurial culture in an innovative biotechnology cluster. In other words, what releases this invaluable spirit, leading to the initiation of entrepreneurship (Garrison, 1985; Morisson, 2000).

Following Krueger and Carsurd (1993, 1995, 2000, 2006), we stated that there are three critical perceptions predicting, whether an individual is likely to pursue an entrepreneurial opportunity – personal desire, support by social norms, feasibility. In our point of view, these concepts to a certain extent are overlapping each other (e.g. what exactly stops a young woman from a masculine traditional society to start a business?..) Indeed, personal non-psychological variables such as education, family, experience (Cuervo et al, 2007), as well as economic environment, national culture, social network etc. influence the tendency to behave entrepreneurially (Rauch and Frese 2000). An innovative cluster is complex phenomena which is capable of initiating a synergetic process, an organization, a complex system made up of economic and technological interdependencies, where protagonists are linked (Maillat 1991). Therefore, complex factors such as venture capital availability, social acceptance of entrepreneurs, formal-informal networks influence the entrepreneurial culture development (Audretsch and Keilbach, 2004). But whereas the individually relevant entrepreneurship determinants are to certain extent widely explored (Parker 2004, Grilo and Irigoyen 2006, Grilo and Thurik 2008), differences on a society level – clusters and countries – remain unexplored (Freytag and Thurik, 2010). So the question arises, what forms these dissimilarities, if such exist?

As far as our research opts to contribute into the understanding not the factors influencing entrepreneurial behavior of a particular person, but a specific group (in the cluster), we will pay specific attention on those [external] parameters.

Table 2-4. Filling in the cluster and country levels of entrepreneurial culture success factors

Articles	Factors influencing entrepreneurial culture:		
	Personal level	Cluster level	Country level
	x	***X***	***X***

We already discussed the personal traits of an entrepreneur before in this chapter. *Moreover, some individual natural characteristics of a person are inborn and could not be influenced from outside* (e.g. by policy makers, even if we admit that those starter-motivating traits could be influenced by some psychological means, this is not the case for our research) *and also hard to study, therefore in this work we will not make a special emphasis of such characteristics and not include in the model, although not doubting their [possible] crucial impact on entrepreneurial culture*.

Thus, the following part of the review will be devoted into indicating and systemizing the factors falling into the categories of social and feasibility perception

Concerning the support by social norms – corresponding to culture itself, and how it determines the attitudes of individuals towards the initiation of entrepreneurship (Vernon-Wortzel, 1997), their influence were extensively studied (Hayton et al. 2002, Beugrlsdijk 2007, Shepherd 2010, Mueller 2000, Perlitz 2004, Hechavarria 2009, Hansen et al 2008, Morisson 2000, Liñán and Chen 2009 and many others) in their various aspects, such as, for instance, value dimensions (e.g. Hofstede (1991), Shane 1992, Baum et al 1993, McGrath et al 1992) and even religion (Foreman-Peck). This factor is sometimes perceived as one of the most prominent influencing entrepreneurship, e.g. Morisson et al (2000). The formation of this norms goes deeply in the mentality of given society, taking into account such variables as historical contest, political and economic system (Lee&Peterson, 2000; Lumpkin and Dess, 1996)

Social norms affect the style of behavior; therefore society perceptions might push a person from/towards starting something new. A significant amount of studies were recently published especially in the field of interconnection between national culture and entrepreneurial culture development. Pioneered by Hofstede (1984) with the analysis of key domains of national culture – Power distance, Individualism, Masculinity, Uncertainty avoidance and Long-term orientation - cultural factors were shown to be instrumental in leading and directing personal motives eventually leading to entrepreneurial culture development. Schwartz (1992, 1994) presented seven cultural domains based on universal human value types (conservatism, intellectual autonomy, affective autonomy, hierarchy, mastery, egalitarian commitment and harmony) which were combined into three dimensions – embedness vs. autonomy, hierarchy vs egalitarianism, mastery vs harmony (Schwartz et al, 1999). The operationalization of those culture variables was done by Inglehart through developing and conducting World Value Survey (WVS). It included two dimensions – authority as the polarization between traditional and secular-relation; well-being as the polarization of survival and self-expression values (Inglehart, 2006). Global Entrepreneurship Monitor (GEM), an annual global study was first conducted in 1997 by Michael Hal and Bill Bygrave, measuring differences in the level of entrepreneurial activity among countries. GEM presents the latest data on (among other) country entrepreneurial attitudes, which reflect entrepreneurial spirit and motivation, general society attitude towards entrepreneurship. We assume that the innovative clusters we are studying, even being a special place, are still a part of the country/society, therefore we postulate that the **overall country orientation towards entrepreneurship** would influence entrepreneurial culture in innovative cluster and will use it as one of parameter describing it.

However, is national culture the only one social parameter influencing entrepreneurial attitude in an innovative cluster? We should not forget that a cluster is a separate territory and therefore doesn't represent all society. Therefore, specific traits and values of this particular area are coming into the arena. Network ties as an environmental characteristics are important for new business creation (Carolis

and Saparito, 2006). Their ties may be based on conversation, affection, friendship, kinship, authority, economic exchange, information exchange, or anything else that forms the basis of a relationship. In a network, flows between objects and actors and exchanges, which might contain an advice, information, friendship, career or emotional support, motivation, and cooperation, can lead to very important ties (Kadushin, 2004). In all environments, entrepreneurs must build reputation-enhancing relationships with outside resource providers who are willing to share valuable information, technology, and finance (Birley, 1985). **Networking** refers to a strategy that focuses on creating and maintaining a lasting relationship between entrepreneurs and their network (Premaratne, 2002).

Another type of success factor is the so-called role model companies – those started in the cluster and rose to success (Chiesa and Chiaroni, 2005). **Role model companies** are the companies that serve as models in a particular entrepreneurial role (e.g. related to R&D, marketing, production or collaboration) for other companies to emulate. Role models and the creation of awareness of successes can contribute to the entrepreneurial culture of a cluster by inspiring other companies and providing an example of how to become successful. Such examples are claimed to be a good motivator for future entrepreneurs showing that big time is basically possible for everyone. Moreover, presence of such companies brings to the cluster experienced managers, who might share the experience with the starters – here come the question of entrepreneurial education and trainings. The relationship between training in starting new business and entrepreneurial attitudes are claimed to e positive (GEM); at least those trainings raise the entrepreneurial inspiration (Soitaris et al. 2007). Managerial courses to science and technology graduates were suggested to be given in innovative clusters to understand commercial possibilities. Rosenfeld mentioned business education to be an effective means for overall innovative cluster development. Therefore, we suggest availability and quality of specific entrepreneurial courses, in other words – **entrepreneurial education** to be another parameter for our descriptive analysis of entrepreneurial culture.

Here we come to the question, by which means entrepreneurial intentions will be brought to life, to the opening the third Krueger and Carsurd's perception – feasibility. As claimed before, those perceptions might be overlapping, and entrepreneurial education is (in our opinion) an example of such overlap. Going further, we have to understand how this training should be provided. If the cluster hosts a University, it might have business courses/faculties/available trainings. In other situation, it might be cluster organization/management itself that provides the latter. Another possibility could be that an organization itself invests into entrepreneurial skill development of individuals it is interested in – all these possibilities within the cluster should be studied and described in order to achieve better understanding of this input to entrepreneurial culture.

Taking the feasibility perception further, we should highlight that supra-level (country, EU, etc) laws and regulations, e.g. government restrictions of economic freedom, appear to impact

entrepreneurial activity and the entrepreneur's motive to start such business actions (Mcmullen et al, 2008), consequently influencing the entrepreneurial culture development. Quality of economic, political and legal institutions is claimed to be positively connected with productivity of entrepreneurship (Baumol 1990, Sobel, 2008, Baptista 2007). Moreover, issues concerning taxation, rules about depreciation of investment and such issues as the rules governing share-options was claimed to affect the general climate for entrepreneurship and rules of competition (Cooke, 2002). Thus, we have to take into account the **Economic enablers** for the entrepreneurial culture development. As for the industry the cluster operates in, first of all we will consult **specific regulations and legislation** in the specific field the cluster is operation.

Digging deeper into a cluster level factors, **availability of specific services and infrastructures** can be crucial in individual's decision for commercialization knowledge (Rosenfeld, 1995; Chiesa and Charoni, 2005) Such infrastructures (incubators, research centers, business parks, technology transfer offices) are aiming to foster the commercialization of research and new ideas, to stimulate scientific entrepreneurship etc (European Commission. 2004). All these services and infrastructures enabling knowledge transfer, which involves new business launches or identification of new business opportunities within existing organizations (Andersson et al, 2010).

Unless the research findings are brought to a market, there is no benefit for economy (Chiesa and Chiaroni, 2005). Due to the focus of our study on knowledge-driven, biotechnology innovative clusters, licensing policy and should also be taken into account – as far as it opens up opportunities for incentives that motivate inventor academics to seek patent as a means of maintaining control over future research (Strandburg 2005). We will go broader the concept of licensing taking into consideration all the process of knowledge commercialization – describing **technology transfer process**. This involves finding, creating and leveraging – both through licensing and creating new products – IP rights that has potential commercial applications.

Finally, the **funding aspect** appears to be another feasibility success factor for entrepreneurial culture development (Rosenfeld, 1995; Chiesa and Charoni, 2005). Availability of finance refers to seed capital, venture capital, governmental funds, and grants from foundations and loans/borrowings (Chiesa and Chiaroni, 2005). Moreover, Broekel and Brenner (2009) included financial situation and firm funding in their list of regional factors influencing innovativeness. We assume, that as far as this factor influences the performance of a cluster as a whole, how it was presented by mentioned above scientists, then, caeteris paribus, availability of funds/capital affect the desire to start a new venture and therefore entrepreneurial culture.

To resume, we have a model of components, building a solid entrepreneurial culture in innovative cluster:

Table 2-5. Success factors of entrepreneurial culture development in an innovative biocluster

		Country level	Cluster level
Entrepreneurial culture	Social perception	1. Country orientation towards entrepreneurship	2. Social networks 3. Role models 4. Entrepreneurial Education
	Feasibility perception	5. Economic enablers 6.Specific legislation	7. Supporting facilities 8. Technology Transfer Processes 9. Funding

The table represents the success factors of entrepreneurial culture development in an innovative biotechnology cluster, which are structured using two perceptions (social and feasibility) and two levels of the factors (a country and a cluster itself).

Our model differs from those previously created in considering different levels of influence, both internal (cluster) and external, while previous researchers were more concerned with either personal factors influencing entrepreneurial culture in the country, individual decision making process, or the influence of the entrepreneurial culture on regional performance.

3. Methodology and conceptualization.

This section of our study is devoted to the description of the way to assess the factors of suggested model, aiming to describe the success factors influencing the entrepreneurial culture in an innovative cluster. Such objective appeals to both descriptive and exploratory study which is a valuable means for clarifying the understanding on an issue, as well as its nature and causes (Robson, 2009). To get the better understanding of success factors suggested and to advance the model we went for a case study. Such portrays, reflecting causal relationships also appeal to discripto-explanatory studies (Saunders et al, 2009). Moreover, we perceive our nine success factor of entrepreneurial culture to be generally applicable; therefore we follow a nomothetic approach - seeking to identify several causal factors influencing class of conditions (Babbie, 2010)

First, we will present the research strategy we will use further - to come up with the step-by step program of the model implementation. This involves a description of the research method applicable and available, for presenting the characteristics we found in the previous chapter. Later on, we will discuss the data available and how it can be processed to present each variable in the model.

3.1. Research strategy

Our research observes of a contemporary phenomenon within its real life, including different sources of evidence, and such approach refers to case studies (Robson, 2002). Moreover, we will have the possibility to observe the differences in the importance of the success factors in the clusters (here we have to specify that for us a “case” is an innovative cluster). The purpose of our study is to come up with the list of the success factors of entrepreneurial culture in a biotechnology cluster, therefore detailed observation of different cases is needed. This strategy is suitable, as far as it is relevant for those studies, when a researcher seeks to gain a reach understanding of the processes and context (Morris and Wood 1991). Looking back to the previous research done in this field, we can see that researchers also tended to test characteristics of an industrial cluster they found important using case studies (Broekel and Brenner, 2010; Chiesa and Chiaroni, 2005).

After the literature review, resulting in the model describing entrepreneurial culture in an innovative cluster, the next step is to use the model for cluster description. Our model consists of nine different characteristics and all of them are perceived to be crucial for entrepreneurial culture in an innovative cluster. The next step is to come up with clear guidelines of data inputs needed.

Our research is predominantly of an explanatory and exploratory nature as it aims to develop and describe the model helping to get better understanding, which regional and country factors determine entrepreneurial culture. We opt for a research design of a qualitative nature as it gives the

opportunity to get deeper understanding of the specific national traits that influence entrepreneurial culture. This study gets into analysis at the cluster level; therefore we will implement the multiple case-study method. The data collection techniques for case studies strategy are advised to be various (Saunders et all, 2009). We will use a mix methodology, combining qualitative and quantitative data. An on-line questionnaire will be used as a quantitative data collection means, while semi-structured interviews will be conducted for qualitative data collection. The data will be taken from the questionnaire and interviews hold during the regional biotechnology study, as far as almost every respondent was asked to elaborate on the topic of entrepreneurial culture.

3.2. Data availability

Our research was inspired by the assignment carried out during an internship in PricewaterhouseCoopers Advisory, Adviesgroep Subsidie Innovatie & Beled in the period February-August 2010. The Regional Biotechnology study I was helping to carry out, was focusing on establishing a methodology and performance indicators for assessing bioclusters and bioregions relevant to knowledge-based bio economy (KBBE) area. This research was conducted for the use of European Commission, Directorate-General for Research. The general objective was to develop a tool which can be employed by both policy makers and cluster organizations to measure the performance or regional biotechnology entities and contain a minimum set of relevant indictors that would allow measuring cluster performance, as well as identification of factors that contribute to the cluster success, the barriers for further development, and how the barriers might be overcome in the future. 16 bioclusters and bioregions from all over the world (Spain, Norway, Germany, Sweden, France, Belgium, Canada, USA, The Netherlands, Austria etc) were approached during this study. Having the dataset from 16 clusters, we selected 4 of them for further consideration in our study. We went for best practices approach – selecting the cluster with stronger entrepreneurial culture. The reason behind this is the will to see the different combinations of factors building developed entrepreneurial culture.

The method of data gathering included desk research (analysis of documents, available websites, and normative acts referring to biotechnology), on-line questionnaire and telephone interviews with cluster participants. PricewaterhouseCoopers kindly agreed to share the data gathered during the study for our research, though the findings of their study should be presented in anonymous way without references to exact biotechnology clusters. As far as our research is aimed to opt into general understanding of the topic, we do not have to disclose any particular names of the clusters. For our study we will use the data gathered during the internship and corresponding with the terms of our interest, mostly cluster-level success factors of entrepreneurial culture. Both survey answers and interview transcripts contained the information we are searching for.

For the data, which was not possible to extract from PwC study (mostly country level variables), we will use secondary data from suitable researches (GEM, World Bank, Wall Street Journal – to be discussed further). Secondary data has the advantage of saving resources (Gronhaugh, 2002) and therefore we are able to analyze far larger datasets (Saunders et al, 2009) such as global- and country-level studies. Additionally, this type of data is likely to be more higher-quality (Stewart and Kamins, 1993). Later on we will discuss the selection of data inputs for each element to pick it carefully to avoid one of the main disadvantages of secondary data usage – mismatching between original purpose of its gathering and our research question(s) (Descombe 1998; Saunders, 2009).

The focus population of the study is the members of innovative biotechnology clusters, studied during mentioned above assignment. Originally, about 140 respondents were approached by the means of a telephone interview, and more than 200 cluster participants filled out the online questionnaire. However, for our study we selected the results of four clusters referring to about 40 interviewees and 50 on-line questionnaire respondents.

Although this sample may not be sufficient in size to result in findings that can be generalized to the population at large statistically, we believe that this sample is sufficient in terms of providing findings, that can be convincing or at least strongly indicative towards the theoretical assumptions adopted in our study.

3.3.1 Cluster level variables

In our research we faced the situation, when we, first, had a dataset available, and only after we had to connect it to variables we were interested in. The data gathered during the internship in PricewaterhouseCoopers can be referred both to secondary and to self-gathered data, as far as my direct responsibility was to conduct interviews with participants from 4 of 16 clusters and to prepare Social Network Analysis for all 16 clusters. The topic of the entrepreneurial culture was not the main objective of the study conducted by PwC, although in-depth discussed, as well as the elements of cluster-level part of our table.

Surveys are claimed to be suitable for all types of research (Babbie, 2009) and the best method available to a researcher, whose aim is to collect original data for describing a large sample especially in studying attitudes and orientations. In our study, we use the results of on-line questionnaire, with both closed- and open-ended questions. Cluster participants representing Universities and other Higher Education Institutions and public/semi-public research institutes, companies (large and SMEs, including start-ups), cluster organisations and other supporting organisations such as Technology Transfer Offices and Incubators were approached. In several cases (approximately ten per cluster) the respondents also were approached for in-depth one hour length interviews. *The number of respondents per cluster was approximately 10-20 for the on-line questionnaire and about 10 telephone interviews per cluster. The*

selection of respondents was done in such way, to cover all types of stakeholders to avoid prevailing of any particular group's interest or point of view.

During the interviews, the respondents were asked to elaborate on their responses to the questionnaire in order to provide a more complete picture. Semi-structured interviews (having the list of topics to discuss) were used giving the opportunity to dig into the themes of more interest/expertise of the respondent (Saunders, 2009).

3.3.1.1. Entrepreneurial culture measurement

Entrepreneurial culture was one of the elements of cultural driving force. Therefore the respondents of the study were asked to elaborate on the topic. To use our model for clusters description, we have to find out how to process the qualitative data from the interviews and survey, to match the list, containing success factors of entrepreneurial culture with the available cluster insights. We made a desk research on the analysis how this concept was measured in previous studies. As stated before, we didn't find any studies literature discussing this particular topic – entrepreneurial culture in the frameworks of an innovative cluster. Some researchers include entrepreneurial culture as one of the inputs of a cluster success factors (Chiaroni 2002, Klofsten 2000, Broekel 2009) and analyzed it as a quantitative variable, when others (Suddle et al, 2007) created a complex quantitative index but for a country level measurement purposes. As far as our purpose is to decompose the concept of entrepreneurial culture and to gain the better understanding of success factors for its development, and, as stated before, entrepreneurial culture, for us, is the atmosphere leading an individual to become an entrepreneur, we perceive the cluster participants to be aware of such atmosphere in their cluster.

In the questionnaire, the respondents were asked to assess the strength of entrepreneurial culture in the following ways:

a) Using of five-item Likert scale (from very week to very strong).

b) Using the multiple-choice question: "main focus of activities in the cluster". One of the possible choices was "establishing new companies (e.g. spin-offs)". We believe that this answer is applicable for the measuring of entrepreneurial culture as far as it corresponds with our definitions of entrepreneurial culture and entrepreneur - atmosphere of individuals involved in the process of innovation and business-creation.

c) Assessing the percentage of spin-offs and start-ups within the cluster

d) When respondents were asked to choose the most important factor for their cluster success, "strong entrepreneurial culture" was a possible answer.

Therefore, we will perceive the entrepreneurial culture within a cluster to be stronger/better-developed, the higher score was achieved by cluster participants on the Likert scale of the entrepreneurial culture strength question, the more respondents marked it to be the crucial enabler for their cluster development and the more respondents marked establishing new companies to be the main focus of activities.

3.3.1.2. Social networks

According to Chiesa and Chiaroni (2005), networking culture refers to the ability to create relationships within academic actors (Universities and other research centres) and companies among the cluster. To bring these actors together means the enhancing and enabling of innovation process (Andersson, 2004). Innovative activity is a collective process, characterized by the transfer of knowledge between networking actors (Graf and Henning, 2010). For us it is important to analyze which agents and how collaborate on the knowledge transfer process – in other words, which paths for future entrepreneurs already exist and how do research centers collaborate with companies giving the possibility to apply research (e.g. by establishing spin-offs etc). Geographical proximity within an industrial cluster itself allows intense interaction and enables large amount of information to be exchanged within and between established networks of complementary and independent activities (Andersson, 2010).

To draw and analyze the networks of a cluster we will use several inputs:

a). In the questionnaire, the respondents had to answer whether the organization feels to be a part of the cluster, to asses so-called “sense of belonging to a cluster”. The possible answers were “yes” or “no”. We will perceive the network to be the more developed the more respondents chose positive answer to that question.

b). Respondents were asked to choose (multiply choice with ticking all applicable variants) which type of collaborations their organization is engaged in. Possible answers included publications, professional networks, mobility of people, informal contacts, cooperation in R&D, sharing of facilities, cooperation in education, contract research and advisory, patent applications. This will be analyzed in descriptive manner to find out which is the prevailing reason to join the network.

c). For better understanding of the overall network picture within a cluster, we will use Social Network Analysis tool. SNA is a methodology developed mainly by sociologists and researchers in social psychology, basing on the assumption that relationships among interacting units matter (Wassermann and Faust, 1994). The picture drawn, based on the answers of the respondents, will reflect the differences in the participating actors (size, academic or company) and the tense of collaboration.

3.2.1.3. Role Model Companies

Existence of successful examples of business within the cluster contributes to entrepreneurial culture within the cluster in the following ways. First, the success of predecessors motivates others to start a new company (Chiesa and Chiaroni, 2005). Secondly, the management of these companies might be invited to conferences and trainings within a cluster to share best practices.

To describe this feature of our clusters we will use numerical data from the survey.

a). Respondents were to identify such companies within their cluster (naming). We will assess this characteristic both numerically (the number of role-model companies) and quantitative – describing size, turnover and history.

b). One of the questions touched upon the factors related to entrepreneurial culture. Respondents had to tick whether role-model companies/motivating entrepreneurial present is present and how. They had to assess it on a 6-item Likert scale (from 0 to 5).

3.2.1.4. Entrepreneurial Education

Sound scientific base is the must but not enough for knowledge commercialization process. To become an entrepreneur, a scientist should look not only at the scientific side if research but also at its commercial exploration. Tacit knowledge can be fully exploited only through creation of a new company (Chiesa and Chiaroni, 2005). To change scientists' and students' attitude towards entrepreneurship and to help those willing to start a business, special entrepreneurial education is needed. It can be provided by universities within the cluster, companies themselves, or arranged by cluster management (conferences, guest lecturers).

We will use the following insights from questionnaire and interviews conducted:

a). In the telephone interviews, selected respondents were asked to elaborate on the personnel development programs. Some of them mentioned business trainings. We will incorporate this qualitative data with the numerical one to be found further.

b). In the on-line survey, one of the questions touched upon the factors related to entrepreneurial culture. Respondents had to tick whether teaching of entrepreneurship and management is present and how. They had to assess it on a 6-item Likert scale (from 0 to 5).

c). Business competitions are believed to motivate people (mainly researchers and developers in the academic and business communities, in our case – both, as far as cluster involves both of these categories) to come forward with their ideas (Dodt et al, 1999) to build their commercial skills by bringing them together with business talent, to attract venture capital, and to identify service providers which

eventually will lead to a stronger entrepreneurial culture. In the mentioned above question, respondents were to assess the presence of such business competitions (on a 6-item Likert scale from 0 to 5).

3.2.1.5. Supporting facilities

Availability of specific services and infrastructures facilitates the development of industrial base of the cluster (Chiesa and Chiaroni, 2005) and therefore enables business starts. As stated in the previous chapter, this feature of industrial cluster influences entrepreneurial culture on the feasibility dimension, therefore we assume that the more supporting facilities are available, the better, ceteris paribus, are the starting conditions for a potential business start. In the case of innovative clusters, and biotechnological in particular, the following services should be discussed:

1. Business incubators, which provide room and shared facilities (both administrative and technical). Such incubators allow start-ups both to save non-product related costs (accounting, secretary, etc) and allow the easy access to laboratories and other science related facilities.

2. Science parks, providing analogous infrastructures and services, houses and support for the companies emerging from incubators on a later stage of their development.

3. Test-facilities or the first suppliers – in our case, hospitals and clinics (for pharmacy-oriented clusters) or canteens (food-oriented).

4. Special service providers, such as legal and marketing advisors to provide start-ups with business advise.

To assess the availability of such supporting facilities, we will use the following data:

a). One of the questions of the questionnaire touched upon this issue. On a 6-item Likert scale (from 0 to 5) he respondents had to rate the availability of the following services:

-Incubators and science parks that cater biotechnology companies
-Transport infrastructure (e.g. roads and proximity to airport)
- Communication platforms (e.g. round tables)
-Group purchasing policies
-Business advisors
-Financial advisors
-Legal advisors
-HR and recruitment advisors
-Property advisors
-Marketing support
-Mutualised technological platforms (e.g. scientific equipment)

b). During the telephone interview, selected respondents were asked to elaborate on the question of available facilities.

3.2.1.6. Technology transfer process

As stated in the previous chapter, technology transfer process involves finding, creating and leveraging – both through licensing or creating new products – IP that have potential commercial applications. "Translating" laboratory researches into products and technologies is potentially leading to, among others, spin-offs creation (Chiesa and Chiaroni, 2005). To describe the ease of such transfers within the clusters we will use the following data:

a). Technology Transfer Offices - TTOs, specific dedicated structures matching the innovation demand and offer – availability. On the stage of desk research, the number of TTOs for each cluster was identified and their structure and bases studied. On the stage of interviews, selected respondents were asked to elaborate on this topic.

b). The online questionnaire contained a question on the focus of main activities within the cluster. Possible answers, among others, included licensing.

c). In the online questionnaire, the respondents had the possibility to highlight cumbersome IP and technology transfer processes.

Therefore, we will describe technology transfer process qualitative using the data from interviews and desk research; perceive the technology transfer to be the more available/easy, the more the cluster is licensing-oriented and the less technology transfer process is said to be cumbersome.

3.2.1.7. Funding

As other innovative industries, biotechnology requires large financial supports and the research is costly. Moreover, the development of such technologies is long, risky and the return of revenue is not possible in short period. Therefore financial variables have a great affect on business start feasibility influencing consequently the will for entrepreneurial action. Here we have to specify that seed capital is in our specific interest as far as it undoubtedly refers to a start-up, when other types or funding might be used for different purposes (enlarging existence companies, research etc)

To assess the availability of funding and their importance the following data was used:

a). In the questionnaire, the respondents were asked to highlight the most important types of funds for their organization – seed capital, venture capital, governmental funds, grants from foundations and loans/borrowings. We will process the data from each cluster to understand the needs of companies in each particular case to compare the demand and supply for desired types of funding.

b). Cluster participants were asked to measure (on a 5-item Likert scale, from 1 to 5) availability of mentioned above types of funding. We will match the results of this question with the outcome of the previous one to understand which type of funding is lacking.

c). The respondents had the possibility to highlight availability of funds (in general) as a main success factor of their cluster. We will see such availability as one of enablers of entrepreneurial spirit.

d). Selected respondents were asked to elaborate on the funding issue. We will incorporate this qualitative descriptions with quantitative ones described above.

3.3.2. Country level variables

To measure the variables on the country level we highlighted on the stage of literature review, we are mostly using secondary data. Such approach allows working with reliable wide-range results, the high-level of which could not be achieved on our own. Academic interest toward entrepreneurship and the level of research been done in this field allows to use the inputs we need for our study and assess the country level variables we previously claimed to affect entrepreneurial culture within an innovative cluster.

3.3.2.1. Country orientation towards entrepreneurship

To measure overall country orientation towards entrepreneurship, we will use the data from Global Entrepreneurial Monitor (GEM), a global study, which was first conducted in 1997 by Michael Hal and Bill Bygrave, now on regular one-year basis, measuring differences in the level of entrepreneurial activity among countries. We select this study as far as GEM presents the latest data on (among other) country entrepreneurial attitudes, which reflect entrepreneurial spirit and motivation, general society attitude towards entrepreneurship.

One of the indexes they calculate is country attitudes perceived by individuals, among others, *perceived opportunities, capabilities, fear of failure, entrepreneurial intentions*. These indexes reflect the percentage of respondents admitted to have such. These variables are suitable for our study as far as it reflects the result of most important inputs for entrepreneurial activity to occur in a country, both opportunities for entrepreneurship and entrepreneurial capabilities. The quantity and quality of perceived opportunities and capabilities is influenced by national conditions such as economic growth, population growth, culture, and national entrepreneurship policy, history, media attention, economic climate, demographic differences, socio-economic or cultural reasons.

We cannot select a single variable for our study as far as If an individual exhibits positive perceptions towards entrepreneurship, it is by no means certain that he or she will actually get involved in entrepreneurial activity (GEM report, 2009).

Therefore, we will use the following assessment strategy for overall country orientation:

a). Entrepreneurial culture in an innovative cluster is the more favorable to occur, the more country scored on the perceived opportunities, perceived capabilities and entrepreneurial intentios indexes and the less on fear of failure index.

b). In the survey, selected respondents were asked to elaborate on the issue of their country orientation towards entrepreneurship. We will incorporate their answers with quantitative data collected from GEM.

3.3.2.2. Economic enablers

Quality of economic, political and legal institutions are claimed to be positively connected with productivity of entrepreneurship (Baumol 1990, Sobel, 2008, Baptista 2007) and, therefore, influences entrepreneurial culture development:

a). The enablers for an entrepreneurial action are on country conditions, including bureaucratic procedures, costs and other issues. To assess the ease of starting a new business we will use the index presented by the World Bank Group[7]. They calculated variables reflecting the bureaucratic and legal hurdles an entrepreneur must overcome to incorporate and register a new firm, examining the procedures, time, and cost involved in launching a commercial or industrial firm with up to 50 employees and start-up capital of 10 times the economy's per-capita gross national income (GNI).

Their annual study results in a table showing the main indicators, including:

- all procedures required to register a firm,
- average time spent during each procedure,
- official cost of each procedure, and
- the minimum capital required as a percentage of income per capita.

Based on these indicators, countries are ranked reflecting the ease of starting a new business. We will incorporate these indicators with the insights of interview, when selected respondents elaborated on the bureaucratic issues on starting new business in their country.

b). Overall economic situation will be measured by the Index of Economic Freedom, calculated over decade by The Wall Street Journal and The Heritage Foundation, Washington's preeminent think tank. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please, with that freedom both protected by the state and unconstrained by the state. Therefore

[7] Retrieved from http://www.doingbusiness.org/ExploreTopics/StartingBusiness/

we will perceive the entrepreneurial culture to be the more likely to developed the higher country scored on the index of economic freedom.

3.3.2.3. Regulations and legislation in the specific field the cluster is operation

Even if the overall economic situation is favorable for starting a new business, cluster participants may face legislation barriers in their specific field (especially in biotechnology). To describe this issue we will use the following data:

a). In the online questionnaire, several questions touched upon the problem of regulation and legislation. These were open questions, which leads to qualitative data analysis approach.

b). Selected respondents elaborated on the issue of regulations preventing knowledge transfer in their countries and discouraging scientists to share their finding bringing to the market.

c). All those potential obstacles mentioned above will be checked using normative documents to prevent from misleading data.

We aim our model to be applicable for getting better understanding of the success factors influencing the entrepreneurial culture development in an innovative cluster. Therefore the following descriptions of the clusters are to find out, whether the features we perceive to be important are such; whether there are other factors influencing entrepreneurial culture; and, additionally, whether any differences are more important than others. The following chapter presents the case studies of four innovative clusters, which scored high on the entrepreneurial culture variable. We will analyze them by our model and discuss the findings – both the difference of success factors influence and possible improvements for our model.

4. Case studies

In this chapter we will use our model to present case studies of four innovative clusters, presented the highest results on the entrepreneurial culture variable. We will use these examples, in order to get better understanding of success factors of entrepreneurial culture development in innovative clusters, and to explore which of them count more – thus advancing the model suggested in the previous Chapter 2. We will use the model to describe the clusters and, later on discuss the findings – both the difference in the importance of success factors and possible improvements for our model:

Table 4-1. Success factors of entrepreneurial culture development in an innovative biocluster

		Country level	Cluster level
Entrepreneurial culture	Social perception	1. Country orientation towards entrepreneurship	2. Social networks 3. Role models 4. Entrepreneurial Education
	Feasibility perception	5. Economical enablers 6.Specific legislation	7. Supporting facilities 8. Technology transfer processes (TTP) 9.Funding

The present chapter will consist of the following: first, selection of the cases will be explained. Secondly, our model will be implemented to describe each of them.

4.1. Entrepreneurial culture measurement

The first step, as was indicated before, is to select the clusters we will discuss later. As stated before, we are willing to consider those clusters where entrepreneurial culture was indicated to be above-average.

After careful consideration of 16 clusters participated in PwC study[8], we selected the following:

- Bio Cluster A - Western Europe (the Netherlands)
- Bio Cluster B - Southern Europe (Spain)
- Bio Cluster C - Northwest Europe (the UK)
- Bio Cluster D - Scandinavia (Sweden)

[8] As far as information disclosure is allowed only to a certain extent, the names of the clusters will not be mentioned

The selection was made by the synthesis of the following measurements:

1. The initial criteria – a relatively high score on self-measurement of entrepreneurial culture by cluster participants.

2. The level of selection "establishing new companies (e.g. spin-offs)" as a main focus of cluster activity within the cluster and the percentage of spin-offs and start-ups within the cluster.

3. The percentage of respondents perceived "strong entrepreneurial culture" to be the main enabler of cluster development

4.1.1. Cluster A (The Netherlands)

Table 4-2. Assessment of the level of entrepreneurial culture in Bio Cluster A

The mean	The mode	The median	Standard Deviation	Respondents
3.1	3	3	0.93	9
Perception of new company creation, incl. spin-offs, to be the main focus of business activity				
30% of survey respondents	Annual reports: a half of the companies are start-ups and spin-offs (39)			
Strong entrepreneurial culture as a main enabler of cluster development				
Selected by 22% of survey respondents	Interviewees highlighted that Cluster A is one of the most entrepreneurial regions in Europe			

When asked about the level of entrepreneurial culture within their cluster, the average level was 3.2 from 5. Comparing to other clusters in our study, it is relatively high (the overall average was below 3, referring to relatively low perception of entrepreneurial culture development perception among cluster participants). 33% of Cluster A participants indicated that the level of entrepreneurial culture is above average among cluster participants. At least 30% of respondents claimed new company creation, incl. spin-offs, to be the main focus of business activity here. This data is supported by cluster annual reports – in this moment almost a half of the companies are start-ups and spin-offs (30). 22% of the respondents claimed strong entrepreneurial culture to be one of the most important factors for overall cluster success. During the interviews, some respondents, even admitting the need for entrepreneurial culture improvement, highlighted that their cluster is one of the most entrepreneurial regions in Europe.

4.1.2. Cluster B (Spain)

Table 4-3. Assessment of the level of entrepreneurial culture in Bio Cluster B

The mean	The mode	The median	Standard Deviation	Respondents
3.19	3	3	0.98	16
Perception of new company creation, incl. spin-offs, to be the main focus of business activity				
The majority of survey participants mentioned various business	Confirmed by interviewees			

activities to be prevalent	
Strong entrepreneurial culture as a main enabler of cluster development	
Interviewees suggest Cluster B to be the one of the most entrepreneurial regions in Spain	

The general level of entrepreneurship in the cluster is reported to lay in the range between average and strong, scoring 3.2 out of 5, like in the previous Cluster. 38% of the respondents perceive entrepreneurial culture to be above average within this cluster. Establishing new companies and "business" as a whole was claimed to be one of the main focuses of activities within this cluster (10%), almost 40% perceive applied research to be such, which implies to business-orientation supporting by cluster participants. According to interviewees, an impressive number of new companies is created in the cluster each year, which can be considered an evidence of a strong entrepreneurial spirit. Moreover, respondents claimed their region to be one of the most entrepreneurial in their country and in Europe as a whole.

4.1.3. Cluster C (the UK)

Table 4-4. Assessment of the level of entrepreneurial culture in Bio Cluster C

The mean	The mode	The median	Standard Deviation	Respondents
4	4	4	1	5
Perception of new company creation, incl. spin-offs, to be the main focus of business activity				
Indicated by 22% of survey respondents		The number of SME and spin-offs in the cluster exceeds 50 (out of 70 companies overall)		
Strong entrepreneurial culture as a main enabler of cluster development				
Interviewees claimed the will to translate basic knowledge into applicable market products to be a driving force for the whole cluster performance				

This cluster was the "leader" on the entrepreneurial culture perception variable. 75% of respondents gave a score of 4 or 5 overall resulting in average 4 out of 5. According to the respondents, establishing new companies is one of the main focuses of activities within the cluster: 21.7% think so. This is supported by the number of SME and Spin-offs in the cluster, which exceeds 50 (having about more than 20 of larger companies). Moreover, the respondents claimed the will to translate basic knowledge into applicable market products to be a driving force for the whole cluster performance.

4.1.4. Cluster D (Sweden)

Table 4-5. Assessment of the level of entrepreneurial culture in Bio Cluster D

The mean	The mode	The median	Standard Deviation	Respondents
3.5	3.5	3.5	1	10
Perception of new company creation, incl. spin-offs, to be the main focus of business activity				
Indicated by 48% of survey respondents		The annual growth of the number of companies since 2005 is 23%		
Strong entrepreneurial culture as a main enabler of cluster development				
Interviewees highlighted high level of entrepreneurial culture among students				

When asked about the level of entrepreneurial culture within their cluster, the average level was almost 3.5 from 5, indicating that the majority of respondents indicated that the level of entrepreneurial culture is above average among cluster participants. According to the respondents, the main focus of activities within this cluster refers to establishing new companies (48%). It is a relatively young cluster. The cluster initiative emerged in 2003, and at this moment, there are more than 50 spin-off companies in the cluster. Through interviews we found out that: *"there are no large companies in the cluster, so for the students it is a very fruitful area to start their own ones – that is why there are so many start-ups"*

4.2. Bio Cluster A (The Netherlands)

Cluster A is a growing innovative cluster of agri-food companies and academic research groups. The main focus areas are food-related research and production. This cluster has attracted a lot of international companies to place their R&D departments. The Cluster A employs about 15000 people in food-related companies and academia, 7500 of those are scientists.

The food industry is perceived to be important for the Netherlands economy; therefore Cluster A receives support from Dutch and EU governmental bodies. Moreover, this cluster was included into the EU level food cluster development program. The Cluster A is relatively young, started in 2004 as a successor of another life-science connected foundation, which was, respectively, started in 1997. The number of SMEs is comparable to the number of large companies presented in the cluster. Cluster A hosts either research or production of more than 40 large food companies known world-wide.

The additional attraction of Cluster A is that there are a lot of initiatives to boost entrepreneurial spirit launched by the cluster organization. Moreover, during the interviews, we found out that the level of entrepreneurial culture is perceived to be higher than average due to country culture, perceiving Dutch to be more entrepreneurial than other nations of continental Europe.

4.2. 1. Social networks.

In general, the cluster members do feel belonging to the cluster: the majority of the survey respondents gave a positive answer on this question. However, during the interviews we found out that not all of them participate in the Cluster A activities, mostly due to distant location, or a mismatch with relatively narrow agri-food focus of the cluster activities. Large companies actively participate in collaboration process, especially through top research institutes. Moreover, the majority of survey participates emphasized their participation in informal contacts/networks, indicating quite develop interactions and non-business related communications inside Cluster A. Such a premise of large companies' members participating in activities together with starters might be extremely inspiring for potential entrepreneurs. Moreover, advisory type of collaboration indicated by survey participants refers to the business knowledge-sharing. The table below represents the heterogeneous types of collaborations in the Cluster A:

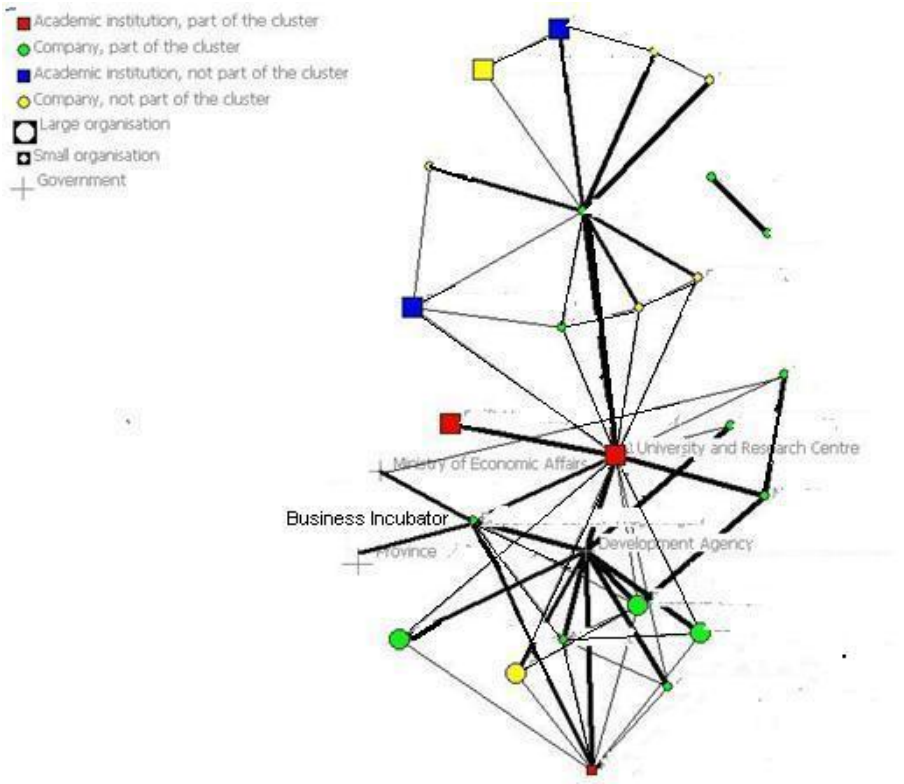
Table 4-6. Types of Collaborations in Cluster A

Types of Collaborations	Count	Percent of Respondents
Publications	4	44.4%
Participation in professional networks and boards	6	66.7%
Mobility of people (mobility from public knowledge institutes to industry and the other way around)	3	33.3%
Informal contacts/networks (e.g. alumni societies, networks based on friendship, other boards)	8	88.9%
Cooperation in R&D (joint R&D projects, sponsoring of research, financing of PhD students, supervision of PhD students)	4	44.4%
Sharing of facilities (shared laboratories, common use of machines, common location or building)	4	44.4%
Cooperation in education (contract education or training, providing scholarships, sponsoring of education, giving information to students, influencing curriculum of university programs)	2	22.2%
Contract research and advisory	3	33.3%
IPR (patent applications)	1	11.1%
Respondents	12	

Additionally, interviewees mostly argued there are no obstacles for networking. Such types of collaborations presented are likely to have an additional positive effect on future joint entrepreneurial actions: informal networks open the chances for joining the knowledge of actors from different backgrounds and boost the creative side of entrepreneurial thinking. The will to learn from more successful actors, accompanied by the possibility to share this experience and sense of the common cluster form a favorable base for entrepreneurial culture development.

The following network picture presents a snapshot on relations among participants of this study to provide an illustrative example of how collaborations within Cluster A tend to be organized:

Picture 4-1. Social networks in Cluster A



Based on the network picture and the interview findings the following conclusion can be made:

- Our data indicates the existence of a dense network within Cluster A. This refers to one of the directions of cluster organization work – collaboration developing, stimulating innovations. This resulted in a bunch of networking events, meetings – therefore, some collaboration are indicated to be informal.

- Cluster A seems to be mostly a solid cluster, mainly concentrated around the University and Research center and a Regional Development Agency. This refers to the fact that the Development Agency is working together and for the cluster organization, focusing mostly on different sorts of financial help for member companies. Moreover, The University and Research Centre is more than the main academic actor, supporting start-ups and partly financing cluster organization.

- Governmental bodies both from inside and outside the cluster seem to be involved into the collaboration network. This refers to importance of the cluster and industry itself and certain attention from different levels of government. Bio Incubator seems to play an important role within Cluster A: the organization is involved in a large number of collaborations with heterogeneous partners. Incubator provides offices, labs and other facilities for pilot production, thus hosting both start-ups and R&D departments of large companies. This can lead to even stronger networking

effect, especially at the informal level, bringing together various actors with diverse background. Such informal collaborations have a potential to facilitate tacit knowledge exchange and create new partnerships.

To sum up, the majority of the study participants feel themselves to be a part of the Cluster A, even if not having collaboration partners within the cluster. The most popular types of collaboration refer to the developing networking itself – by participating in alumni societies, networks based on friendship, other boards Therefore, start ups or potential entrepreneurs can receive a lot o benefits, both from informal contacts and by having the opportunity to work with a well-known corporation. Thus, we would assess social network development parameter of our model as relatively high.

4.2.2. Role model companies.

The survey results indicated that there is a large number of companies of role model companies in the Cluster A. Indeed, the Cluster hosts both internationally known large companies and successful businesses started within the cluster and achieved certain success. Representatives of both of these two categories were mentioned by interviewees and survey participants. One of the SMEs was referred to mostly often - Company N. During the interview of the CEO of N we found out that this example is a success story of a start-up appeared and succeeded due to facilities, organizations and useful links for the continuation of research. Nowadays the management of N is also involved into master-classes aiming to increase entrepreneurial culture in the Cluster A. The fact that Company N was referred to as the role model company by other cluster participants indicates awareness of premises available and possibilities one can take for achieving their business goal.

Moreover, the majority of survey respondents so far suggested the presence of mature role companies to boost the entrepreneurial spirit within the cluster, to have a positive impact on entrepreneurial culture development. As found out before, large companies do not just physically present in the Cluster A Although the majority of large companies collaborate with research institutions, they are engaged into relatively tense networks, referring to both formal and informal types of collaborations, thus being available to share experience with start-ups or potential entrepreneurs.

To sum up, large companies do present in the Cluster A and might inspire potential entrepreneurs by establishing informal collaborations, through business partnership possibilities. However, we perceive that a SME as a role-model company has a much more positive effect on entrepreneurial culture boosting – showing the exact example of success feasibility within Cluster A. Overall, the role-model variable of the model can be seen here as an enabler of entrepreneurial culture development.

4.2.3. Entrepreneurial education

The level o entrepreneurial education available within Cluster A is relatively high. The survey responds showed that such activities exist on a relatively high level. During the interview with the cluster organization we found out that the stimulation of entrepreneurial culture was proclaimed to be one of the goals of its goal, which resulted into the creation of several types of trainings and other programs available for cluster members, especially targeting start-up support:

- trainings,
- meetings with role-model companies management, experts or experienced people in this field to give advice and tips for those who are at the very beginning of their business careers,
- a program for exchange PhDs with Universities in USA.
- IPR advice,
- coaching for those willing to start a new business,
- moreover, there is a new initiative supported by Dutch government and the province of bringing tools and education to stimulate entrepreneurship

They are mostly provided by the joint consortium of the cluster organization, regional development agency, the University and Business Incubator. Moreover, the University possesses a Business School.

The majority of survey respondents perceive business competitions to have an important contribution to entrepreneurial culture development. One of the prize of such competitions – Cluster A reward, was mentioned by the Company N CEO as a useful tribute for a start-up – enjoying the services of the cluster organization and facilities within the cluster for free during one year (normally about 2000€) - is especially important for young companies.

To sum up, the level of entrepreneurial education within the Cluster A was reported to be relatively high, especially applicable for those involved in start-up creation. Joint efforts of cluster consortia aiming to develop entrepreneurial culture within cluster A resulted in various activities available. The reason behind the appearance of several relatively negative answers during the survey is likely to be explained by the lack of awareness about these trainings by the larger companies' management.

4.2.4. Supporting facilities

The Cluster A shows relatively high level of availability of premises for a business start:

Table 4-7. Availability of specific services and infrastructures in Cluster A

Type of services and infrastructures	Availability
Incubators and science parks that cater for biotechnology companies	Medium/High
Transport infrastructure (e.g. roads, proximity to airport)	Medium
Communication platforms (e.g. round tables)	High
Group purchasing policies	Low/Medium
Business advisors	Medium
Financial advisors	Medium
Legal advisors	Medium
Human Resources and recruitment advisors	Medium/High
Property advisors	Medium
Mutualised technological platforms (e.g. scientific equipment)	Medium

Moreover, the Cluster A possesses a high level of advisory support – not only coaching-alike, but also HR advising, help in solving legal issues, even designing.

Business Incubator was mentioned by one of the interviewees even as a main enabler of entrepreneurial culture boosting:

> "New companies get plenty of room to flex their wings, the conditions to lower the threshold, remove the obstacles and break new ground. A good climate for newcomers is part of a healthy business climate"

This center houses offices, labs, storage space and multifunctional facilities that can be used for pilot production. This is for fledgling and start-up companies and established business that want to try their hand at something new. The incubator offers flexible workspace, facilities, service and support: access to coaching, guidance and support in the fields of business and legal advice, as well as intellectual property acquisition. It gives access to its own network of investors (informal and venture capital) and points to other cash-raising channels. Aim of the incubator is to stimulate entrepreneurship by creating an entrepreneurial climate, offering full support, services and facilities to start-ups and young companies, offering tailor made accommodation to start-ups, young companies and R&D units of multinationals. The situation that young start-ups are neighboring R&D offices of large well-known companies could be very inspiring or the first, giving the possibility to establish informal networks, which can eventually lead to spill-over effects and sharing of tacit knowledge.

Moreover, a special entity is dedicated into supporting small and medium-sized businesses in renewal processes; it offers advice, organizes meetings and refers clients to the advisors, businesses and research institutes they need. Moreover, they run a free internet matching tool for SMEs seeking knowledge.

Overall, the availability of supporting facilities could be seen as an enabler for entrepreneurial culture development in the Cluster A. Taking into account the focus of their work, which is mostly targeted to the needs of SMEs including start-ups, it forms a favorable base for entrepreneurial culture development.

4.2.5. Technology Transfer Process

The commercialization of knowledge within the Cluster A is mostly done by Research Institutes for Industrial Contract Research. However, there are some premises available for start-ups:

-Technology Transfer Office for IPR and spin-off companies which was set up by the board of the University to create an environment for conversion of knowledge into commercially viable products. It consists of a small team of domain-specific investment managers responsible for scouting and screening ideas and inventions that have business potential. Also, the organization can provide expertise in legal and financial matters. Annually, they aim to set up three to six new companies based on discoveries and findings from research within the University.

- The Cluster A is the home to a Dutch Plant Protection Agency and many consulting companies and public advisory bodies dedicated to the various agri-food sectors.

Despite the fact that the facilities for TTP seem to be quite available, the IPR generation was not selected to be the core focus of activities in the cluster by the survey participants, and some of them mentioned IPR process to be cumbersome. The reason behind these difficulties is exceeding the cluster level and applies to the whole Dutch regulation, and will be discussed further. Start-ups are receiving some advisory help and support in patent requests. Thus, we would rate the TTP facilities to be on a relatively high level - therefore, to be rather an enabler for the entrepreneurial culture development.

4.2.6. Funding

The table below reflects that the situation with funding in the Cluster A is more or less sufficient. Availability of governmental funds was considered by both survey and interviews participants to be more-than-average available there, and such type of funding was also perceived to be the most important:

Table 4-8. Availability of funds in Cluster A

Type of funds	Availability
Availability of seed capital	Low/Medium
Availability of venture capital	Low/Medium
Availability of governmental funds	Medium/High
Availability of grants from foundations	Medium
Availability of loans/borrowings	Medium

Availability of governmental funds is connected to the fact that the Food Industry is in attention of Dutch Government. Interviewees claimed that on regional level, it is not so difficult to obtain support - but the funds are not so large. On national level, it is not that easy but feasible – if the project is satisfying the focus of the program, it is said to be very likely to receive financial aid.

However, the survey respondents mentioned the lack of seed capital which can be crucial for a potential entrepreneur.

As mentioned before, a special entity is dedicated into providing help for start-ups: The consortium supports business start-ups, by a personal loan (pre-seed loan); equipment and facilities brokerage. The University with the collaboration with the Development Agency is doing spin-offs funding.

However, only a minority of respondents perceives the availability of funds to be a success actor for Cluster A. It seems, that even though the funds are said to be relatively available, they are still hard to obtain.

Overall, the financial support for start-ups in the Cluster A seems to be sufficient. However, the lack of seed capital and venture capital (for the future development) may hinder one's entrepreneurial intentions. Therefore, we would rate the funding variable of our model as medium.

4.2.7 Country orientation towards entrepreneurship

Overall, the Dutch culture was perceived by interviewees to be an enabler for entrepreneurial culture formation, especially compared to other European countries. This is the only once cluster in our study, representatives of which didn't mention risk-aversion during the telephone interviews. Using the GEM data, we found out that the Perceived Opportunities Index in the Netherlands is above European Average (36 vs. 28), as well as Perceived capabilities Index (47 vs. 43). The Index of Entrepreneurial intentions is relatively low (5 out of 100 vs. 9). However, the Fear of Failure Index doesn't indicate a risk-averse culture (29 vs. 34 average). This applies to the fact that overall country orientation towards entrepreneurship seems to be an enabler for entrepreneurial culture development.

4.2.8. Economic enablers

As mentioned before, the interviewees and survey respondents named some country-level issues to prevent them from commercializing the knowledge and, consequently, hindering entrepreneurial culture.

According to World Bank Group, in the year 2010 the Netherlands are on the 70th place in the world-ranking for starting a business. Additionally, the recent drop was almost 20 positions down. It is explained by the number of steps entrepreneurs can expect to go through to launch, the time it takes on average, and the cost and minimum capital required as a percentage of gross national income (GNI) per capita in the world in the starting a business variable, requiring a lot of efforts and time for a potential entrepreneur.

Table 4-9. Economic enablers in the Netherlands

Indicator	The Netherlands	Average
Procedures (number)	6	5,7
Time (days)	10	13
Cost (% of income per capita)	5.6	4.7
Min. capital (% of income per capita)	49.4	-

On the European level, the situation in the Netherlands is about average.

The Netherlands' economic freedom score is 75.0, making its economy the 15th freest in the 2010 Index. The Netherlands are ranked 6th out of 43 countries in the Europe region, and its overall score is above the world and regional averages. The Dutch economy is diversified and modern, with institutional strengths such as strong protection of property rights and an efficient legal framework. The entrepreneurial environment is generally facilitated by high levels of business freedom, trade freedom, monetary freedom, and investment freedom. The regulatory environment is efficient and transparent. Monetary stability is well maintained, and the judiciary, independent of politics and free of corruption, has demonstrated an exemplary ability to protect property rights.

As we perceive the entrepreneurial culture to be the more likely to developed the higher country scored on the index of economic freedom, the situation in the Netherlands could be seen rather as an enabler for entrepreneurial culture development, above average.

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4.2. 9. Regulations and legislation in the specific field the cluster is operation

The survey respondents mentioned, that governmental support is more applicable for those who are working in relatively narrow agri-food field and, therefore, it is hard to obtain by the others. During the interviews we found out that these application programs suffer from red-tape and the focus on technological innovation makes the process cumbersome:

"Sometimes the rules and regulations can be such that it does not invite to participate. And sometimes also the amount of paperwork and other obligations can be such that it takes considerable time away from the project".

This can be particularly discouraging for scientists.

Moreover, bureaucracy in ministries was highlighted by the interviewees as one of the main barriers for a business start.

"For instance, to implement a high-tech product (let's say bacteria) it is not clear to which ministry you have to apply… whether food safety or health. And they continue sending you with your product to each other. This is very discouraging and de-motivating. And the new companies just have the time for these issues – they have to survive, to proceed with the business".

Controversially, the tax incentives for R&D companies were mentioned by both types of respondents as a positive legislation.

Overall, the level of specific regulations and legislations can be assessed to have a medium/neutral effect on entrepreneurial culture variable, combining enablers and barriers for entrepreneurial culture development.

4.2.10. Cluster Summary.

Looking at the Cluster A success factors variables, we see an overall enabling situation for entrepreneurial culture development in an innovative cluster. The results of both survey and interviews indicate, that the level of entrepreneurial culture is sufficient, but still can and have to be improved. This aligns with our model – during the initial cluster selection step we assessed the entrepreneurial culture to be above average. According to the respondents, the network development and role model companies (especially start-ups) were the main contributor to the boost of entrepreneurship within the cluster, while funding issue (availability of seed and venture capital) were argued to be the main barriers. In this particular case cluster level variables overall seem to be more important, both social and feasibility ones, than those on country level; the respondents mostly referred to them. However, the cluster scored relatively equal on both country level and cluster level variables; therefore, it is not yet feasible to understand, whether one level of variables is more important than another.

Table 4-10. Success factors of entrepreneurial culture development in Cluster A

Entrepreneurial culture		Country level	Cluster level
	Social perception	1. Country orientation towards entrepreneurship – relatively high	2. Social networks – relatively high 3. Role models – relatively high 4.Entrepreneurial Education – relatively high
⟺	Feasibility perception	5. Economic enablers - medium/high 6.Specific legislation - medium	7. Supporting facilities – relatively high 8. TTP – relatively high 9.Funding – medium

4.3. Bio Cluster B (Spain)

This cluster is relatively young, has been developing dynamically since its establishment in 2006. It consists of more than 350 companies, 60% of those have less than 10 employees. Main focus of innovations is biotechnology, biomedicine and medical technology. Biotechnology is currently seen as a driving force behind economic growth in the region, where it is located. The region as a whole is one of the main economic drivers of Southern Europe. Despite its relatively young age, Cluster B has already become one of the main biotechnology hubs in its home county, clearly surpassing the level of many European regions in terms of the number of companies, entrepreneurship and R&D investment. The cluster also leads national ranking of biotech companies in terms of the number of granted patents and those in the application process.

Custer B is managed by a cluster organization, which activities include facilitating networking among different stakeholders, fostering biotechnology as a key economic driver for the country,

promoting cluster at the world stage, and informing and contributing to a better understanding and perception of biotechnology. Cluster organization has also developed a strategic plan for the sector to turn the region, where cluster is located, into an international biotech hub. Cluster C represents a coherent cluster, mainly concentrated around two internationally-known Universities, one of which possesses a Scientific Park.

We selected Cluster B for our analysis due to the following reasons: as presented before, the strength of entrepreneurial culture in the cluster is above average, satisfying our initial criterion. Every year, new 10 companies are started. There was additional attraction of Cluster B: in general, culture of Southern Europe is considered to be rather risk averse (for us it means almost the opposite of entrepreneurial spirit), while in this cluster it was managed to build relatively strong entrepreneurial culture, motivating business-start initiatives.

4.3.1 Social networks

Overall, the cluster demonstrates strong networking culture with a high level of engagement of cluster participants in different types of collaborations. The majority of survey participants so far answered that they feel being a part of Cluster B. The activities of the cluster are reported to be more important for SMEs than for large companies - one of the CEOs of SME said:

"We are a small company and we are enjoying the benefits of networking with larger entities within the cluster. For us such collaboration is very useful since we can gain a lot of resources and experience from those who have already achieved success".

Therefore, entrepreneurial activities tend to be motivated and enabled from the cluster level. Networking for its own sake is one of the most popular types of collaborations:

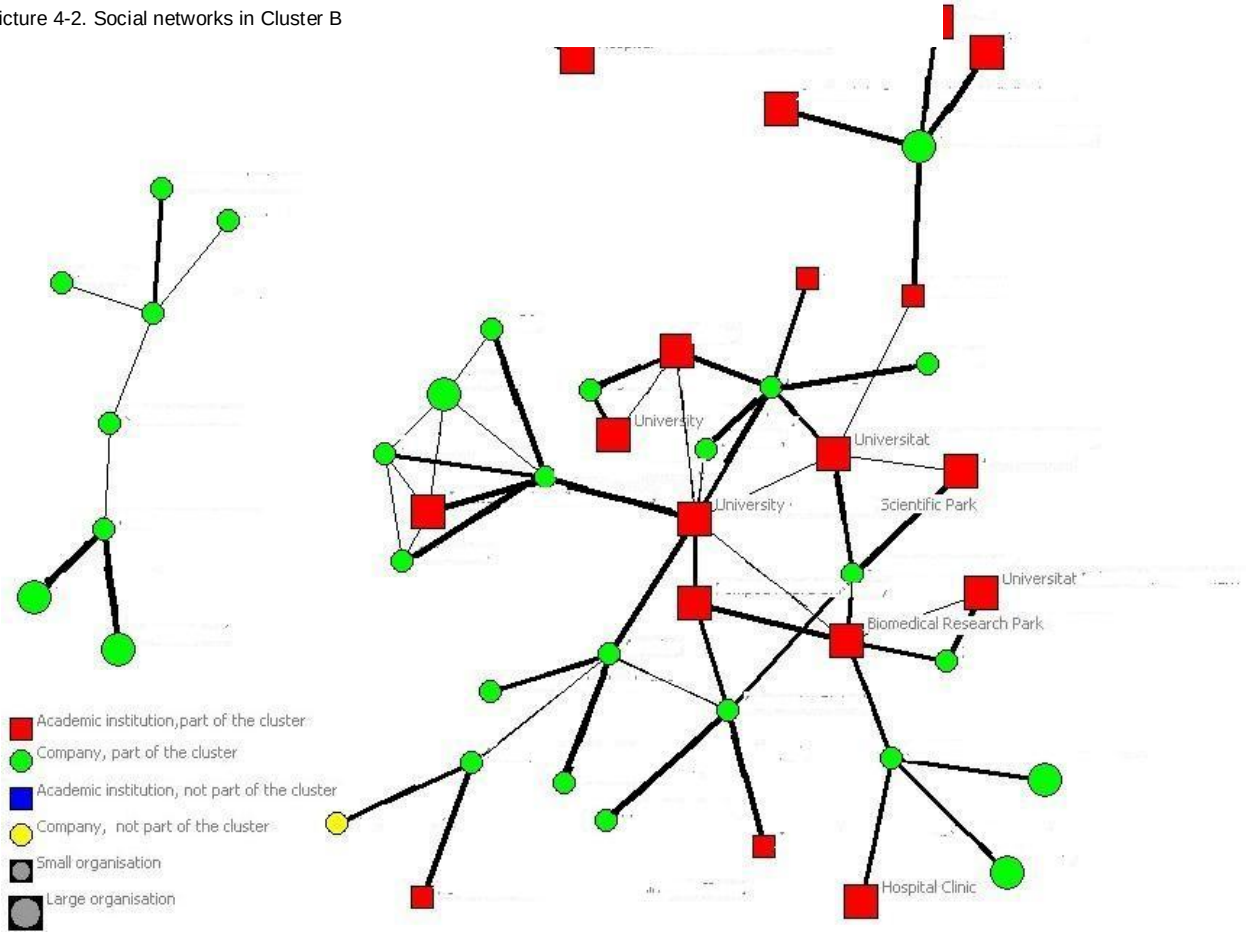
Table 4-12. Types of Collaborations in Cluster B

Types of Collaborations	Count	Percent of Respondents
Publications	4	16.7%
Participation in professional networks and boards	14	58.3%
Mobility of people (mobility from public knowledge institutes to industry and the other way around)	6	25.0%
Informal contacts/networks (e.g. alumni societies, networks based on friendship, other boards)	12	50.0%
Cooperation in R&D (joint R&D projects, sponsoring of research, financing of a PhD student, supervision of a PhD student)	10	41.7%
Sharing of facilities (shared laboratories, common use of machines, common location or building)	5	20.8%

Cooperation in education (contract education or training, providing scholarships, sponsoring of education, giving information to students, influencing curriculum of university programs)	8	33.3%
Contract research and advisement	5	20.8%
IPR (patent applications)	3	12.5%
Total Respondents	24	-

Collaborations within the cluster are highly diverse - the most popular types of collaboration refer to participation in professional networks and boards, informal contacts and networks, and cooperation in R&D. During the interviews we found out that support from other organizations (cooperating, advising etc) is inspiring for potential entrepreneurs as far as it assures help on the initial stage for the start-up. The existence of such activities was confirmed by the cluster management as well. Therefore, such a distribution proves the importance of joint efforts for the development of SMEs, and, consequently, to the boosting of entrepreneurial culture development. Network-stimulating events mentioned during the interviewees included even informal dinners which help start-ups and managers from the companies both from inside and outside the cluster to share their ideas and to receive some advice. The following network picture presents a snapshot on relations among participants of this study to provide an illustrative example of how collaborations within Cluster B tend to be organized:

Picture 4-2. Social networks in Cluster B



Based on the network picture and the interview findings the following conclusion can be made:

- Our data indicates the existence of one strong and coherent cluster, mainly concentrated around the two main Universities and University Scientific Park. This Scientific Park seem to play a major role in the cluster as it is involved in a large number of collaborations with different organizations, including SMEs. This relates to the fact that in this relatively young cluster there is a large number of start-ups, benefiting from the cluster facilities.
- Universities and other academic institutions seem to play an important role in the Cluster B. Almost a half of nodes are square-shaped, referring to academic institutions. Universities have a lot of intense collaborations with companies and between each other. SMEs tend to collaborate more with academic institutions or between each other then with larger companies. This may refer to the lack of link between them, which is to be found later.
- The separated groups of organizations (at the top and left of the diagram) seem to be separated from the cluster network, but, as pointed out by the interviewees, they are a part of a cluster

organization and are taking part in cluster activities such as participation in professional networks and boards.

To sum up, the majority of the study participants feel themselves to be a part of Cluster B, the most popular types of collaboration are for developing network itself - participation in professional networks and boards, informal contacts and networks. Smaller companies, which are the point of our interest, collaborate mostly between each other and with academic actors, such as Universities and Scientific parks, claiming the need of well-establish networks to boost entrepreneurial culture.

4.3.2. Role model companies.

The majority of the survey respondents indicated the presence of mature role-model companies, however showed a discussion on the exact number of those. This might be explained by the differences in the definitions of what a mature role model company actually means (as suggested in the survey: mature role model companies are companies that serve as models in a particular entrepreneurial role (e.g. related to R&D, marketing, production, collaboration) for other companies to emulate) and, as a result, a certain degree of subjective judgment of respondents. Another explanation might refer to a lack of awareness about the existing successes in the cluster. Furthermore, existing role models are not always willing to share their successes. In fact, 8 of top-ten pharmaceutical groups have delegations here.

As we saw before, start-ups don't collaborate a lot with larger companies. This lack is claimed to be felt by SMEs:

"We don't have the opportunity to show the good examples and present role models. We don't have large companies willing to help us".

Such a situation may affect negatively a potential entrepreneur as far as they don't have successful example inspiring them. Although such opportunities are presented (there are successful companies) and during the interviews existing entrepreneurs recognized the importance of dialogue between smaller companies and larger, such dialogue has not (yet) been established. At the same time, just the fact of presence of large companies has a positive impact for entrepreneurial activity:

"We have great opportunities to learn from those large companies who did succeed. These role model entrepreneurs are really inspiring".

Neither survey respondents nor interviewees showed the evidence of role model companies to have a direct impact of large or mature role companies on entrepreneurial culture development.

To sum up, the role model companies variable is not obviously well-developed within the Cluster B - large companies do present and might inspire potential entrepreneurs indirectly, but the dialogue (in forms of collaboration, trainings, etc) still has to be established.

4.3.3. Entrepreneurial education

Though workforce development seems to be well-established in the Cluster B, the survey participants reported the trainings to be mostly devoted to scientific and technical skills. IPR management trainings were also reported to be the popular among the cluster participants, though during the interviews we understood that the majority of cluster members are not aware of programs stimulating business skills which would lead to boosting entrepreneurial culture.

At the same time, the interview with the cluster management revealed that there are managerial and business courses and other activities, organized in the form of meetings and conferences. Additionally, there is also a specific organization providing a set of trainings, aiming to develop managerial, economic and financial knowledge of cluster participants. Moreover, Universities in Cluster B provide with MBA programs and Master of Science in Innovative Management. Start-ups' managers may be invited to give a speech on such a conference, which might be inspiring for potential entrepreneurs. However, the cluster members, both during the interviews and filling out the online questionnaire, didn't show awareness of them, or didn't see a lot of use for their organization/future entrepreneurs, - they tended more to claim the lack of entrepreneurial education. One of the respondents connected the lack of such programs with the lack of international reputation - suggesting to take example of Anglo-Saxon clusters, where former cluster participants obtain experience in going for a high-tech jobs in USA, and then giving lectures on that back home. But the Cluster B doesn't have this possibility yet. There are efforts for promotion to attract some experienced people in this field. Therefore, entrepreneurial education aspect is also claimed to be indirectly connected with the cluster reputation.

Survey respondents claimed that the main focus of workforce development refers to maintaining very high quality of scientific research, and this is stimulated through education, communication etc and there is not so much motivation to commercialize these findings. Indeed, IPR management trainings should be referred to entrepreneurial education, since licensing is the initial step of knowledge commercialization, when something brings the results. Although, we cannot claim that this has direct effect on entrepreneurial culture boosting – the initiative here mostly comes from companies' side, and the scientists do not tend to commercialize their findings themselves.

On the later stages of young companies' development, business competitions are claimed to play an important role for participants of Cluster B. The majority of survey respondents of selected this aspect stimulating entrepreneurial culture to be present in the range of average-high. This aspect refers to initiative of cluster organization, which launched special grant programs to incorporate international experts and strategic consultants on company boards (in cooperation with the Department of Economy and Finance). The key to success of these grants lies in guaranteeing that this type of support is stable and continues over time, without being effected by changing legislative mandates. That would allow

companies to incorporate this human capital in their mid-term strategies. The Cluster organization management mentioned the goal to improve the situation, having an agreement with local government - to promote entrepreneurship, coordinate internationalization efforts in the sector, draft strategic plans for the sector, design training programs and collaborate on improving and commercializing research.

Overall, the entrepreneurial education aspect within the Cluster B seems to be controversial in the sense that, on one hand, business education seems to be available and existing companies receive specific trainings and are welcome to take part in business competitions, while the initial step between a scientist and entrepreneur is not being tracked and simulated. Moreover, the master-classes are mostly given by the cluster participants, SMEs management, while it could be more inspiring to attract outsiders, foreigners and management of corporations. According to the interviewees, the situation when entrepreneurial education might be explained with the lack of businessmen themselves, in that sense that cluster participants do not (yet) appreciate the importance of entrepreneurial education for cluster development. For us it means, that to boost entrepreneurial culture in the Cluster B, more emphasis should be done on entrepreneurial and business education, though nowadays companies are mostly driven by former scientists lacking such background. Cluster management understands that the lack of entrepreneurial culture is an issue in Cluster B, therefore one of their goals is to pay attention to bio-business projects, which involves developing of business skills - there is a high possibility this aspect will be improved soon.

4.3.4. Supporting facilities

In general, the availability of specific services and infrastructures in the cluster can be ranked as Medium. The Cluster B hosts nine top quality science and technology parks devoted to life sciences, twelve Universities and six large facilities as laboratories. The business incubator is claimed by the survey participants to be one of the main enablers for potential entrepreneurs.

Table 4-12. Availability of specific services and infrastructures in Cluster B

Type of services and infrastructures	Availability
Incubators and science parks that cater for biotechnology companies	Medium / High
Business advisors	Medium
Financial advisors	Low / Medium
Legal advisors	Medium
Human Resources and recruitment advisors	Medium
Property advisors	Low / Medium
Marketing support	Medium

4.3.5. Technology transfer process

Cluster B possesses Technology Transfer Offices, which are based in the Universities, though interviewees claimed that such facilities are not enough and should be created in hospitals as well. Another issue mentioned by the cluster participants is that scientists are not so willing to commercialize their knowledge as far as it is not clear whether IP will be owned by them or by the University. In the case that it is owned by scientists, it could be a good starting point for a start-up, but the ambiguous situation reduces entrepreneurial spirit.

In the survey, on a question on the focus of main activities within the cluster, only a few votes were for licensing, though the Cluster B is still a country leader in terms of patents. The survey respondents had the possibility to highlight cumbersome IPR and technology transfer processes. They claimed that there is a lack of regulatory framework for innovation and the bureaucracy in public institutions prevents them to start a business, or a project.

Overall, the smaller companies claimed that the level of Technology Transfer availability was enough for them to start a company, though it can be improved, creating more TTOs and dealing with red-tape.

4.3.6. Funding

Funding seems to be one of the more important issues in the Cluster B. Some survey respondents even claimed that their cluster shifted from the stage of focusing on scientific research to the one aiming to find financial support to their existing companies or to start new ones. Even in the issue of funding, the culture tends to play an important role. Interviews continuously emphasized the national culture of risk-aversion to be the main disabler in finding financial support – for potential entrepreneurs it seems to be relatively hard to convince investors to invest in a long-term project, therefore reducing the level of entrepreneurial culture, discouraging potential company starters. Another discouraging feature of such funding type reported is high level of bureaucracy in public institutions, high unpredictability of continuation of governmental support.

Here the lack of entrepreneurial education also plays an important role – interviewees claimed that the relatively young age and small size of local companies is usually accompanied by inexperienced management teams. These factors often correlate with a lack of specialized venture capital that can open doors to international venture capital. As a result, local companies often have a business model that focuses on survival rather than value creation. This makes them less attractive to international investors, as well as to international companies that could be interested in licensing and co-development deals. Consequently, the abovementioned set of factors creates an inertia that is difficult to stop.

Table 4-13. Availability of funds in Cluster B

Type of funds	Availability
Availability of seed capital	Low / Medium
Availability of venture capital	Low / Medium
Availability of governmental funds	Medium / High
Availability of grants from foundations	Low / Medium
Availability of loans/borrowings	Medium

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Interviewees claimed, that the most available type of funding is a governmental loan, but it has the disadvantage that it has to be returned in short-time period – seed capital which is provided by public institutions for start-ups are limited in the period of 2-3 years, which is said to be not enough for Biotechnology industry:

"It is almost impossible for our scientific area of work".

4.3.7. Country orientation towards entrepreneurship

Overall, Spanish culture is perceived by the interviewees and survey respondents as relatively risk-averse. The interviewees were continuously referring that even if people in Spain are entrepreneurial enough to start a company, the lack of entrepreneurial spirit will prevent them from developing their business further, because of the fear of failure.

Using the GEM data, we found out that Spain scores relatively law (16 out of 100) on the perceived opportunities index, entrepreneurial intentions (4 out of 100), high on risk of failure index (45 out of 100). Although, perceived capabilities index is relatively high (48 out of 100), the overall picture proves Spanish culture to be indeed risk-averse, lagging behind even other South-European countries.

Therefore, the national culture variable seems to be rather an obstacle for entrepreneurial culture development in the case of the Cluster B.

4.3.8. Economic enablers

As mentioned before, the both types of the respondents complained about bureaucratic procedures delaying the start of new business and/or obtaining financial support, licensing.

According to the World Bank Group (2010), Spain is just on the 146 place in the world in the starting a business variable, requiring a lot of efforts and time for a potential entrepreneur.

Table 4-14. Economic enablers in Spain

Indicator	Spain	Average
Procedures (number)	10	5,7
Time (days)	47	13

Cost (% of income per capita)	15.0	4.7
Min. capital (% of income per capita)	12.8	-

Such results prove the interviewees' complaints about the bureaucracy, - the overall situation is not favorable for potential entrepreneurs.

Concerning Economic Freedom, Spain enjoys the status of 36th freest country in the world. Procedures for business formation are claimed to become streamlined and efficient, and the overall entrepreneurial environment is conducive to vibrant private-sector development.

As we perceive the entrepreneurial culture to be the more likely to developed the higher country scored on the index of economic freedom, the situation in Spain is slightly ambiguous – overall the environment is favorable, but to start a new business is hard due to red-tape.

4.3. 9. Regulations and legislation in the specific field the cluster is operation

Even if the overall economic situation is favorable for starting a new business, cluster participants do face some legislation barriers in biotechnology. The survey participants named barriers in hospital research and innovation aspect, the lack of a solid framework. A positive aspect is that there are tax incentives for companies starting up and the customer for those companies; therefore we would rate this aspect as at least average in terms of boosting entrepreneurial culture.

4.3.10. Cluster Summary.

Cluster B is an example of a cluster, where relatively unfavorable for entrepreneurial culture country level variables are combined with favorable on cluster level. There is still a room for improvement, as far as the respondents perceive the view of entrepreneurs to be very local.

"They are not ambitious enough. They don't have this vision of breakthrough; they don't want to challenge themselves to move to a new level"

Table 4-15 Success factors of entrepreneurial culture development in Cluster B

Entrepreneurial culture	Country level	Cluster level
Social perception	1. Country orientation towards entrepreneurship – relatively low	2. Social networks – relatively high 3. Role models – medium (can be improved) 4. Entrepreneurial Education – medium (can be improved)
Feasibility perception	5. Economic enablers – relatively low 6.Specific legislation - medium	7. Supporting facilities – medium (can be improved) 8. TTP - medium

Concerning our model, the example of Cluster B supports the conclusions of the previous case – the cluster level variables seem to be more important than the country level ones. Having non-favorable country orientation towards entrepreneurship and economic enablers, Cluster B still shows relatively high overall entrepreneurial culture level. In this case, networking seems to be the most important enabler for the entrepreneurial culture development. Collaboration in the Cluster B has a

significant effect on entrepreneurial culture and it was stimulated by the cluster management – therefore, the activities of such organizations should be suggested to be included in our model. Moreover, the lack of well-established reputation/awareness of Cluster B both in Spain and internationally was mentioned to be an obstacle to attract key business people, by this hindering the role-models and trainings variables. Such an indirect factor as reputation of the cluster here seems to influence the overall entrepreneurial culture development.

4.4. Bio Cluster C (the UK)

Cluster C is situated in the East of non-continental Europe and contains over 250 biotech companies, 100 medical technology companies and 370 service companies supporting the life science sector, with the majority of these being within a 35 mile radius of worldwide known University. Cluster C employs 30,000 in total in biotech, all life sciences, and relevant pharmaceutical and research. There are 30 Universities and Research Institutes, including 5 pre-eminent in their fields at both national and international levels.

For us, the additional attraction of this cluster is in its difference from the others studied – rich history (since late 1980s), world-known name, the University reputation, availability of high-tech facilities. This cluster has a bench-mark reputation in its sphere of operation. The Cluster C has a high level of world recognition; due to it the country possesses more Nobel Prize winners in medicine and chemistry than the majority. Moreover, Cluster C emerged due to the efforts of academic actors and individuals - individual initiative has been just as important as the role of institutions and companies in driving start-ups, which implies to above average level of entrepreneurial culture even before the emergence of the cluster – hypothetically, it as to do with country level variables, Anglo-Saxon culture. Now, the stream of entrepreneurial ideas seems as strong as ever (most of the companies are SMEs), and the cluster also has been successful in attracting companies from other parts of the country and mainland Europe, including some international pharmaceutical companies which now have housed small R&D groups within the cluster.

4.4.1 Social networks

The development of networking within Cluster C represents relatively ambiguous phenomena. On the one hand, all the respondents of the survey and interviewees admitted they feel being a part of Cluster C. Networking was claimed to be common via participation in professional networks, company boards, or via informal means. There also seems to be a high degree of cooperation in R&D and sharing of facilities and equipment:

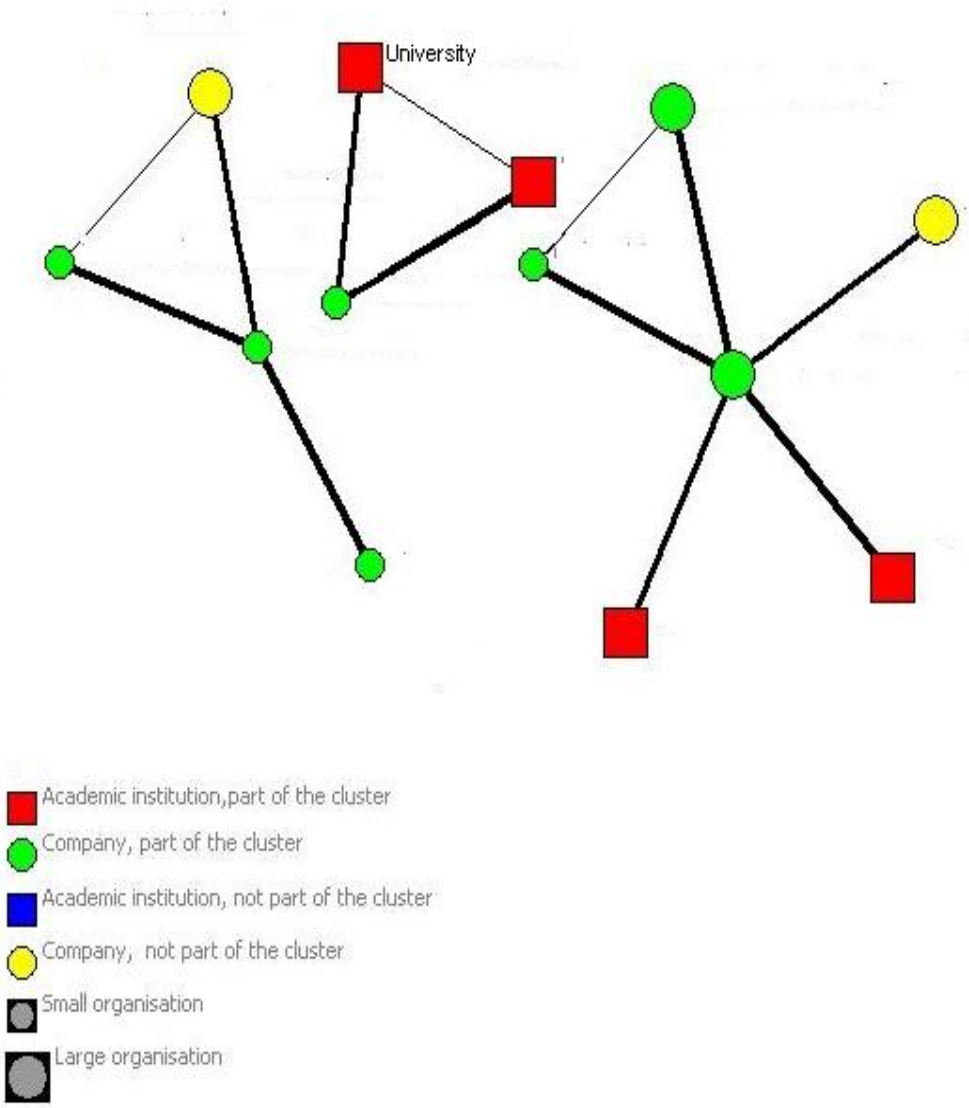
Table 4-16. Types of Collaborations in Cluster C

Types of Collaborations	Count	Percent of Total

		Count
Publications	2	5.9%
Participation in professional networks and boards	4	11.8%
Mobility of people (mobility from public knowledge institutes to industry and the other way around)	3	8.8%
Informal contacts/networks (e.g. alumni societies, networks based on friendship, other boards)	5	14.7%
Cooperation in R&D (joint R&D projects, sponsoring of research, financing of a PhD student, supervision of a PhD student)	4	11.8%
Sharing of facilities (shared laboratories, common use of machines, common location or building)	4	11.8%
Cooperation in education (contract education or training, providing scholarships, sponsoring of education, giving information to students, influencing curriculum of university programs)	2	5.9%
Contract research and advisement	5	14.7%
IPR (patent applications)	5	14.7%
Total Count	34	-

In the same time, the majority of producing collaborations of various types of companies (from large to SMEs) are said by their managers to be external to the Cluster C. They forge partnerships globally. Additionally, non-scientific out-sourcing (Finance, Audit, Legal, IPR, Human Resources) can be made both within Cluster C or in London, which is just 60 miles away. On the picture, representing the snapshot of main collaborations, we can see the evidence of relatively low collaboration level:

Picture 4-3. Social networks in Cluster C



Based on the network picture and the interview findings the following conclusion can be made:

- First of all, the data-quality in the Cluster C poor, and this relatively low will to participate in survey might refer to the fact that Cluster C participants do not see any need for additional attention – the cluster is well-known and developed enough.
- Our data indicates, that the Cluster C might primarily be a geographical entity, since collaborations among the organizations do not seem to be intensive. Moreover, there are a number of collaborations involving companies from outside the cluster. This might be an obstacle for potential entrepreneurs, although during the interviews we found out that there is not so much problems to establish collaborations with companies from outside the cluster.
- A large portion of nodes is marked in red, indicating a strong presence of academic institutions. Relatively large organizations are highly active in the cluster. This indicates the

importance of the large academic institutions (e.g. world-known University) for SMEs, and that large companies do collaborate with SMEs, which can be very inspiring for them and shift the reputation of SMEs.

Overall, the Social network development seems to be on a relatively high level and favorable for SMEs, though we didn't find the evidence for a solid cluster in terms of business collaborations. The general sense of belonging to a cluster and high reputation of it, as well as the popularity of informal networks, is likely to have a positive impact on overall level of entrepreneurial culture.

4.4.2. Role model companies.

The results of the survey indicate that there is some discussion among the respondents, concerning the number of role-model companies inside the Cluster C, though all of them admitted that such companies highly present. Moreover, the survey respondents referred the presence of role-model companies to the well-developed entrepreneurial culture within Cluster C and this was confirmed by the interviewees.

However, several interviewees lamented the current relative lack of mature role models amongst independent biotechnology companies – the majority of successful businesses are being acquired by large pharma companies. There is a concern, whether Europe can ever build companies equivalent to those from the USA, if companies get acquired soon after their R&D shows success. In any case, from our perspective, such acquisitions are more likely to stimulate the will to repeat such success.

One of large companies deserves a special attention – a consulting group, played a central role in the early stage of the cluster (both in technology and life sciences), which is providing commercial human capital (business development etc), is still a bridge between scientists, who are 'un-commercial' and 'commercial people' who doesn't get science.

Thus, the overall level of role-model companies in Cluster C is relatively high, especially taking into the account, the collaborations established between large companies and SMEs. However, we didn't find any evidence of workshops or trainings given by the role-model companies' management, which slightly reduces the level of positive impact of this variable on entrepreneurial culture.

4.4.3. Entrepreneurial education

The level of trainings, developing entrepreneurial and business skills, is relatively high within Cluster C. In the survey, Training and Education provided in the cluster were estimated as Medium/High. Such trainings are being provided from a variety of sources: own organization, the cluster organization, public or private entities. The broad range of trainings available was highlighted during the interviews as well. One fifth of survey respondents indicated that trainings developing business-skills, of IPR management trainings and those, aiming to develop financial skills are available.

From the interviews we found out that there is a portfolio of training courses for life science and healthcare companies, among those there are “introduction to management”, ‘’Commercial Awareness...from bench to balance sheet’’, ‘BioProject Management’. Moreover, the cluster organization, in the collaboration with local (world-leading) University’s Business School provides the access to a series of lectures which form part of the MPhil course in Management of Technology and Innovation. These include: High Tech Marketing Commercializing Science, Finance and Accounting, Microeconomics, Decision Analysis, Strategy for Innovative Firms

Moreover, the mentioned above University offers a Masters degree in Biotechnology Enterprise, however most students come from outside the cluster and indeed from outside the country: few native students join the course. Another University, located in Cluster C, has a degree course in entrepreneurship.

Despite the impression of a high availability of entrepreneurial education, the results of both survey and interviews showed that there is an issue with the access to the trainings. It was mentioned by one of interviewee, that the cost of training can be a real problem for small under-capitalized businesses and staff in these companies can find themselves at a real disadvantage compared with those in large pharmaceutical companies with substantial funds available for training. To address this issue, the cluster organization advertises the availability of public money that is available to subsidies up to 50% of training costs. This initiative supports SMEs in training their staff.

To sum up, the availability of entrepreneurial education is at relatively high level within cluster C; moreover, having a world-leading University gives the possibility to attract world-leading lecturers and businessmen. However, we didn’t find the evidence of sharing success stories initiated by role-model companies, which can be much more inspiring. This might refer to the maturity of cluster itself.

4.4.4. Supporting facilities

Overall, the Cluster C contains a relatively good range of premises for starting up a business. Survey respondents gave high scores for the Bio incubators and Science Parks. Bio-incubators have been mentioned as key supporting driving force since the 1980s, and new facilities are continuously being built. The cluster contains a very good range of sites and premises for companies and investors. Different from the previous cluster, the level of Financial and Legal Advisors, HR advisors and property advisors was assessed by the survey respondents from High to Medium:

Table 4-17. Availability of specific services and infrastructures in Cluster C

Type of services and infrastructures	Availability
Incubators and science parks that cater for biotechnology companies	High

Type of services and infrastructures	Availability
Business advisors	High
Financial advisors	Medium/High
Legal advisors	Medium/High
Human Resources and recruitment advisors	Medium/High
Property advisors	Medium/High
Marketing support	Medium

During the desk research we found out that the Cluster possesses several Science parks. One of them surrounds the main University. It hosts over 100 companies and has 1,650,000 sq ft of buildings. Another one houses world-famous research centre and also forms part of the European Bioinformatics Institute. Biomedical Campus of the University is one of the largest centers of health science and medical research in Europe, it is a major centre for clinical trials, led to many breakthroughs in clinical treatment. There is another Scientific Park, a relatively new actor, appeared in 1997 and is privately funded as a commercial enterprise. It has a small number of quite large tenants, about 10 in total, including research centers of international companies.

Cluster C possesses a Bio incubator, accommodating over 30 start-up biotechnology companies, employing over 250 people in approximately 80,000 square feet of serviced, modern high-quality facilities. A range of support services are provided including laboratory support services, access to meeting rooms, and chemistry and biology/antibody services. The services are designed to help early-stage companies by providing a way to reduce cash-burn during their formative years and a supportive environment in which nascent scientific enterprises can flourish. Another advantage of this facility is that its management organizes a regular investment meeting which provides a platform for small start-ups to 'pitch' for funding to national and international venture capitalists attending the forum.

The Business Centre is believed by the survey respondents to be a key player which brought the Cluster C to its overall high level of development. The Centre tenants are start-up and early-stage companies operating in a wide range. Around 60 companies are currently located on the site, employing over 300 people. Over a recent five year period the survival rate for companies was over 88%, compared to about 50% for other similar businesses in the Cluster C, and 45% for businesses nationally-wide. This is more than just a home to a number of companies; Business Centre is offering services to the tenants, such as marketing, accountancy, legal services etc. This was a deliberate decision in the early days of the centre, to foster a diverse business community within the building. It also offers a virtual tenancy package which enables small companies to use Centre as their business address, offers telephone, fax and post handling, and gives preferential access to meeting and conference rooms and business support services. The service has been used by numerous start-up companies prior to becoming a tenant.

Several small communities (villages) in the Cluster C also have smaller business parks with facilities for start-up companies, but support services are usually not provided.

Thus, the availability and accessibility of supporting facilities is relatively high. Different from the previous clusters in our study, advisors are available in all the aspects related to business start. We can assess as an enabler for developing strong entrepreneurial culture, especially because of the Business Centre policy which enables to start a business with minimum administrative costs.

4.4.5. Technology transfer process

Some of these academic institutions have established technology transfer groups in order to facilitate commercialization of the academic science.

By desk research we found out that on the base of The University there is a special entity specialized on the Technology Transfer. The Research Park of the University itself was established in 1960s aiming to promote Technology Transfer. The access is easy and after a submitting a form, the applicants are welcome to discuss the project. Moreover, this enterprise is more than a Technology Transfer Office. Its activities include invention disclosure management; patent strategy, filing and maintenance; proof of concept funding; research reagents transfer; intellectual property licensing and bespoke marketing, as well as consultancy services - expert advice or facilities to public and private sector organizations worldwide, negotiation of contract terms, assistance with costing and pricing, formal arrangements for the use of University facilities, invoicing, debt collection and income distribution. In addition, academics may benefit from the University's Professional Indemnity and Public Liability insurance policies. In the other Research Park, belonging to an Institute, a special Transfer Technology Laboratory is established to promote the translation of Institute and third-party technology into investment ready propositions. However, 10% of the survey respondents answered that the Cumbersome IP and technology transfer processes are cumbersome. During the interviews we didn't find the elaboration on this answer.

Overall, the Technology Transfer Process has a relatively high level of support within Cluster C. There are several organizations providing this service as well as supporting ones.

4.3.6. Funding

The availability of funding was the only one variable on the cluster side of our model which appeared to be relatively low within the Cluster C. Survey respondents rated the availability of seed capital as low to medium, as well as venture capital, grants from foundations and availability of loans. The interviewees showed concern about availability of funding as well. In the part of the survey, where respondents had to decide which types of funds are important, all types were considered such, except loans:

Table 4-18. Availability of funds in Cluster C

Type of funds	Availability
Availability of seed capital	Medium
Availability of venture capital	Low/Medium
Availability of governmental funds	Medium
Availability of grants from foundations	Medium
Availability of loans/borrowings	Low

The situation with funding seems ambiguous: though venture capital funding for private companies were mentioned by the interviewees to be accessed globally (there are venture capital scouting firms from Europe and USA 'scouting') we didn't find records of the total amount of funding raised each year by biotechnology companies within the cluster. New variables influencing funding availability were mentioned during the interviews – proximity to the capital of the country and English as a mother tongue (for international search).

Additionally, only the companies in private sector seem to have the problems with financing – academia is supported better:

"As a public sector organization, most of our funding comes from government, so not a major problem over the last decade"

For the purpose of our study, we are more interested in the problems of SMEs and potential entrepreneurs. Therefore, a good support for academia is not the direct enabler for entrepreneurial culture development. However, The University was reported by the interviewees to be successful in providing funds for start-up companies. It has three major funds: Discovery Fund, Venture Fund and the Challenge Fund. During the four year period 1 August 2005 to year ending 31 July 2009, the University funds made 50 investments, of which 47 were in new technology companies and 3 were in other early stage technology funds. During the 2009 financial year 22 of the 47 investee companies have transferred technology from the University for public or business use via product sales or licensing and collectively employed over 430 people.

Despite of the help of the University help, we didn't find enablers for potential entrepreneurs. Interviewees highlighted risk-aversion of EU funding organizations compared to the USA, especially on early stages. Like in other clusters studied, there is a difficulty in sustaining funding to build a company for the long term. The sector offers high-risk long-term investments not attractive to investors who do not have a scientific background or interest'

The situation is exacerbated by the fact that EU funding schemes are regarded as very

bureaucratic and rarely worth the effort for the amounts awarded. The reward/effort ratio is regarded as poor. Companies said that they would need to pay an experienced specialist in EU grants because of the high paperwork burden and high number of rules:

"The cluster [C] is now dynamic and exciting, successful it is in generating new ideas and spawning new companies, but there is a feeling that the financial system of the country will not support their development beyond a certain stage. This is important - the region needs a few major home-grown companies as role models"

The key objective for the Cluster C was said by the survey respondents to be attraction of new funding into the cluster from a variety of sources (Venture Capital and company acquisitions were mentioned).

Overall, the level of funding is so far the only one variable hindering the development of entrepreneurial culture. Although the help of the University is useful for start-ups, the scarce of the funding was mentioned by the majority of respondents and interviewees, which implies to the general feeling of the lack of finance.

4.4.7. Country orientation towards entrepreneurship

Overall, national culture of the UK was perceived by the interviewees to be relatively entrepreneurial, in comparison with the cultures of continental Europe. Additionally, the World Bank study points out that there is a long tradition of entrepreneurship. Moreover, the Cluster C itself emerged due to bottom-up efforts by individuals, referring to strong orientation towards entrepreneurship in the society.

Using the GEM data, we found out that, the country scores average on Entrepreneurial Intentions Index (4 out of 100, the same as Spain and slightly less than the Netherlands), Perceived Opportunities Index is higher than in Spain, but again lower than in the Netherlands (24 out of 100), the same applying also for the Fear of Failure (32 out of 100). However, the Perceived Capabilities Index is relatively high (47 out of 100), and the overall picture shows that the culture of the UK is rather an enabler for entrepreneurial culture development, as was suggested before.

Moreover, the both types of the respondents of the study suggested their culture to be an enabler for entrepreneurial action, as well as the representatives of other clusters referred to Anglo-Saxon entrepreneurial mindset, therefore, we would rate this variable in our model as medium/high.

4.4.8. Economic enablers

Both types of the respondents were referring to culture likelihood to start a new business. Additionally, the start-ups representatives didn't point out the issue of setting a business itself. Controversially, the interviews revealed bureaucracy-related issues (in the obtaining finance). .

Indeed, according to World Bank Group, the country enjoys the 16st place in the world in the starting a business variable, scored exactly on average for the time and procedures, and much lower than average capital is needed to start a business:

Table 4-19. Economic enablers in the UK

Indicator	The UK	Average
Procedures (number)	6	5,7
Time (days)	13	13
Cost (% of income per capita)	0.7	4.7
Min. capital (% of income per capita)	0.0	-

Such results prove the enabling situation for potential entrepreneurs.

Concerning Economic Freedom, the UK enjoys the status of 11th freest country in the world. Business formation is streamlined and efficient. An independent and efficient judicial system enforces contracts and intellectual property rights. As we perceive the entrepreneurial culture to be the more likely to developed the higher cluster scores on both economic enabler variables, the environment in the UK should be rather an enabler for potential entrepreneurs, thus positively effecting entrepreneurial culture.

4.4.9. Regulations and legislation in the specific field the cluster is operation

"Not much legislation or regulation has been specific for this cluster's development"

However, the survey respondents showed a certain concern about government actions that hinder progress of the cluster. High levels of taxation overall and a more specific regulation - 'EU Clinical Trials Directive'[9], - were pointed out to be an obstacle for those desiring to develop a product/conduct a research/start a business. This was supported by the interviewees:

"Bureaucracy has dramatically increased costs of conducting clinical trials which has resulted in companies moving out of Europe to the Far East".

The interviewees claimed that this document, rather than harmonizing clinical trials activity across Europe, had the opposite effect with different member states implementing its requirements more, or less, stringently. Therefore the UK participation in global clinical trials dropped by 4% in the years 2002-2006

However, the national system of R&D tax credits was mentioned regularly as an important supportive factor.

[9]Officially Directive 2001/20/EC of 4 April 2001, of the European Parliament and of the Council on the approximation of the laws, regulations and administrative provisions of the Member States relating to implementation of good clinical practice in the conduct of clinical trials on medicinal products for human use) is a European Union directive that aimed at facilitating the internal market in medicinal products within the European Union, while at the same time maintaining an appropriate level of protection for public health.

In summary, the regulations and legislations in the UK can be viewed as barriers rather than enabler for potential entrepreneurs, thus hindering the entrepreneurial culture development.

4.4.10. Cluster Summary.

Cluster C is an example of a cluster, where relatively favorable variables on social perception are combined with slightly less favorable ones on feasibility level. The most visible obstacles are funding and legislation (regarding bureaucracy) problems. Overall, outcome of the combination of success factors in the suggested model aligns with the relatively high level of entrepreneurial culture. As we saw in the previous example, the funding variable seems to have a great impact on the overall level of entrepreneurship within the cluster.

Table 4-20. Success factors of entrepreneurial culture development in Cluster C

		Country level	Cluster level
Entrepreneurial culture	Social perception	1. Country orientation towards entrepreneurship – medium/high	2. Social networks – relatively high 3. Role models – medium/high 4. Entrepreneurial Education – medium/high)
	Feasibility perception	5. Economic enablers – medium/high 6.Specific legislation – relatively low	7. Supporting facilities – medium (can be improved) 8. TTP - high 9.Funding – medium

While studying Cluster C, the issue of a cluster reputation emerged again – now we saw that the high level of awareness about the Cluster C, especially, due to world-known University indirectly contributed in the trainings establishment and attracting key people into the cluster. Moreover, the actions of the policy makers (both on the country and EU level) seem to have an effect on several variables in our model – funding, TTP. It can be suggested further to interconnect these variables.

4.5. Bio Cluster D (Sweden)

Cluster D is a fast-growing cluster of Life Science companies and academic research groups in the very North of Scandinavian region. The cluster emerged in a bottom-up way as an initiative of some individuals and is supported by the local municipality, Swedish and EU Structural Funds. Attracting venture capitalists is a highly challenging task since investors often do not know what Cluster D has to offer due to its geographically distant location. That is why Cluster D is sometimes called “the best kept secret” of Sweden where it is located.

Although Cluster D possesses a strong scientific base formed by four large academic institutions, large companies tend to perform their R&D activities outside it and, therefore, are hardly

involved in R&D collaborations and licensing deals. The SMEs base is fast-growing. The Cluster D has two cluster organizations, with activities that mainly complement each other. The cluster management promotes innovation; the process of knowledge commercialization is under great attention and the facilities for it are provided by cluster organization.

The attraction of this cluster is, after satisfying our initial criteria, in its unique, very distant location. The Cluster D is also a relatively small (about 2000 people employed, about 60 companies) and closed community and therefore the level of trust in the cluster is considerably high, the collaboration processes are easier and more informal. Additionally, relatively high level of entrepreneurial culture was formed among students and a lot of activities to promote entrepreneurial culture within Cluster D participants are done by cluster management.

4.5.1. Social networks

Our data indicates that most cluster participants feel the sense of belonging to the cluster. The survey participants mentioned the involvement into courses, meetings and workshops organized by the cluster organizations. Given that the cluster is rather small, most people know each other quite well:

"People know each other very well, all our kids go to the same kindergarten".

Controversially, one of the interviewees pointed out that not all the companies feel like they are in the cluster, because not all of them are engaged in collaborations within the cluster. It was referred more to larger companies, working directly with organizations from abroad. The smaller, which do collaborate with each other, revealed the need to join efforts in order to survive high competition outside the cluster. Overall, the process of collaboration in the cluster represents a natural phenomenon, rather than the result of special measures of managing actors. Cluster organization provides additional enabling platforms (databases, meetings) that make those collaborations easier and more effective.

The survey responds indicated that the cluster participants are engaged in various types of interactions. The most popular types of collaboration refer to participation in professional networks and boards, informal contacts and networks and sharing of facilities:

Table 4-21. Types of Collaborations in Cluster D

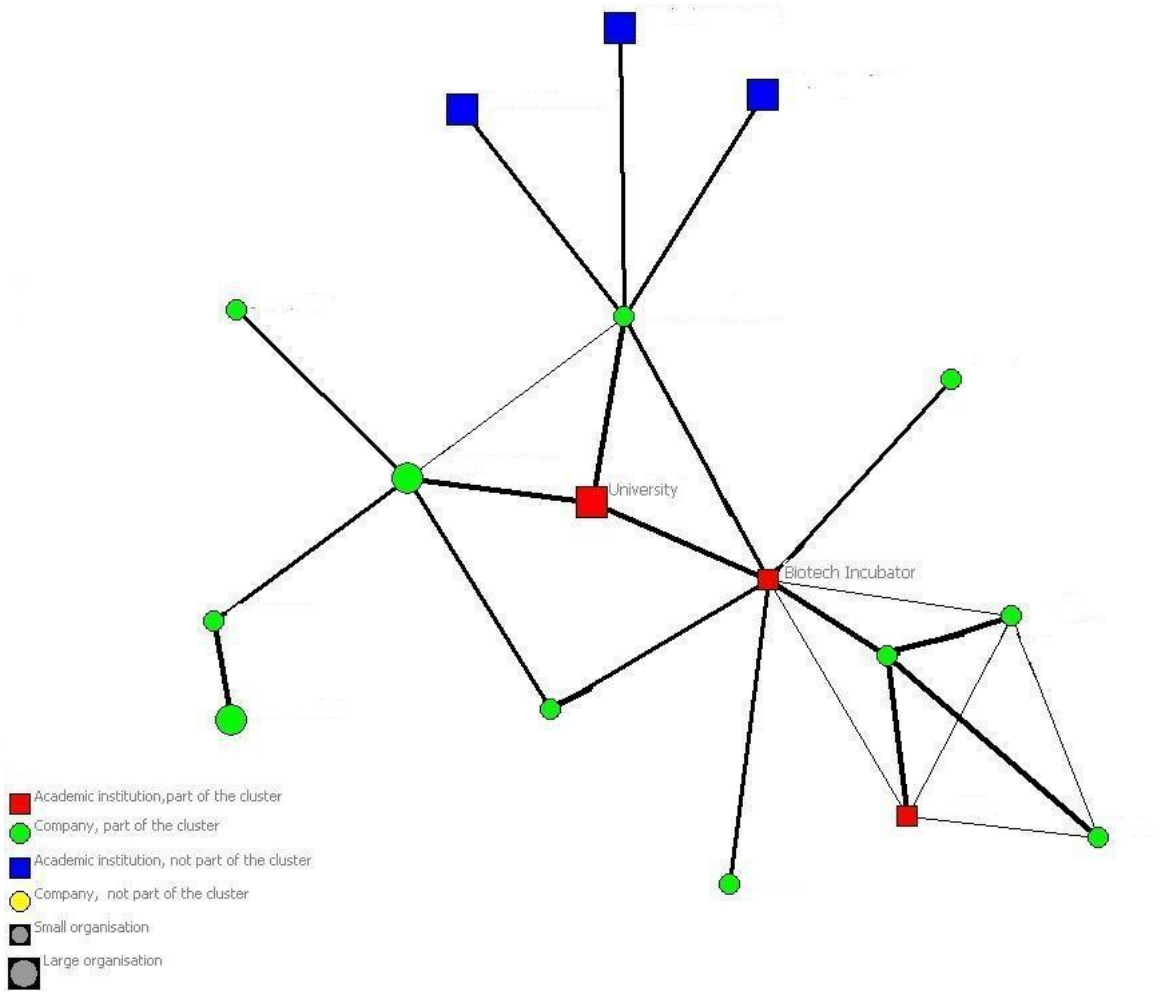
Types of Collaborations	Count	Percent of Respondents
Publications	4	16.7%
Participation in professional networks and boards	14	58.3%
Mobility of people (mobility from public knowledge institutes to industry and the other way around)	6	25.0%
Informal contacts/networks (e.g. alumni societies, networks based on friendship, other boards)	12	50.0%
Cooperation in R&D (joint R&D projects, sponsoring of research, financing of a PhD student, supervision of a PhD student)	10	41.7%
Sharing of facilities (shared laboratories, common use of machines, common location or building)	5	20.8%
Cooperation in education (contract education or training, providing scholarships, sponsoring of education, giving information to students, influencing curriculum of university programs)	8	33.3%
Contract research and advisement	5	20.8%
IPR (patent applications)	3	12.5%
Total Respondents	24	-

Such types of collaborations can be a good enabler for future joint entrepreneurial actions: professional networking events bring together academic actors and companies, which might result in a commercializing of academia findings; informal networks open the chances for joining the knowledge of actors from different background and boost the creative side of entrepreneurial thinking; cooperation in education leads to creating programs satisfying the exact needs of the cluster and again bringing actors with different actors together. Moreover, the level of entrepreneurial culture in Cluster D is reported by the interviewees to be especially high among students, therefore creating alumni and keeping in touch can lead to potential partnerships in the future. Thus, the networking possibilities are favorable for entrepreneurial culture development. Although, interviewees added that lack of financing can prevent from the cooperation:

> "If an organization is struggling to find the money to survive, its management doesn't think too much to collaborate or not – they are solving more important problems"

The following network picture presents a snapshot on relations among participants of this study to provide an illustrative example of how collaborations within Cluster D tend to be organized:

Picture 4-4. Social networks in Cluster D



Based on the network picture and the interview findings the following conclusion can be made:

- Cluster D networking picture represents one solid cluster, not divided in sub-groups of partners. The collaborations are quite tight. This indicates that the environment in the cluster is open for collaborating and establishing networks, so common networking events should be successful, potentially resulting in new businesses started.

- Cluster D is relatively closed and does not have a lot of external collaboration partners. The prevailing color is green, indicating that the majority of organizations involved into the network are the companies from the cluster itself. Moreover, the prevailing size of the dotes is small, indicating non-heterogeneous network, where the majority of companies are SMEs. As was indicated before, larger companies do not actively participate in cluster activities and are not engaged in collaborations.
- Biotech Incubator seems to play an important role in the Cluster D. It is involved in a larger number of collaborations especially with SMEs, and the strength of those social ties is said to be strong. As our data shows, the incubator represents the link between SMEs and the University.

- Our data indicates at least one large company, playing an important role within the cluster and involved in several collaborations both with SMEs and the University. Such collaborations are inspiring for SMEs and, in the cooperation with University, enable start-ups creation.

Overall, the networking aspect is well-developed in Cluster D. The collaborations are easy to establish: due to geographical proximity and sense of belonging to one community, relations between people go beyond formal business agreement. The most popular types of collaborations are in the business developing (professional meetings) sphere as well as aiming to boost networking itself. SMEs which are the most presented actors of Cluster D are actively collaborating, especially with the University and Incubator. There is (at least) one large company actively collaborating with SMEs as well.

4.5.2.Role model companies.

The majority of survey participants so far indicated the presence of role model companies. However, the interviewees argued that, Cluster D lacks good examples of booming businesses and this was supported by desk research. At this moment, there are still no big success stories within the Cluster A. As indicated before, larger companies, even if present, are almost never involved in any kind of collaborations with cluster participants.

Company growth was mentioned in the interviews as one of the key challenges for the cluster*:*

"Nobody here made a real success. Undoubtedly there are companies, started with one or two people, having 5 after 2 years and 8 after 5 years. But we would like to have here the companies started with 1 or 2 founders and enlarged to 600 after the same period of time. This can be really inspiring"

In the same time, we found out that some of the start-ups and spin-offs from University attracted the attention of foreign large companies and were acquired by them. One of the managers of such a company argued during the interview that this way is becoming popular – to start a company, sell it to a corporation, then to start another. Such an approach indicates very high level of entrepreneurial spirit. Having such organizations, even not blooming businesses, can be inspiring for potential entrepreneurs. Indeed, the majority of survey respondents admitted presence of such companies to boost entrepreneurial attentions within the cluster.

Therefore, Cluster D doesn't possess a large number of role-model companies, but the one which present provide with quite inspiring example of pure entrepreneurship – starting up a new business just after selling the previous start-up. Referring to the fact that the Cluster D is a relatively small community and such success stories a very visible, we would rank the impact of role-model companies as quite positive.

4.5.3. Entrepreneurial education

Training system developing business and entrepreneurial skills seem to be well-developed in the Cluster D. Different types of training are provided to the local workforce. The majority of the survey respondents so far indicated that business skills, and IPR management skills are being developed through these trainings. Moreover, almost every survey participant correlated the high level of entrepreneurial culture with the business and entrepreneurial education available in the Cluster D.

While interviewing a representative of a cluster organization responsible for Innovation, we found out that these trainings are mostly provided by this entity: in order to stimulate entrepreneurship in the cluster, Entrepreneurship Programme was developed. The programme consists of two parts. The first part aims to help a potential entrepreneur to judge whether the business idea can survive in the real world. This part involves activities such as market research and simulation exercises. The second part of the programme represents a more standardized course that involves a series of lectures and helps the entrepreneur to prepare a business plan. The course also introduces some basic terms of sales and economics. In addition, a flexible set of lectures is available when a particular topic is demanded.

Such programs are especially applicable for scientists, due to the large number of start-up companies from academia which are often ruled by researches who do not posses relevant business skills and knowledge. The entrepreneurship courses are embedded in all scientific faculty programs, and are thus quite popular among university students. An entrepreneurship program is also developed and run by the Biotech Incubator, with the target group PhD-students within biomedicine and biotechnology; new ventures often make use of this kind of support. As for large organizations, the courses provided by the cluster prove to be less relevant.

Overall, the level of entrepreneurial education has a sound positive effect on entrepreneurial culture in the Cluster D. Although, relatively high level of researches willing to participate in such programs indicated, that these programs of entrepreneurial education available may not have such a positive effect in another cluster, where scientists would be less willing to participate in them; therefore entrepreneurial education might have such an impact only as a secondary means – there should be entrepreneurial spirit before. During the interview, one of the cluster managers responsible for such programs developing entrepreneurial skills explained:

"When such activities were just started 2 years ago, no one was willing to participate in activities we created. We have been continuously trying to encourage researches to meet the business, and now it goes successfully"

Thus, entrepreneurial education and related trainings (at least within Cluster D) do have a profound effect on entrepreneurial culture, both directly and indirectly, attracting a scientist at least to admit they might become an entrepreneur.

4.5.4. Supporting facilities

In general, the availability of specific services and infrastructures of the cluster can be ranked as medium. Incubators and Science Parks that cater for biotechnology companies represent an outlier in this trend and are highly available. Other specific services such as business, financial, legal and HR advisors are also present in the cluster; however, their availability is considered by the survey participants to be rather low.

Table 4-22. Availability of specific services and infrastructures in Cluster D

Type of services and infrastructures	Availability
Incubators and science parks that cater for biotechnology companies	Medium / High
Business advisors	Medium
Financial advisors	Low / Medium
Legal advisors	Medium
Human Resources and recruitment advisors	Medium
Property advisors	Low / Medium
Marketing support	Medium

Here we would like to attract a special attention to incubators and science park facilities, as far as in general such facilities, not to mention the initial essence for start-ups performance, have also a potential to boost informal collaborations resulting in joint business projects in future. In the case of Cluster D we also saw, that the Bio Incubator was an active actor on the networking picture. During the interviews, the members of the Cluster D proved the importance of the Incubator which is aiming to bring great ideas into life. Moreover, Bio Incubator as an actor of the Cluster, participates in different aspects of cluster life – education, building competencies, taking part in seminars. The managers of the Incubator arrange entrepreneurial courses, organizing meetings for companies searching for venture capital – with potential investors form both inside and outside the cluster. Thus, those companies hosted in the incubator, enjoy much more benefits then others comparing with other clusters.

In the same time, some of the survey respondents mentioned the lack of research laboratories, especially of the kind where companies would be able to visit scientists. But such initiatives are almost impossible to be brought to live – interviewees explained that here geographical factor plays its role*:*

> "In the USA, there are laboratories where researches are working on their projects and companies can come and have a look at them. Unfortunately, we cannot build such kind of laboratory – we just grew out of our premises – there is no more space for a new building"

To sum up, the availability and access to special facilities within Cluster D can be ranked as above average, though there is an issue, that there is no more room for new facilities and in long-term period to declining of the level of this variable.

4.5.5. Technology transfer process

There is a number of organizations within Cluster D, acting as a Technology Transfer Office – one of the cluster organization, promoting innovation; discussed above Bio Incubator. The first organization, is calling itself *glue keeping businesses and research together*. They work with students, employees, researchers willing to develop their achievements. Scientific discoveries, research results needing patent are also in their work field. Moreover, this organization provides other entities with business coaches *to guide academia at the long difficult road to business*.

Bio Incubator is a non-profit company providing incubator services, laboratory space and equipment to researchers, supports a special organization responding for seed funding. Additionally, there is another non-profit incubator, which within life sciences is handling new business concepts (mostly medical device and healthcare).

Surprisingly, but only a few of the survey respondents see licensing/IPR generating as the main focus of cluster activities. Moreover, a 13% of them feel that the knowledge commercialization process is cumbersome. The teacher's exception has been mentioned by interviewees as a possible barrier for successful knowledge commercialization in the cluster. The teacher's exception is a national-level regulation, giving University researchers and teachers the full ownership and control of their research results. Therefore, some scientists interested in the pure science and publications, might be not willing to share and commercialize their findings:

"Nowadays scientists have to suffer a lot before creating a new product. It is risky, costly and not everyone is ready to quit his stable life"

. The interviewees also suggested that not enough research results from universities are used, either commercially or any other way, that benefits the surrounding community. Though, they were not sure themselves whether teacher's exception stimulates or hinders knowledge transfer.

Cluster management during the interview indicated the aim to promote licensing:

"Emphasis is that there is a large gap between interests of scientists and the business world".

Again, researchers are claimed to be interested in pure science and publications, not willing to collaborate with commerce. This necessary culture of commercializing scientific findings is said to be improved over last period of time. Among the students this level is higher.

Overall, the level of technology transfer facilities can be assessed as above average, though knowledge commercialization, even being the aim of the cluster organization, is not perceived as a main focus of activities by the participants, and might be complicated due to specific regulations.

4.5.6. Funding

The situation with financial support within Cluster D is in general not favorable for potential entrepreneurs. There is an obvious lack of financing in the cluster, indicated during the survey:

Table 4-23. Availability of funds in the Cluster D

Type of funds	Availability
Availability of seed capital	High
Availability of venture capital	Very low / Low
Availability of governmental funds	Medium
Availability of grants from foundations	Low / Medium
Availability of loans/borrowings	Medium

One of the cluster organizations, aiming on Innovation, is providing help with seed capital, i.e. capital used for the initial investment in a project or start-up company, for proof-of-concept, market research or initial product development, and these types of capital are considered to be highly available in the cluster. Therefore, the possibilities for initial entrepreneurial action are quite high,

However, the major concern refers to funds after seed investments. Several interviewees have emphasized the problem of “bridging Valley of Death” - the gap between the initial business idea and actual commercialization of intellectual property. General availability of venture capital was ranked as Very low / Low by most of the survey respondents as well. Venture capital and governmental funds are considered to be the most crucial types of funds for the development of the cluster.

The lack of finance was proved by both types of respondents to influence other enablers of entrepreneurial culture - e.g. collaboration. Attracting venture capitalists was mentioned by the survey participants to be one of the key objectives of the Cluster D, it is hard for a distant, young and small, cluster having low reputation at the international level. As pointed out by one of the interviewees, investors often do not know what Cluster D has to offer due to geographically distant location of the cluster. Therefore, the promotional aspect, the international reputation seems to play an indirect, but important role.

Overall, the general lack of finance in Cluster D seems to hinder entrepreneurial culture development, both directly and indirectly. In the same time, the financial support for initial entrepreneurial action, short-term, is available. The issue is that to take such a risk, being sure in financial support only for a short period of time, could be possible only for a high-entrepreneurial person.

4.5.7. Country orientation towards entrepreneurship

Overall, Scandinavian culture is perceived by the interviewees to be rather an enabler for an entrepreneurial action, as far as in the case of failure there will be a sound state support. However, during they pointed out relatively risk-aversion of investors.

Using the GEM data[10], we found out that Sweden scored relatively high (49 out of 100, much more than other countries we study, that year) on the Perceived Opportunities Index, also Entrepreneurial Intentions Index (32 out of 100) was also high, the Risk of Failure Index (9 out of 100) was relatively low, but higher than in the Netherlands that year. However, the Perceived Capabilities Index was medium (49 out of 100), lower than in the UK and the Netherlands that year. Overall, the data we gathered shows that Swedish culture is open towards entrepreneurship, enabling the entrepreneurial culture development.

4.5.8. Economic enablers

Surprisingly, Sweden is just on the 43 place in the world in the starting a business variable, requiring considerable efforts and time for a potential entrepreneur. The country recently lost 11 positions due to the challenges of launching a business are shown below.

Table 4-24. Economic Enablers in Sweden

Indicator	Sweden	Average
Procedures (number)	3	5,7
Time (days)	15	13
Cost (% of income per capita)	0.6	4.7
Min. capital (% of income per capita)	28.5	-

Although the time variable is more than average, the minimum capital needed is less than in the Netherlands.

Moreover, Sweden is the 21st freest economy in the World. With its economy open to global trade and investment, Sweden scores well in trade freedom, investment freedom, monetary freedom, and financial freedom. The overall regulatory and legal environment, transparent and efficient, encourages robust entrepreneurial activity. The judicial system, independent and free of corruption, provides strong protection of property rights.

Therefore, the economic situation in Sweden rather could be seen as an enabler for entrepreneurial culture boosting.

4.5. 9. Regulations and legislation in the specific field the cluster is operation

Unlike the other clusters studied in this paper, the Cluster D shows an example of a potential positive effect of regulation and legislation variable on entrepreneurial culture development. The

[10] Here we use the 2007 year data

following aspects of legislation and regulation were mentioned by both types of study participants as incentives for cluster development:

- Funding for entrepreneurship program, networking events, incubators and science parks etc.
- Funding to a cluster organization coordinating the whole spectrum of cluster activities;
- Incentives for scientists to engage in commercialization (mentioned before Teacher's exception).

However, the latter was considered as a barrier rather than incentive by some interviewees for knowledge transfer in Sweden. Teacher's exception implies that Swedish university researchers and teachers are granted full ownership and control of their research results. However, not all researchers are willing and are capable to claim this ownership and commercialize their research. Consequently, as suggested by some interviewees, a considerable part of research results with commercial potential is not exploited. Moreover, lack of tax incentives for venture investments in start-ups (as in the majority of EU countries), high unpredictability of continuation of governmental and EU Structural funds, ban on using governmental and EU funds for direct support of spin-off companies and too much bureaucracy with regard to the EU Structural funds were mentioned by the survey participants as obstacles for starting a business.

Therefore, the impact of this variable can be medium, as far as positive enabling regulations are balances with a hindering lack of tax incentives for start-ups.

4.5.10. Conclusion.

The level of feasibility and social perception variables in Cluster D is unequal, but overall proving the applicability of suggested model:

Table 4-25 Success factors of entrepreneurial culture development in Cluster D

		Country level	Cluster level
Entrepreneurial culture	Social perception	1. Country orientation towards entrepreneurship – relatively high	2. Social networks – high 3. Role models – high 4. Entrepreneurial Education – high
	Feasibility perception	5. Economic enablers – medium/high 6.Specific legislation - medium	7. Supporting facilities – medium 8. TTP – medium/high 9.Funding – low

As we saw in previous examples, one of the most important enabler for entrepreneurial culture development was the networking, while the main obstacle refers to funding issue. Additionally, cultural aspect seems to have more weight than country one. The insights from Cluster D also point out the importance of cluster managing organization and the cluster reputation.

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5. Conclusions and recommendations

5.1. Results

The aim of the clusters description was to get the better understanding of the success factors of the entrepreneurial culture development in an innovative biotechnology cluster and, if needed, to advance the model. We saw, that the clusters, initially selected as examples of well-developed entrepreneurial culture presented respectively high scores on the variables included in the suggested model. Additionally, several factors seemed to have a more important impact than the others. Moreover, the findings show that a number of variables have to be added in the model, as far as additional enablers of entrepreneurial culture development were mentioned by the respondents during either the survey or interviews. Such factors seem to have an at least indirect impact on entrepreneurial culture development. Finally, several success factors already presented in the model appeared to be interconnected.

In this sub-section, we will first put together the individual clusters findings, and, secondly, suggest the overall model reconsideration.

In general, the application of our model to description of **Bio Cluster A** seemed to be successful – the high score on the main entrepreneurial culture development parameter is supported by the sum of parameters in the model. We found out the *Social Networks* and the *Role-model Companies* to be the most important enablers for entrepreneurial culture development. In this particular case, we also observed the importance of the reputation of the cluster in attracting the world-known companies, which would form the role models for several respondents. However, the Role-model variable revealed an additional issue in the model – that the SMEs, started within the cluster and eventually succeeded, are in general perceived to be more inspiring, than the giants established their headquarters in the cluster. Additionally, this variable appeared to be connected to the *entrepreneurial education* one – as far as those trainings, provided by role-models, were perceived to be the means of best practice sharing. Overall, *networking* appeared to be crucial for all cluster level parameters. Moreover, digging into the origins of networking development within the Cluster A, we found out the boost of networking was due to the cluster organization stimulating it. The cluster management also provided several types of trainings and supporting facilities, advisory. Therefore, we suggested including the activities of a cluster organization in the model.

Funding was argued to be the main factor hindering entrepreneurial culture development. The respondents especially highlighted a clear distinction between the seed capital (for initial step) and the venture capital (for the business continuation). It appeared that sole availability of seed capital does not mean the boost of entrepreneurial culture, because the biotechnology companies generally need up to 3

years for the product finalizing. Thus, there is a feeling that in our model we have to include the level of availability of seed and venture capital.

Bio Cluster B differs from other clusters in our study, as it scored lowest on the majority of the variables; especially culture on the country level variable seemed to be unfavorable for entrepreneurial culture development. However, the scores on the cluster level were higher. The *Social Networks* variable was the only one scored obviously high, and it was mentioned by the respondents to be the most important. The sound development of networking in Cluster B is due to the cluster organization management. Again, the main collaborations were established among SMEs - in both informal events and master-classes given by start-ups. The Cluster B achieved relatively high score on the networking parameter, even though the large companies are not involved that much, thus implying to the fact that inter-SME networking might be more important for the entrepreneurial culture development. Another issue, highlighted by the representatives of Cluster B, is the *need for promotion* and cluster reputation – to attract key business people and companies. This parameter seems to have an indirect influence on the *Role model* variable and the *entrepreneurial education*. Moreover, cluster promotion and networking are related to the *actions taken by the cluster organization* – thus supporting the need to include the activities of such entities in our model.

Bio Cluster C was an example showing how relatively favorable variables on social perception can be combined with slightly less favorable ones on feasibility level. The most visible obstacles indentified were funding, and legislation (regarding bureaucracy) problems. Overall, outcome of combination of success factors in the suggested model aligned with the relatively high level of entrepreneurial culture. Having the relatively high score on the rest of parameters, the respondents argued that without additional financial help the cluster will stop its developing (consequently, no more companies will be started, hindering the entrepreneurial culture). In this case, the actions of the policy makers (both on country and EU level) seem to have an effect on several variables in our model – funding, TTP. It can be suggested further to interconnect these variables.

Moreover, the factor of a cluster reputation emerged again – now we saw that the high level of awareness about Cluster C, especially, due to world-known University indirectly contributed in the trainings establishment and attracting key people into the cluster.

The findings from **Bio Cluster D** partially correspond with the general conclusions of other clusters - one of the most important success factor of entrepreneurial culture development was the Social Networks, while and the main obstacle refers to Funding issue. Additionally, cultural aspect seems to have more weight than feasibility one. The reputation factor was also mentioned as an important factor for the Cluster D – an unfavorable geographical location hinders the attraction for potential trainers, companies and investors. However, such a location was seen as a stimulator for establishing tense collaborations inside the cluster, which are seen as an enabler of the entrepreneurial culture development. The insights from Cluster D also question the entrepreneurial educational variable – whether the availability of such trainings is initial or the will to attend them comes from the culture.

Another conclusion to be made from this case is that SMEs succeeded within the cluster (and then probably sold) are seen as role-model companies, instead of larger companies.

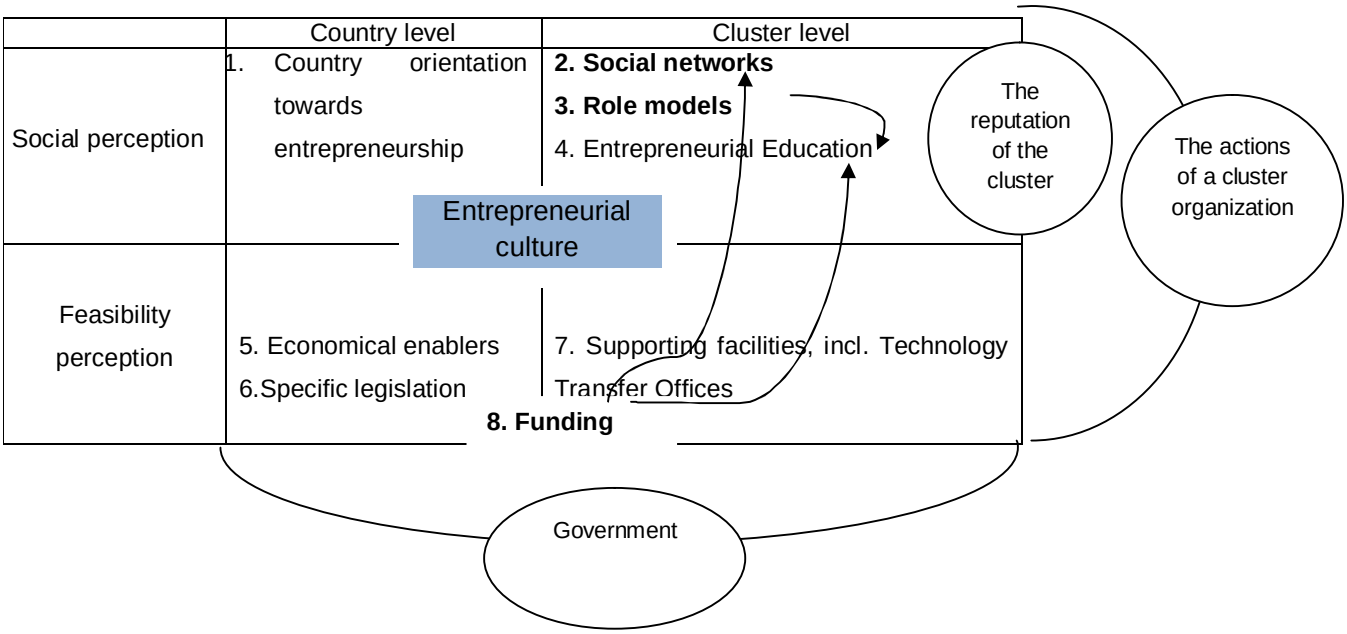
The table below summarizes the study findings per variable:

Table 5-1. Summary of the funding per varuable

Variable	Findings
Country orientation towards entrepreneurship	Medium impact on the entrepreneurial culture development: the social perception variables on the cluster level seem to be more important
Social networks	High impact on the entrepreneurial culture development, can be influenced by the *actions of a Cluster organization* and in some cases by *Funding* variable
Role models	High impact on the entrepreneurial culture development, is often influenced by the *cluster reputation,* which can be improved by the *actions of a Cluster organization*
Entrepreneurial Education	Medium impact of the entrepreneurial culture development. Dependent on the presence and actions of *Role-model companies, a Cluster organization, Cluster reputation* and *Funding*
Economic enablers	Medium Impact – seem to have a more indirect effect on the entrepreneurial culture development by influencing *Legislation, Funding* and *TTP* variables
Specific Legislation	Medium Impact – seem to have a more indirect effect on the entrepreneurial culture development and are influenced by the actions of various levels and of *Government*-related issues (from bureaucracy to regulations)
Supporting facilities	Medium/High impact on the entrepreneurial culture development – are mostly determined by *a Cluster Organization actions* and have an indirect impact on the *Social networks* establishment
TTP	Medium impact. Additionally, this variable can be put as a part of Supporting Facilities variable as far as the latter generally include facilities operating as Technology Transfer Office
Funding	High impact on the entrepreneurial culture development – is influenced by both *Government* and various supporting institutions from inside the cluster – Universities, other organizations

Therefore, we suggest re-combining of our model indicating the interconnection of some variables, especially on the cluster level. We also suggest distinguishing between core and peripheral variables. The latter will be perceived to determine the core success factors, and, therefore, to indirectly effect entrepreneurial culture development:

Table 5-2. Improved model of success factors of entrepreneurial culture development



The advanced model suggests the existence of core and peripheral variables.

The core variables include those initially put in the model as success factors of entrepreneurial culture development as far as the finding of our study prove their direct influence on the entrepreneurial culture development:

1. Country orientation towards entrepreneurship
2. Social Networks, which is to be one of the most important success factors. This variable is proved to be influenced by the Funding variable.
3. Role Models, another important success factor, affect the Entrepreneurial education variable.
4. Entrepreneurial education (influenced by Role Models and Funding Parametres)
5. Economic Enablers
6. Specific Legislation
7. Supporting Facilities, including Technology Transfer Offices (previously, Supporting Facilities and Technology Transfer Process were put separately, however, they proved to be closely related and therefore suggested to put together)
8. Funding, one of the most important success factors. Previously was put on a cluster level, however proved to appear on both cluster and country levels.

The peripheral variables added in the model refer to those having an indirect influence on core-level success factors of entrepreneurial culture development, including:

1. The reputation of the cluster – the level of national/international awareness of the biotechnology cluster. This factor proved to influence the Role Models and Entrepreneurial education success factors.
2. The actions of cluster organization affect all cluster-level success factors
3. Governmental actions, as well as the level of beauracracy is influencing he success factors on Feasibility perception – Economic Enablers, Specific Legislation, Supporting Facilities and TTP, Funding.

The importance of actions and strategies of both different levels of governmental bodies and cluster organization is also proved by the literature. Thus, the strategies selected by Federal Government (exploiting existing institutions and cooperation patterns) and implemented on lower level, are claimed to be crucial to create a competitive advantage and the longitude leadership of government is sometimes viewed as an important success factor of overall Biotechnology success (Adleberger, 1999; Breschi et al, 2001).

5.2. Conclusions

The data suggests a number of conclusions about the success factors for entrepreneurial culture development within an innovative cluster.

First, the cluster level success factors seemed to be more important than the country level ones. Moreover, there are additional factors indirectly determining them. Therefore, success factors of entrepreneurial culture can be influenced by the internal forces, leading eventually to the shift of entrepreneurial culture development.

Secondly, the importance of peripheral factors - cluster reputation, as well as the actions of a Cluster organization and government-related parameters were highlighted.

Third, the study provides the findings of the interdependence of the suggested success factors. Therefore, a low level of one success factor can lead to the failure of others and to a future hindering the entrepreneurial culture development. Thus, the entrepreneurial culture development should be viewed as a complex process.

The explanation of these conclusions can be found in institutional theory. According to it, organizations are influenced by the societies in which they operate (Granovetter, 1985), and exhibit their values (Zuccer, 1977). In order to survive, they must conform to the rules and belief systems prevailing in the environment (Scott, 1995). In our case, it refers to the fact that e.g. economic enablers, specific legislations, viewed as core factors, are affected by the regulations of the government, while the boost of Social Networks – by a Cluster organization. Moreover, the cluster management was perceived by both types of survey participants to be in charge of promotion of a cluster, which will eventually improve the attraction of key commercial and business people. The connection and importance of institutes for a cluster development was also highlighted by scholars, e.g. Coriat and Weinstein (2002).

The study contributes into the understanding of the entrepreneurial culture development in a particular type if innovative clusters – those operating in the biotechnology industry. According to European Commission[11], life sciences and biotechnology are widely recognized to be the next wave of the knowledge-based economy, creating new opportunities for [member states] societies and economies. This sector is on the forefront of the frontier technologies and therefore needs to be studied and understood. The specifications of biotechnological industry were revealed in our study. For instance, the funding issue claimed to be important for the entrepreneurial culture development, was already highlighted by scholars as crucial for the whole biotech industry: the really testing time for emergent clusters of biotechnology firms is claimed to come, when large doses of second round funding are needed (Cooke, 2002). Specific role played by the scientists shapes the importance of geographic proximity in the firm-scientist link (Stephan et al, 1996) proving the networking to be especially important

[11] Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee of the Regions, *Commission's Action Plan for skills and mobility*; *Life sciences and biotechnology – A Strategy for Europe*. Brussels, 23.1.2002, COM(2002) 27 final

in biotechnology clusters. Moreover, the profit from its commercial application seems not to be so obvious. Therefore certain efforts should be put onto the entrepreneurial culture development. Our study, answering the main research question, - *what are the main determinants of entrepreneurial culture in an innovative biotechnology cluster*, contributes in the formation of a theoretical basis for the entrepreneurial culture development in this particular industry.

Despite the findings, the study has a number of limitations. One refers to the scope of the study – approximately 20-30 respondents per cluster (both by the means of survey and interviews) were approached, thus hindering the statistic analyzes possibility.

Given the preliminary nature of this study, much work remains to be done. Further research should increase the number of indirect variables employed to identify the importance of such factors for the entrepreneurial culture development. Secondly, the model should be advanced to be used for related innovation science clusters (e.g. energy). We also suggest to apply the model on a larger scale or globally, comparing the success factors of entrepreneurial culture within innovative clusters. Future researchers might be interested in finding out to which extend some factors have a more importance than others.

In short, this study suggests that researchers looking at success factors of entrepreneurial culture development in innovative clusters should investigate the interconnection of them and make the suggested model applicable for the use in practice – not only to understand the success factors, but to stimulate them - for the Cluster Organizations, various types of policy makers and science.

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Annex A. Base of the literature review (journals)

Financial Times Top-40 Journals (2006):

Entrepreneurship Theory and Practice (Baylor University, Waco, Texas) – 9 articles

Journal of Business Venturing (Elsevier) – 22 articles

Academy of Management Journal (Academy of Management, Ada, Ohio)

Academy of Management Review (Academy of Management) – 2 articles

Journal of International Business Studies (Academy of International Business) – 1 article

Management International Review (Gabler)

Strategic Management Journal (John Wiley and Sons) – 1 article

Organization Science (Informs) – 1 article

California Management Review (UC Berkeley)

Organizational Behavior and Human Decision Processes (Academic Press)

Harvard Business Review (Harvard Business School Publishing)

Sloan Management Review (MIT)

The Journal of Business Ethics (Kluwer Academic)

Additional Journals (or peer-reviewed articles)

Comparative Labor Law & Policy Journal – 1 article

Journal of Evolutionary Economics – 4 articles

Regional Studies – 2 articles

Knowledge-Driven Entrepreneurship (collected by Spiegel) – 5 articles

Entrepreneurship and Culture (collected by Springer, 2010) – 2 articles

Small Business Economics – 1 article

The Journal of Economic Behavior & Organization – 1 article

The Journal of Economic Literature – 1 article

Annex B. Concept review matrix

Article	*Concepts*			
	Entrepreneurial culture	**Innovative clusters**	**National culture differences**	**Entrepreneur**
Andersson, M. & Karlsson, Ch. (2004), Regional Innovation Systems in Small & Medium-Sized Regions.	All actors should be committed into developing an entrepreneurial culture. To bring these actors together means the enhancing and enabling of innovation process			
Andersson, T., Curley, M. & Formica, P. Knowledge-driven Entrepreneurship.		Services and infrastructures enabling knowledge transfer involve new business launches or identification of new business opportunities within existing organizations		
Audretsch, D.B. & Keilbach, M. Entrepreneurship Capital and Economic Performance.	Complex factors such as venture capital availability, social acceptance of entrepreneurs, formal-informal networks influence the entrepreneurial culture development			
Baumol, W.J. Entrepreneurship: Productive, Unproductive, and Destructive.		Policy can influence the allocation of entrepreneurship more effectively than it can influence its supply.		Quality of economic, political and legal institutions is positively connected with productivity of entrepreneurship
Broekel, T. & Brenner, T. Regional factors and Innovativeness: empirical analysis of four German industries.		Financial situation and firm funding are some of the regional factors influencing innovativeness.		

Brenkhert, G.G. Innovation, Rule Breaking and the Ethics of Entrepreneurship.				Entrepreneurs are widely said to engage in rule breaking. Certain instances of rule breaking, even if morally wrong, are nevertheless ethically acceptable and part of the creative destruction that entrepreneurs bring not only to the economy but also to morality
Buegelsdijk, S. Entrepreneurial Culture, Regional Innovativeness and Economic Growth			Differences in economic growth in Europe can be explained by differences in entrepreneurial culture, albeit mostly in an indirect way.	
Bygrave, W.D & Hofer C.W. Theorizing about Entrepreneurship				There is an "ideal" model of entrepreneurship should comprise. Entrepreneur should be seen in regard of desire and process of new venture creation
Cantillon, R. Essai sur la Nature du Commerce en Général				Entrepreneur is someone who identifies the willingness to bear personal financial risk of a business venture
Carolis, D. & Saparito, P. Social Capital, Cognition, and Entrepreneurial Opportunities: A Theoretical Framework		Specific traits and values of a region are important. Network ties as an environmental characteristics are important for new business creation		
Cornelius, B. Landstrom, H. Entrepreneurial studies: The dynamic research front of a developing social science				Entrepreneurship has developed from a subdiscipline of management studies reliant on alien terms and cognitive methods toward a separate field with increasing complexities of its own. Entrepreneurship shows all the signs of a maturing field from its increasingly internal orientation and the establishment of key areas of research through to an enhanced, discipline-specific, theoretical approach with a professional language of its own.

P. Cooke, Regional Innovation Systems: General Findings and Some New Evidence from Biotechnology Clusters		Issues concerning taxation, rules about depreciation of investment and such issues as the rules governing share-options (usually national) affect the general climate for entrepreneurship and rules of competition. The really testing time for emergent clusters of biotechnology firms comes when large doses of second round funding are needed		
B. Coriat, O.Weinstein Organizations, firms and institutions in the generation of innovation		Developing the innovation system analysis by bringing together the "institutional" and "organizational" dimensions of the process of innovation at the firm level		
Cromie, S. Assessing Entrepreneurial Inclinations: Some Approaches and Empirical Evidence.				Various instruments that purport to measure key entrepreneurial characteristics such as need for achievement, locus of control, and creative tendencies are considered
Carsurd, A. & Krueger, N. Social Psychology: Behavioral Technology for Understanding the New Venture Initiation Processes	There are three critical perceptions predicting, whether an individual is likely to pursue an entrepreneurial opportunity – personal desire, support by social norms, feasibility			
Cuervo et al Entrepreneurship: Concepts, Theory and Perspective.				Personal non-psychological variables such as education, family, experience influence the tendency to behave entrepreneurially
Cumming D. Government Policy Towards Entrepreneurial Finance: Innovation Investment Funds		Governmental investment programme facilitated investment in start-up, early stage and high tech firms as well as the provision of monitoring and value-added advice to investees.		

Davidsson, P. Determinants of entrepreneurial intentions				The primary determinant of entrepreneurial intention is a person's conviction that starting and running one's own firm is a suitable alternative for him/her. Attitudes are believed to act as mediators for influences of personal background factors. Apart from this "main chain" of causal influences, the individual's current situation (i.e., employment status) is expected to have an impact on both conviction and intentions
Freytag, A. & Thurik, R. Entrepreneurship and Culture.			Whereas the individually relevant entrepreneurship determinants are to certain extent widely explored differences on a society level – clusters and countries – remain unexplored	
Gartner, W. What are we Talking about when we are Talking about Entrepreneurship?				There are two conceptually different approaches in understanding entrepreneurship, either discussing its outcomes (added value) or the process, situation itself – involving innovative approach, uniqueness. Followers of the latter address an entrepreneur as an individual with unique personality characteristics and abilities
Graf, H. &Henning, T. Public research in Regional Networks of Innovators: A Comparative Study of Four East-German Regions		Universities and non-university institutions of public research are key actors in all regional networks		

Hansen, J.D., Dietz G.D., Tokman., M, Marino, L.D., & Weaver K.M. Cross-National Invariance of Entrepreneurial Orientation Scale			There are not so much differences in assessing entrepreneurs indifferent countries	Sound measures of entrepreneurship are especially critical for managers attempting to understand the construct's cultural dynamic, at both the organizational and country levels, within subsidiaries, agencies, and other such entities presently representing or offering to represent the firm's interests abroad.
A.Gibb, Creating an entrepreneurial culture in support of SMEs	Definition of entrepreneurial culture as a set of "values, beliefs and attitudes commonly shared in a society which underpin the notion of an entrepreneurial 'way of life' as being desirable and in turn support the pursuit of 'effective' entrepreneurial behavior by individuals or groups"			
Harber, S. & Reichel, A. The cumulative nature of the entrepreneurial process: the Contribution of Human Capital, Planning and Environment Resources to Small Venture Performance				The human capital of the entrepreneur, particularly managerial skills, were the greatest contributing factor to performance
Haynie, J.M. et al A Situated Metacognitive Model of Entrepreneurial Mindset				'Entrepreneurial mindset' is a special feature - the ability to sense, act, mobilize under certain circumstances

Hayton, J.C., George, G. & Zahra, S. A. National Culture and Entrepreneurship: a Review of Behavioral Research.			There are three broad research streams that address national culture and entrepreneurship. The first research stream focuses on the impact of national culture on the aggregate measures of entrepreneurship such as national innovative output or new businesses created. The second stream addresses the association between national culture and the characteristics of individual entrepreneurs. Within this stream of literature, researchers have examined the values, beliefs, motivations, and cognitions of entrepreneurs across cultures. The third stream explores the impact of national culture on corporate entrepreneurship	
U. Hilpert, D. Bastian Focus on biotechnology Issues related to R&D in biotechnology - Denmark in a comparative perspective	The venture capital company is crucial in developing entrepreneurial culture, " the real entrepreneur"			
Hisrich, R. Intuition in Venture Capital Decisions: An Exploratory Study Using a New Technique				Investment decision constructs can be grouped into three areas—management, unique opportunity and appropriate return. Principal component analyses indicate the relationships between these concerns and reveal relatively low cognitive complexity: essentially, just one or two major areas of emphasis predominate in each venture capitalists thinking

Inglehart, R. Mapping Global Values.			Differences may be assessed by resented World Value Survey (WVS). It includes two dimensions – authority as the polarization between traditional and secular-relation; well-being as the polarization of survival and self-expression values	
Krueger, N. F. & Carsrud, A. L. Entrepreneurial Intentions: Applying the Theory of Planned Behavior	Discussion of entrepreneurial intentions and their determinants - attitudes toward the target behavior, reflecting beliefs and perceptions. The need to have Intentions-based models allowing to better understand the impact of various antecedents of organizational emergence; identifying not only what influences emergence, but also how.			
Kwon, S.-W. & Arenius, P. Nations of Entrepreneurs: A Social Capital Perspective.			Importance of social capital difference between national countries. A resident of a country with higher generalized trust and breadth of formal organizational memberships are more likely to perceive entrepreneurial opportunities. A resident of a country with higher generalized trust are also more likely to invest in an entrepreneur with whom they had a weak personal tie than was a resident of a country with lesser generalized trust.	

Lee, J.-H. & Venkataraman, S. Aspirations, Market Offerings, and the Pursuit of Entrepreneurial Opportunities.			The formation of social norms goes deeply in the mentality of given society, taking into account such variables as historical contest, political and economic system	
Leibenstein, H. Entrepreneurship, Entrepreneurial Training, and X-efficiency Theory				For the growth of (regional) economy, the set of individuals with gap-feeling and input-completing capacities is exogenous and highlighted the importance of their personal characteristics One of the traits of an entrepreneur is creativity as a an ability to recombine existing inputs in a new outcome by that adding value
Licht, A The Entrepreneurial Spirit and What the Law Can Do about It.				Scholars tend to more describe what entrepreneurs do instead of what they are
Linan, F. & Chen, Y.-W. Development and Cross-culture Application of a Specific Instrument to Measure Entrepreneurial Intentions.			The cognitive process from perceptions to intention is essentially similar in different cultures. The relative importance of each antecedent in the configuration of intention may differ, but intentions would always be formed based on the three motivational antecedents. National particularities manifest themselves in the way people apprehend reality and transform it into perceptions toward entrepreneurship.	

Lumpkin G.T., Dess, G.G. Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance.				One of entrepreneurial traits is the need for autonomy as a will and personal capacity to fight for the goals without third force
McGee, J.E., Peterson., M., Mueller, S.L., Sequira, J.M. Entrepreneurial Self-efficacy: Refining the measure.				Nascent entrepreneurs consistently posted higher ratings on the ESE (Entrepreneurial Self-Efficiency) measures. Additionally, a positive relationship between nascent entrepreneurship and ESE was revealed using covariance analysis in the form of confirmatory factor analysis
McGrath, R., Ian MacMillan, I., Yang, E. & Tsai, W. (1992). Does Culture Endure, or is it Malleable?				Special features distinguish entrepreneurs from non-entrepreneurs and can be studied empirically
McMullen, J.S., Bagby, R.D. & Palich, L.E. Economic Freedom and the Motivation to Engage in Entrepreneurial Action.	Government restrictions of economic freedom, appear to impact entrepreneurial activity and the entrepreneur's motive to start such business actions			
Mitchell, J.R., Shepherd, D.A. To thine own self be true: Images of Self, Images of Opportunity, and Entrepreneurial Action.				Both images of self – vulnerability and capability – impact one's images of opportunity

Mueller, S.L. & Thomas, A.S. Culture and Entrepreneurial Potential: A Nine Country Study of Locus of Control and Innovativeness			Some cultures are more conducive for entrepreneurship than others. In individualistic cultures we found an increased likelihood of an internal locus of control orientation. There was also support for the hypothesis that an entrepreneurial orientation, defined as internal locus of control combined with innovativeness, is more likely in individualistic, low uncertainty avoidance cultures than in collectivistic, high uncertainty avoidance cultures.	
Rauch, A. & Frese, M. Psychological Approaches to Entrepreneurial Success. A General Model and an Overview of Findings			Economic environment, national culture, social network etc. influence the tendency to behave entrepreneurially	
Rosenfeld, S. A Over Achievers: Business clusters that work—Prospects for regional development		Business education, incubators, and venture capital that systematically target workers and opportunities within the cluster can be more effective than general programs		
Rotter, J. B. Generalized Expectancies for Internal Versus External Control of Reinforcement				Locus of control as an entrepreneur's trait reflects the ability to be in charge of the situation, highlighting the person's actions to determine its outcome, not the fate, third party or environment

Shane, Sc Cultural Influences on National Rates of Innovation.			Rates of innovation are most closely associated with the cultural value of uncertainty acceptance, but that lack of power distance and individualism also are related to high rates of innovation. This research suggests that nations may differ in their rates of innovation because of the cultural values of their citizens	
Schultz, T.W. The Value of the Ability to Deal with Disequilibria.				Entrepreneurship is an ability to deal with the situation if economic disequilibria
Soiutaris, V., Zerbinati, S. & Al-Laham, A. Do Entrepreneurship Programmes Raise Entrepreneurial Intention of Science and Engineering Students? The Effect of Learning, Inspiration and Resources	Importance of educational programmes for entrepreneurial culture development: the programmes raise some attitudes and the overall entrepreneurial intention and that inspiration (a construct with an emotional element) is the programmes' most influential benefit			
P. Stephan and D. Audretsch, Company-scientist Locational Links: The Case of Biotechnology	.	Specific role played by the scientists shapes the importance of geographic proximity in the firm-scientist link		
Suddle, K., Beugelsdijk, S., Wennekers, S., Entrepreneurial Culture as Determinant of Nascent Entrepreneurship	Entrepreneurial culture affects levels of entrepreneurship, but has no direct effect on economic growth, because the mediating variable entrepreneurship is not related to growth in a linear way			

Uhlaner, L.M., & Thurik, A.R. Postmaterialism Influencing Total Entrepreneurial Activity across Nations.			Significance of postmaterialism (using GEM) in predicting total entrepreneurial activity and more particularly, new business formation rate. The measure for postmaterialism is based upon Inglehart's four-item postmaterialism index. A set of economic, demographic and social factors is included to investigate the independent role postmaterialism plays in predicting entrepreneurial activity levels	
Wennekers S, Thurik R, van Stel A., & Noorderhaven, N. (2007). Uncertainty Avoidance and the Rate of Business Ownership across 21 OECD Countries, 1976–2004				Tolerance for ambiguity as dealing with controversial or incomplete information, willingness to face uncertainty is a distinction feature of an entrepreneur
Wood, R. & Bandura, A. Social Cognitive Theory of Organizational Management.				Self-confidence which is related to self-efficacy) – self-estimation of capabilities to mobilize internal resources and skills when needed is an important trait of anentrepreneur

Annex C. Survey questions used

Question	Type of question	Options	Stakeholder group
Please select the relevant bio cluster.	Single choice		All
Please identify the stakeholder group you represent.	Single choice	Cluster organisations Large companies (>250 employees) SMEs (<250 employees) Financial Institutions Hospitals Policy makers Research Centers Science and Technology Parks Technology Transfer Offices and Incubators Universities Other (please specify)	All
How does your organisation participate in the biocluster?	Single choice	The organisation does not participate in cluster activities. The organisation is engaged in a few collaborations with other cluster members. The organisation is regularly collaborating with several cluster members. The organisation is highly active in the cluster due to a large number of collaborations.	All
What are the main objectives of the cluster?	Multiple	Job creation Create business (create companies / attract new companies) Stimulate growth of existing companies Marketing the regions Develop research capacities/ capabilities Attract venture capitalists	All
What is the *main* focus of activities in the cluster? (please select maximum two items)	Multiple choice	**Research focus :** Basic science research Applied research **Business aspect :** Generating IP Licensing	All

Question	Type of question	Options	Stakeholder group
		Product Development Establishing new companies (e.g. spin-offs) Other (please specify)	
Which of the following factors related to entrepreneurial culture are present in the cluster? Please rate them according to their level of presence (1 – hardly present; 5 – highly present). Please elaborate.	Matrix question Open question	*Options rows* Business competitions Teaching of entrepreneurship and management Role model entrepreneurs (''entrepreneurial spirit'') Other *Options columns:* 1 2 3 4 5	All
How strong is the entrepreneurial culture in your cluster? (1 - very weak; 5 - very strong)?	Single choice	1 2 3 4 5	All
How can entrepreneurial culture in the cluster be stimulated?	Open question		All
Does your organisation feel a sense of belonging to a cluster? Please elaborate.	Single choice, Open question	Yes No	All (except Cluster Organisations and Policy Makers)
What types of collaborations is your organisation engaged in (in the context of the biocluster)? (check all that applies)	Multiple choice	Publications Participation in professional networks and boards Mobility of people (mobility from public knowledge institutes to industry and the other way around) Informal contacts/networks (e.g. alumni societies, networks based on friendship, other boards) Cooperation in R&D (joint R&D projects, sponsoring of research, financing of a PhD student, supervision of a PhD student)	All (except Cluster Organisations and Policy Makers)

Question	Type of question	Options	Stakeholder group
		Sharing of facilities (shared laboratories, common use of machines, common location or building) Cooperation in education (contract education or training, providing scholarships, sponsoring of education, giving information to students, influencing curriculum of university programs) Contract research and advisement IPR (patent applications)	
Please list your main collaboration partners within and outside the cluster (max 10 organisations). Please also indicate the partner type, strength of relationships with each listed partner and type of collaboration.[12]	Partner name: open question Partner type: single choice Relationship strength: single choice Type of collaboration: single choice	Partner type: Academic institution, part of the cluster Company, part of the cluster Academic institution, not part of the cluster Company, not part of the cluster Relationship strength: Weak Medium Strong Type of collaboration: Formal Informal	All (except Cluster Organisations and Policy Makers)
Please indicate which of those partners work together. The matrix will only appear on the screen if you properly answered the previous question.	Matrix		All (except Cluster Organisations and Policy Makers)
What are the top *motivators* for collaboration within your biocluster community? (maximum three options possible)	Multiple choice	Access to additional funding Access to equipment / technological platforms Access to specific knowledge and expertise of collaboration partners Solving internal capacity issues (e.g. HR, space, etc.) Access to markets Access to (standardisation)	All

[12] (1) weak ties (cost-effective search for codifiable information), (2) medium ties, (3) strong ties (exchange of complex information and tacit knowledge).

Question	Type of question	Options	Stakeholder group
		networks Bonding with powerful actors Other (please specify)	
What are the top *enablers* for effective collaboration within your biocluster community? (maximum three options possible)	Multiple choice	Entrepreneurial culture of the cluster Presence of a cluster organisation Presence of top research institutes Availability of governmental funds supporting collaboration Presence of platforms for communication with other cluster members Other (please specify)	All
What are the top *barriers* for effective collaboration within your biocluster community? (maximum three options possible)	Multiple choice	High level of competition among cluster members Lack of local venture capital Culture of risk aversion Cumbersome IP and technology transfer processes Lack of networking events and platforms for communication with other cluster members Regulatory burdens Other There are no barriers for effective collaboration	All
How many large companies (more than 250 employees) are currently present in the cluster? What are their main industrial focuses?	Open question Open question		Cluster organisation
How many SMEs (less than 250 employees) are currently present in the cluster? What are their main industrial focuses?	Open question Open question		Cluster organisation
How many Start-ups /spin-offs (less than 50 employees) are currently present in the cluster? What are their main industrial focuses?	Open question Open question		Cluster organisation
What is average growth rate of Large, SMEs and Start-ups companies on the last 5 years?	Open question		Cluster organisation

Question	Type of question	Options	Stakeholder group
Which are the 'role model' companies[13] currently present in the cluster?	Open question		All
What kind of business trainings are offered to the local workforce within the cluster ? (check all that applies)	Multiple choice	Business development skills IP management Financial skills Communication skills Human Resources skills Other (please specify)	All
Who provides these training programmes? (check all that applies)	Multiple choice	Employing organisations (internal programmes) Cluster organisation Other (please specify)	All
Please rate the impact of those trainings on business development in the cluster.	Multiple choice	High Medium Low	All
Please rate the level of availability of the following aspects relevant to the development of the workforce within the cluster.	Matrix question	*Row options*: Attractiveness of the location Attractiveness of the organisation Attractive wages Legal job security Incentive systems (e.g. tax incentives) Career development opportunities Training & Education Recruitment support Other (please specify) *Column options*: Low Medium High	All
On a scale of 1 (low) to 5 (high), please rate the availability of the following types of funds in the cluster.	Matrix	*Row options:* Availability of seed capital Availability of venture capital Availability of governmental funds Availability of grants from foundations Availability of loans/borrowings	All

[13] Companies that serve as models in a particular entrepreneurial role (e.g. related to R&D, marketing, production, collaboration) for other companies to emulate.

Question	Type of question	Options	Stakeholder group
		Column options: 1 2 3 4 5	
Which *three* of these types of funds are most important for the development of the cluster? Please rank them according to their level of importance (1 – most important from the top 3; 3 – least important from the top 3).	Matrix	Availability of seed capital Availability of venture capital Availability of governmental funds Availability of grants from foundations Availability of loans/borrowings	All
What are the main barriers for obtaining financing in the cluster?	Open question		All
How can venture capital investments be attracted to the cluster?	Open question		All
On a scale of 1 (low) to 5 (high), please rate the availability of the following services and infrastructures in the cluster.	Matrix	*Row options:* Incubators and science parks that cater for biotechnology companies Transport infrastructure (e.g. roads, proximity to airport) Communication platforms (e.g. round tables) Group purchasing policies Business advisors Financial advisors Legal advisors Human Resources and recruitment advisors Property advisors Marketing support Mutualised technological platforms (e.g. scientific equipment) *Column options:* 1 2 3 4 5	All
Please elaborate on specific legislation and regulation that act as *incentives* encouraging cluster development.	Open question		All
Please elaborate on specific legislation and regulation that act as *barriers*	Open question		All

Question	Type of question	Options	Stakeholder group
preventing cluster development.			
Are there any government promotion measures susceptible to be effective in improving cluster development? Please elaborate.	Open question		All
Does the national tax regulation stimulate innovation in the country? Please elaborate.	Open question		All
Does the national law on protection of Intellectual Property stimulate innovation in the country? Please elaborate.	Open question		All
Does the national law on Protection of Intellectual Property stimulate publication or patenting first?	Open question		All
What is your estimation on the average survival rate (%) for spin-off companies in the cluster in the last five years? Please elaborate your answer.	Multiple choices Open question	< 25% 25-50% 50-75% > 75%	Cluster organisation
What are the most critical success factors for your cluster?	Multiple choice	Strong networking culture Strong scientific base Growing company base Strong skill base Availability of specific services and infrastructures Strong industrial base (large companies in specific industries) Strong entrepreneurial culture Availability of funds	All
Please provide any general remarks which you consider to be important.	Open question		All

Annex D. Interview Template

- Does your organisation participate in cluster activities? Does it feel being a part of … Cluster? Why? Is it beneficial to participate?
- What are the goals of the cluster (e.g. job or business creation, growth of existing companies, marketing the region)? Is your organisation aware of them? Do you follow these objectives?
- What is the main focus of activities within … Cluster (research and business activities)? Does your organisation follow the same track?
- Does … Cluster have the reputation to attract key scientists and business specialists? Why do you think so? In your opinion, is the cluster known on national level? On global? How can it be improved if needed?
- How would you assess the level of entrepreneurial culture in the region? Please elaborate on why you think so. How can entrepreneurial culture be improved if needed?
- What is the role of cluster organisation? Which services it is providing? What would you suggest to add? How does it help your organisation and development of cluster as such?
- Are there any barriers for collaboration? How can the situation be improved?
- Please elaborate on specific regulations/laws/governmental strategies influencing the cluster development. How does the national strategy influence particular on your cluster?
- Are you aware of measurements using to assess your cluster performance? What would you personally suggest for evaluating the cluster performance?