TI 2013-193/VIII
Tinbergen Institute Discussion Paper

In Search of Creative Champions in High-Tech Spaces – A Spatial Application of Strategic Performance Management

Karima Kourtit
*Peter Nijkamp**

Faculty of Economics and Business Administration, VU University Amsterdam, Tinbergen Institute, The Netherlands.

* A. Mickiewicz University, Poznan, Poland.

Tinbergen Institute is the graduate school and research institute in economics of Erasmus University Rotterdam, the University of Amsterdam and VU University Amsterdam.

More TI discussion papers can be downloaded at http://www.tinbergen.nl

Tinbergen Institute has two locations:

Tinbergen Institute Amsterdam
Gustav Mahlerplein 117
1082 MS Amsterdam
The Netherlands
Tel.: +31(0)20 525 1600

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Duisenberg school of finance is a collaboration of the Dutch financial sector and universities, with the ambition to support innovative research and offer top quality academic education in core areas of finance.

DSF research papers can be downloaded at: http://www.dsf.nl/

Duisenberg school of finance
Gustav Mahlerplein 117
1082 MS Amsterdam
The Netherlands
Tel.: +31(0)20 525 8579

In Search of Creative Champions in High-Tech Spaces
A Spatial Application of Strategic Performance Management

Karima Kourtit
Department of Spatial Economics
VU University Amsterdam
De Boelelaan 1105
1081 HV Amsterdam, The Netherlands
k.kourtit@vu.nl

Peter Nijkamp
Department of Spatial Economics
VU University Amsterdam
De Boelelaan 1105
1081 HV Amsterdam, The Netherlands
Tinbergen Institute
and A. Mickiewicz University, Poznan, Poland
p.nijkamp@vu.nl

Abstract
The business performance of firms in the creative high-tech sector shows much variation. This paper examines whether the geographical location of such business firms influences the performance of these firms. The overarching analysis framework of this paper emerges from the recently developed Strategic Performance Management (SPM) concept for individual firms, which in the present study is extended with spatial meso-attributes related to the location of these firms. SPM aims to improve the firms' competitive performance through the application of strict internal management principles. Our study thus adopts a micro-business perspective on the organizational determinants of a firm's economic performance and its links with distinct spatial entrepreneurship conditions and general economic moderator variables. The present study focuses on both large and small and medium-sized (SME) firms, mainly operating in the creative high-tech sector in the Netherlands. The research methodology uses stepwise the following analytical tools: multivariate analysis of an extensive micro- and meso-data set on the internal performance of firms and regional covariates; Data Envelopment Analysis (DEA) and its recent extension to super-efficient DEA for mapping out in a comparative way the achievements of both regions and firms; a GIS-oriented statistical analysis to identify geographically-discriminating factors in the firms' performance; and the design and estimation of a Structural Equations Model (SEM) for assessing the performance of the firms concerned (using what is called the '*flying disc'* model). Our results show significant differences in the performance of large vis-à-vis SME firms that have adopted SPM, while their geographical position in the country, in general, also plays a significant role.

Keywords: creative industries, high-tech sector, Data Envelopment Analysis (DEA), super-efficient DEA, principal component analysis, Structural Equations Model, flying disc model

JEL codes: M19, M21, Q5, Q56, R10, R11, R12, R15

1 Aims and Scope

Modern regional development policy finds its origin in both micro-based location theory and meso- or macro-oriented economic growth theory (see, e.g., Capello and Nijkamp, 2009; Kourtit et al., 2011a; Stimson et al., 2011). In recent years, a wealth of new contributions to a better understanding of spatial dynamics has been published. In particular, *regional innovation theory* – in association with spatial endogenous growth theory – and *modern agglomeration theory* – in association with the New Economic Geography – have acquired a prominent place in regional growth analysis (see, e.g., Acs and Armington, 2006; Acs and Varga, 2002; Brakman et al., 2001, Crescenzi and Rodriguez-Pose, 2011; Fujita and Thisse, 2003; Karlsson et al., 2009; Redding, 2010). These frameworks form important conceptual cornerstones of the present study.

Despite many advances in the above mentioned frameworks, it is surprising that recent approaches in the management sciences and business administration literature have hardly been applied in contemporary economic growth research. In particular, business performance analysis – as a solid framework for understanding entrepreneurial learning strategies and developing comparative benchmarking principles – is an underdeveloped part of current regional growth studies. The present paper seeks to fill this gap by offering a coherent blend of three strands of the literature: (i) *neo-innovation theory,* in which economic growth is connected with creative entrepreneurship, in the vein of endogenous growth theory (see, e.g., Acs, 2002; Boschma and Fritsch, 2007; Stough, 1998); (ii) *new spatial-economic network theory,* in which industrial district concepts (à la Marshall) are connected with industrial network and 'filières' concepts, often under the umbrella of New Economic Geography principles (see Capello, 2008; Karlsson et al., 2010; Martin and Ottaviano, 1999); (iii) *extended strategic performance analysis* from the business and management literature, in which internal micro-economic efficiency analysis at the firm level – called Strategic Performance Management (SPM) – is connected with spatial-economic covariates by, inter alia, designing and applying quantitative benchmark analyses that use new variants of comparative Data Envelopment Analysis (DEA) (see Kourtit et al., 2011b).

The primary aim of our study is now to trace *where* (i.e. in which type of region, such as urban, semi-urban, or rural areas) the highest performing firms (known as '*creative champions*') (notably with a high knowledge intensity) in the innovative and creative sector can be found, and why. In our research, a distinction is made between adoption and non-adoption of SPM, in both large firms and small and medium-sized enterprises (SMEs). The empirical work focuses on firms and regions in the Netherlands. Our analysis framework comprises: (i) a super-efficient Data Envelopment Analysis (DEA) of individual firms, so as to identify '*exceptional firms*' that have an extraordinary business performance; (ii) a GIS-oriented analysis of the spatial-economic profile of the regions where these firms are located, using a multivariate analysis of the spatial moderator variables; (iii) the design and estimation of a Structural Equations Model (SEM) in order to provide a comprehensive econometric estimation of the complex champions-regions nexus.

This paper is organized as follows. Section 2 is devoted to a concise and selective overview of the innovation and creative business literature. Next, Section 3 addresses the geography of the competitive performance of firms (including an outline of SPM), and leads to the design and presentation of a conceptual *'flying disc'* model. Then, in Section 4, the database employed and the architecture of our exploratory data analysis are described. Section 5 provides a concise introduction to

super-efficient DEA for discriminating between the performances of '*creative champions*', while the empirical results are provided in Section 6, leading to the identification of '*exceptional firms*'. This information is then further used in Section 7, which presents the results of our operational *'flying disc'* model linking micro- and meso-data, including an interpretation of our findings on firms and regions in the Netherlands. Section 8 contains the description, estimation, and interpretation of the causal effect (or path) model for our spatial SPM analysis, using an integrated SEM. Finally, Section 9 makes some retrospective and prospective observations on our research.

2 Creative Firms in Creative Spaces

The geographical location and spatial clustering of industries – including the spatial distribution of firms over urban, urbanized and rural areas − has received intense attention in recent years. This issue has repeatedly been addressed in the past literature on economic and geographical networks, economic development policy, and business strategies. Dating back to Marshall's concept of industrial districts (Marshall, 1920), agglomeration economies related to market-pull effects and interactive network externalities − as sources of higher and sustained economic growth − have in recent decades been analysed, both conceptually and empirically, by various authors (see, for instance, Capello, 2008; Malmberg and Maskell, 1997; Porter, 1990). A renewed interest has emerged because of the far-reaching influence that localized concentrations of creative economic activity may have on regional and national economies, in particular through creating new businesses and job opportunities, or through an increase in advanced competitiveness, e.g. caused by regional and economic specialization. Such a new geographical force field may induce the development of creative clusters and hubs. Clearly, the current geographical dynamics of industry in a global context means that competition between regions, cities and firms is tending to intensify. The rise in creativity, productivity, R&D intensity, entrepreneurship and sustainability is an important characteristic of an innovative spatial system ('*creative spaces'*). Firms operating in an environment of heterogeneous market development − for instance, through monopolistic competition − aim to outperform others in a diversified spatial product or service system, which prompts the development of such '*creative spaces*' (cities or regions), the achievement of competitive knowledge-driven local or regional economies, and an increase in trade competitiveness, both regionally and globally (see, e.g., Fujita and Thisse, 2002; McCann, 2007, Czarnitzki and Hottenrott, 2008).

It should be added that innovation and entrepreneurship benefits are also related to the level and type of – as well as access to – market information and knowledge exchange within a broader spatial-economic network system. These conditions are often met in the creative sectors and industries, such as high-tech industries, business and financial services sectors operating in knowledge-intensive market segments with high-skilled (high-wage) workers, and specialized cultural industries. The 'new paradigm' of creativity, innovation and entrepreneurship – and the upsurge of scientific research in this domain – is often ascribed to the emerging dominance and perceived international success of the creative sector[1], in connection with successful and promising industrial locations of this business. This

1 It should be noted that the creative sector may have two components: a) specific industrial branches, in particular the arts sector, the media and communication sector, advertising and publishing, architecture, fashion and design, performing arts and the cultural sector; and b) specific parts of all other economic sectors that specialize in the creation of new ideas, concepts or inventions (e.g. dedicated consultancy services, think tanks or R&D divisions of corporate organizations, etc.).

new interest originates mainly from Florida's (2002, 2003) and Scott's (2000) seminal work on the economic importance of the Creative Industries (CIs) in modern cities. Its importance is also illustrated in a study on European countries which shows that, between 1999 and 2003, the growth in value added in the EU GDP from the creative sector was 6.5 per cent for the EU-25 (KEA, 2006). Over the same period, this sector developed at a considerably faster pace than the average growth rate for the European economy as a whole. CIs – and in particular the creative branches with a high knowledge intensity – are increasingly regarded as strategic vehicles to introduce new technological innovations, or as new tools for delivering more innovative products and services. These branches normally reflect a high degree of professional specificity to generate significant added value for the stakeholders and their firms, both economically and spiritually. They are often characterized by rapidly changing design specifications in order to serve increasingly individualistic lifestyles (Scott, 2006). Usually, they also have a high potential to unlock and serve new markets with high levels of macroeconomic uncertainty and a dynamic spatial-economic and flexible business climate. And, finally, they are often found in geographical clusters as part of their new positioning and marketing strategies, while they frequently use a common and fashionable marketing language to reach customers across many borders, especially in the context of creativity, innovation, and sustainable development (see Ioannides, 2010). Admittedly, their business model already dates back to Porter's *Five Forces Model* (1979) and Ansoff's (1957) *Business Growth Theory*.

Especially from a dynamic competence point of view, the local and regional determinants, capabilities and resources – along with advanced infrastructure and other geographical or cluster facilities – are decisive for the relatively strong competitive position of high-tech firms. Meeting these conditions ensures and fosters long-term viability for a creative and innovative business process, including financial-economic viability or survival potential. CIs tend to prefer places that are diverse, tolerant and open to new ideas, and in which regional economic growth is induced, driven by successful geographical or locational choices of others (Grimes and White, 2005).

In conclusion, a wealth of literature suggests that geographical and location-specific facilities, smart resources and market accessibility, tolerance and creativeness, knowledge production and commercialization, and the adoption of a modern business lifestyle (see, e.g., Bögenhold et al., 2001; Romijn and Albu, 2002; Yamoto and Hirose, 2007; Winters, 2011; Glaeser et al., 2010) are important drivers of the performance levels of CIs. This holds in particular for the availability of information and communication technologies and modern and sustainable transport and logistic systems, especially for attracting and retaining these firms and for recruiting talented people in vibrant environments in modern and networked agglomerations.

This summary of the characteristics of the CIs will now be used as a selection mechanism for identifying creative firms in our fieldwork. Rather than mechanically using secondary data provided by statistical offices, we aim to identify − on the basis of primary data on intrinsic firm characteristics − a set of firms in the creative high-tech sector that may qualify as '*creative champions*'. This selection is then further tested through in-depth field interviews. A novel feature of our research is that – as well as an analysis of generally accepted drivers of the locational behaviour of CI firms – the focus is specifically on the use – and the maturity of acceptance – of SPM. This integrative perspective will be further outlined in Section 3.

3 The Geography of Strategic Performance Analysis: the '*Flying Disc*' Model

A strategic performance analysis serves to induce a flexible business response in a rapidly changing, globally competitive economy. Firms have to identify their competitors, and then to develop business and marketing strategies in order to gain competitive advantage, to create unique selling propositions, to react appropriately to competitors, to prevent costly competition, to gain brand loyalty, and to actively market to targeted customer groups. Creative firms in particular must be able to design attractive strategies, and continually provide high-quality innovative goods and services to reach business markets in novel ways and stay ahead of fierce – often global – competition.

The growing importance of geographical markets and external changes in the high-tech industries puts great emphasis on creative entrepreneurship (information and knowledge-based economic activities), and on locational decision making and spatial strategies, for example, moving away from mass production to flexible innovation and specialization ('learning curve effects') (Scott, 1988). This has further intensified and supported the need for efficient and effective management techniques for executing innovative business strategies and enhanced performance (Millett, 1998; Haas and Kleingeld, 1999; Norreklit, 2000; Zeng and Zhao, 2005; Teece et al., 1997). This new management literature has also emphasized the geographical aspects of segmented industrial markets or *'meso-segments'* (an important element of spatial market planning), which encourages businesses to stay competitive and profitable. The currently most popular management tool in modern business practice is Strategic Performance Management (SPM) (Davis and Albright, 2004).

SPM can be understood as a "business supporting process where steering of the organization takes place through the systematic definition of mission, strategy and objectives of the organization, making these measurable through critical success factors and key performance indicators, in order to be able to take corrective actions to keep the organization on track" (de Waal, 2007). SPM is thus a tool for assessing business creativity, in order to: address continuously changing business environments; develop systematic strategic tools that improve the organization's capability to cope with continuous competitiveness; and ensure a permanent innovative business attitude among managers. SPM requires firms to understand not only the '*what*' and '*how*' issues, but also the '*where*' question, in order to advance strategy, policy formation, business execution and, in turn, accountability. The locational and spatial market dimension is of critical importance in any business process and decision making. It provides spatial information and knowledge from outside the firm about (scarce) capital resources and trends in a changing spatial business environment (Covey, 2003; Kourtit et al., 2011b). It is a process that starts with understanding where business performance is today (positioning), which direction it should take (strategic planning), what targets should be set, and how (internal and external) resources should be allocated to achieve relevant business targets. SPM can help firms to channel and mobilize geographical resources towards their most important strategic objectives, in order to achieve the desired goals related to their strategic vision, and, in addition, it may encourage businesses to stay competitive and profitable.

From the rich SPM literature, it appears that this concept offers useful opportunities not only for managing human capital but also for acquiring a sustainable competitive advantage by creating an environment that fosters entrepreneurship. This, coupled with the adoption of the geographical

concentration of relevant economic activities or business operations, provides a new key way to boost growth, and strengthen the competitive position of firms, or, if necessary, to cooperate. This is empirically confirmed in a recent study by de Waal et al. (2009), who find that firms that have a completely implemented an SPM system[2] (also referred to as '*creative champions'*) are becoming more competitive than firms that are still in the process of considering such a system. Furthermore, firms that have not yet – but almost − completed the implementation of an SPM system are also gaining qualitative benefits, but lower financial revenues.

An important question is now: How does the SPM framework – addressing the internal management strategies of the firm – relate to the region concerned? The spatial analysis of business location is traditionally analysed within a regional-economic framework, which emphasizes the role of specific competitive advantages that a certain geographical location may offer to a wide variety of industries. Classical studies of Ross (1896), Marshall (1920) and Weber (1929) (based on neoclassical location-production models) have laid the foundations for evaluating the competitive advantage of firms or even entire industries by identifying and developing a set of critical location factors (e.g. labour, suppliers, transport), based upon least cost solutions. More recently, the work of Porter (1998a,b), which builds essentially on Ricardo's theory of comparative cost advantage, provides a practical, strategic framework by highlighting patterns of business location attractiveness and the values of an industry structure or economic activity that yield additional benefits to maximize productivity and profitability. Against this background, SPM is a strategic internal tool to reinforce the firm's position in the external (e.g. regional) world.

The previous analysis suggests clearly that a geographical concentration or agglomeration of firms engaged in similar or related activities tends to enhance competitiveness. This has prompted the development of various business advantages (external economies), such as a large pool of specialized workers; suppliers of materials and specialized services; easy access to suppliers of specialized inputs and services; the quick dissemination and building of a multifaceted community by sharing new resources, knowledge, and experience; and the ability to harness local intelligence to meet many challenges (see also Arikan and Schilling, 2011; Karaev et al., 2007; de Leeuw and van den Berg, 2010; McCann and Folta, 2011; van Oort, 2004).

There is an extensive recent literature on the critical importance of various types of capital for regional growth and efficiency, sometimes combined in the umbrella notion of 'territorial capital' (see Capello et al., 2011)

An integrative synthesis of the literature review in Sections 2 and 3 allows us to highlight in a comprehensive way the particular importance of three distinct classes of external (regional) critical success factors ('drivers') for a competitive spatial performance of CI firms, viz.:

- *Regional Growth Resources,* which comprise, inter alia, talents, skills and innovative entrepreneurial attitudes.
- *Regional Community Resources,* which refer mainly to mutual trust in society and 'smart citizenship'.

[2] A 'completely implemented' SPM means that there is a fully operational system in place that contains critical success factor and key performance indicator data of the firm, which is used on a regular basis to monitor, discuss, and manage business performance related issues (de Waal et al., 2009), at a detailed spatial level. In this context, maturity is defined as a measure of the level of strategic performance development (or sophistication) of a strategic business process.

- *Regional Attraction Resources,* which concern pull factors such as infrastructure, suprastructure and cultural amenities.

The above three drivers are essentially latent constructs that cannot be directly measured in quantitative terms. They may be further subdivided into distinct categories of explanatory production factors that may be appropriate for empirical measurement in the applied part of our research (for a similar type of approach, see Jones and Romer, 2010). This hierarchical decomposition is based on the three above-mentioned classes of resources derived from the previous literature overview, and uses the following systematic typology of regional input or capital factors for each of the three resources concerned:

- *Regional Growth Resources* (***Reg Growth Res***) contains three capital factors, namely:
  - *Creative Capital (**Crea Cap**)*: consists of measurable variables such as numbers of creative professionals and talents in creative sectors, meeting points for professionals, innovative entrepreneurial climate, or multicultural neighbourhoods, which are primarily responsible for urban innovations, sustainable socio-economic growth, and the transformation of regions and cities.
  - *Human Capital (**Hum Cap**)*: contains competences, social and personality attributes such as the economically active population, skilled labour force, per capita GDP, rise in knowledge intensity, share of higher wages, or level of educational attainment. All these may be considered as important inputs that facilitate spillovers and the rise in knowledge necessary for productivity, innovation and economic growth, and may lead to a new focus on the role of learning and skills in the local innovation economy.
  - *Economic Capital (**Econ Cap**)*: consists of standard capital variables that include financial credit markets and support businesses, domestic price indices, unemployment rates, foreign direct investments, innovative entrepreneurial business climate, or R&D expenditures (both private and public); these variables are typically instrumental for a higher level of sustainability and innovation that creates local wealth and generate economic prosperity.
- *Regional Community Resources* (***Reg Comm Res***) refers to two capital factors, namely:
  - *Social Capital (**Soc Cap**)*: contains social network conditions such as social and informal linkages (e.g. participation in − and membership of − business or sport clubs, etc.), civil engagement, enforceability of societal contracts, quality and quantity of social interactions within communities, participation in policymaking, religiosity, presence of health centres, and quality-of-life neighbourhoods; these may improve the quality of society's collective welfare and transfer its human capital into greater socio-economic prosperity which facilitates sustainability.
  - *Knowledge Capital (**Know Cap**)*: includes valuable resources such as higher education institutions, share of knowledge workers in the total working population, rise in scientific and artistic activity, knowledge creation in terms of patent applications, or R&D expenditures in higher education; all these ensure that the regional economy benefits from the related knowledge spillovers together with sharing and developing

new knowledge, and improving or promoting innovations in regions which generate economic wealth and achieve competitive advantages.

- *Regional Attraction Resources* (***Reg Attrac Res***) is composed of three factors, namely:
  - *Connectivity Capital (**Conn Cap**)*: is composed of variables such as mass transit facilities, airports, highways, ports, mobility of population and workforce, length of roads, motorways and rail tracks, number of telephone mainlines, or electricity generation capacity; such infrastructural provisions have positive effects on the production and consumption side of the economy. This factor demonstrates how the interdependent aspects of various (formal and informal) networks that comprise various regional attraction resources result in the emergent socio-economic performance patterns of regions and cities.
  - *Technological Capital (**Tech Cap**)*: contains ICT resources such as telecommunications access and use of digital government sources; this increasingly means access to global relationships and (informal and formal) networks, as they highlight economies of scale.
  - *Cultural Capital (**Cult Cap**)*: refers to non-financial social assets linked to the arts and culture in a way that combines a wide range of amenities, such as public provision for the arts and culture, cultural and creative activities, cultural participation, number of visits to cultural and recreation services (museums, art galleries, theatres, cinemas, sports events), or cultural support systems.

These eight types of capital resources – decomposed from the three original classes of resources – call for their more evidence-based empirical measurement on the basis of an extensive data base. The empirical assessment of the impact of these input or capital resources on the performance of the business sector (***BPF***) will be discussed in Section 4 of the present paper.

As well as the external forces, the business performance and the rise of firms' productivity in the CI sectors are also determined by internal SPM strategies aimed at enhancing in particular three business output objectives: (i) the profitability goals of firms (***Prof***); (ii) the quality of products or services offered (***Qual***); and (iii) the commitment of firms in realizing their business objectives (***Busc***). Thus, ***BPF*** can be decomposed into ***Prof, Qual,*** and ***Busc***. The specific choice and definition of these three output-oriented categories emerges from a multivariate analysis of a set of relevant variables representing the most relevant components of SPM strategies of the sample of individual firms investigated in our study, and will be further justified in Section 4 as well.

The integration of the external regional drivers of the business performance of individual firms with the internal SPM strategy indicators leads essentially to a complex multilevel conceptual model. The merger of the internal-external force field (input and outputs) of the CI firms' performance levels can now systematically be incorporated in a stylized dynamic cause-effect framework, which we call the '*flying disc*' model (see Figure 1).

This '*flying disc*' model connects micro-data on firms with meso-data on regional covariates and clearly has a multilevel structure. Multilevel models are based on a hierarchical organization in which units at one level are grouped within units at the next higher level (Gelman and Hill, 2007; Goldstein, 1987, 2003). Such a hierarchical decomposition offers an appropriate model design in multidimensional social science research, and has found extensive applications in many domains

(see e.g., Bliese, 2009; Corrado and Fingleton, 2012; Islam et al., 2006; Klein and Kozlouski, 2000; Snijders and Bosker, 1999).

The *'flying disc'* model serves as a strategic navigation instrument that maps out main directions in a comprehensive micro-meso framework, which includes an integrated set of essential locational factors (inputs) in core geographical zones, as well as linkages that determine a firm's micro-business performance (outputs). This framework is a tool to evaluate and rank the comprehensive performance of firms in the creative sector, provided that detailed assessments of geographical and urban determinants are available. These determinants are at the core of the *'flying disc'* model that encompasses prominent input factors which are of decisive importance for the firm's performance (output).

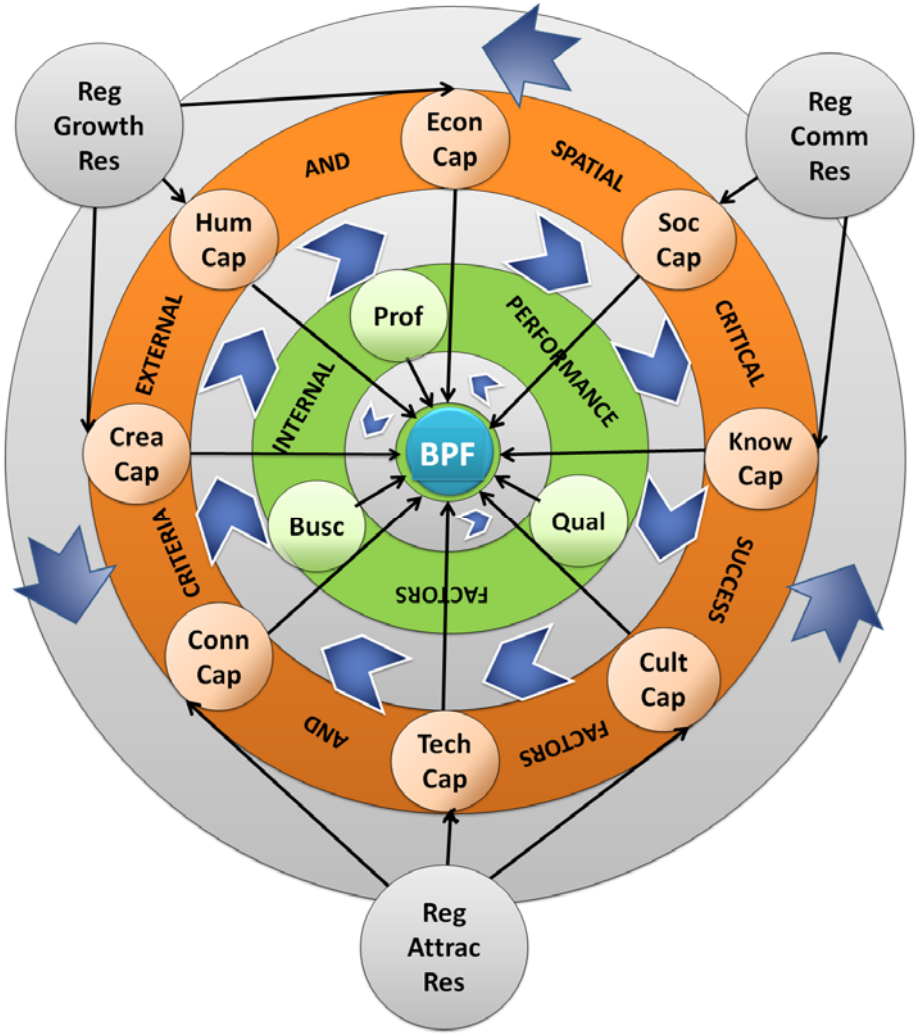

Figure 1. Architecture of the *'flying disc'* model of firms' business performance in geographical space

The *'flying disc'* framework raises intriguing issues concerning the role of contextual factors, the urban and regional climate, and the cultural 'milieu', as referred to by Florida and others (see also Landry, 2000; Roberts, 2006). Their presence may create critical conditions for the attractiveness of a city, a favourable concentration of geographical space (clusters), and a sound basis for locational

decisions (of talented individuals, business firms, or investors), as well as for business success in a competitive economic system traditionally driven by profit motives. The concept of spatial proximity (based on the concepts of industrial districts à la Marshall (1920) and external economies (Krugman, 1991)) may generate new benefits in terms of efficiency and competitiveness for firms. Furthermore, such a spatial concentration may positively influence the firm's (business) performance which, in turn, may bring about positive socio-economic achievements which may enhance cities' and regions' competitive advantages (Martin et al., 2008). In other words, agglomeration economies do not directly foster regional economic growth, but do so indirectly, through their effect on firm performance. In this way, regions and cities use their indigenous resources and offer unique geographical and locational conditions and facilities – beyond other competitive assets – to attract talent and firms to relatively deprived regions in order to generate positive externalities. In other words, agglomeration economies may lift a firm to achieve an exceptional performance by facilitating it with competitive advantages to outperform other firms in competitive markets, as compared with the same firms or sectors in different regions (Passemard and Kleiner, 2000). Since most innovative firms are operating under conditions of complexity, acceleration, and continuous change, the implementation of promising strategic decisions and the integration of locational and logistic decisions into their daily corporate strategy are extremely important for their strategic planning.

The *'flying disc'* picture shows how macro- and meso-determinants (regional, general) have an impact on the individual firm's performance. This calls for extensive data at both firm and regional levels. Before focusing on the statistical-econometric aspects of the *'flying disc'* model, we first pay attention to the database used in our study, as well as to a novel framework for assessing business performance based on super-efficient Data Envelopment Analysis (DEA), with which we are able to determine the relative achievement of the business firms under investigation.

4 Database on Regions and Firms

Our empirical research seeks to explore in particular to what extent a firm's location (including both the spatial profile of its business activity and more general entrepreneurship conditions and economic moderator variables) influences the firm's performance (see our *'flying disc'* framework). Thus, the performance of a firm is determined not only by its internal decisions, but also by the geographical and local business environment of that firm.

In our empirical application, we make use of a large, original macro/meso- and micro-scale data set in the Netherlands. The macro-meso-set contains approx. 400 different spatial socio-economic data collected at the level of Dutch municipalities and regions. These data are quantitative measurements of the relevant aspects of the eight regional capital categories described in Figure 1. Each of these eight categories thus comprises various relevant data related to each of the categories (see Section 3). These variables – individually and in combination – are assumed to act as drivers of the business performance of firms in the municipality or region concerned. Not all data, however, were available at the same geographical level in the Netherlands, so that we were forced to aggregate consistently all available data from different geographical scales into what is called the COROP level (which contains 40 Dutch regions) by using GIS interface methods. These COROP regions cover the entire country and correspond to the standard EU NUTS-3 level (for details, see the map presented in

Figure 2). The meso-spatial data (both municipal and regional) used in our study were provided, inter alia, by Statistics Netherlands (CBS). Our final database contained detailed information about geographical and regional socio-economic indicators regarding the location characteristics and meso-environmental factors of the 40 Dutch COROP regions (2008).

The system of COROP regions can be used for different spatial zoning analyses in the country depending on the classification concerned (for an illustration, see also Figure 10). A first classification of these regions is according to their degree of *centrality*: the *Randstad Core Region* (the highly-connected and densely-populated Western part of the Netherlands); the *Intermediate Zone* (a semi-circle of semi-urban areas); and the *Periphery* (a set of less connected, more low-density and isolated areas). Another classification − consistent with the previous one – is into *urbanization* levels, with a distinction of the COROP regions into 5 grades of urbanization (ranging from very urbanized regions – with more than 2,500 addresses per square kilometre – to non-urbanized areas – with less than 500 addresses per square kilometre). Both spatial demarcations will be used in our case study.

Figure 2: Map of the 40 COROP regions in the Netherlands
Source: http://en.wikipedia.org/wiki/COROP

Besides the spatial data at a regional scale, we also obtained detailed micro-information about a multiplicity of relevant business characteristics − based on the SPM methodology − of a large set of individual firms in the creative high-tech sector in the Netherlands, in all of which SPM played a role. The choice of these firms deserves some clarification. The first selection mechanism for these firms was partly based on information from Dutch industrial branch organizations on the management profile of high-tech and knowledge intensive firms, and partly on previous expert contacts established

with them, so that easy access was facilitated. In the selection of firms, we aimed for a reasonable degree of representativeness of firms over various regions. The final set of participating companies, all from the private sector, was next selected on the basis of two distinct criteria: namely, whether they operated in the creative industry[3], and were familiar with, or had implemented and used, SPM measurement systems. The individual firm data are related to both output and input (quantitative and qualitative) performance characteristics, as well as to the motivational and driving forces that are decisive for turning the firm into a high-performance firm, a *'creative champion'*, in each part of its business operation. In order to identify the opportunities and barriers associated with the business performance of these firms in the Netherlands, extensive personal interviews were organized (typically conducted face-to-face) with important executives and firm officials (e.g. chairman of the board, HRM director, region manager, cluster manager, division COO, CFO, operations manager, network senior vice-president, research vice-president). On average, four such key officers in each firm were interviewed. For practical reasons it was rather hard to conduct full-scale interviews with more than 240 persons. But the wealth of in-depth insights from such interviews appeared to be far higher than could be obtained with the use of secondary data. Thus, our data set is based on an in-depth survey questionnaire in our search for such *'creative champions'*.

In the interview rounds, a systematic format was followed. As a prior broad literature search did not create a solid basis for a satisfactory and validated questionnaire which would enable us to obtain verified and systematically-structured information from the managers in these firms on their critical success factors, a self-composed 'statement questionnaire' was used[4]. First, very detailed performance statements in the questionnaire were identified from the broad literature available (indicators were converted into statements and presented to the interviewees), and these were then formulated so that the interviewees could give them a rating on a 5-point Likert scale, varying from '1= *not at all*' (i.e. 'we did not experience any SPM (quantitative and qualitative) advantage at all') to '5 = *very strong*' (i.e. 'we experienced the SPM (quantitative and qualitative) advantage very strongly'). The interviewees were also asked if they had experienced other clear disadvantages from the implementation and use of the SPM measurement system in their organization (for details, see also Kourtit and Nijkamp et al., 2011b).

It should be noted that this type of research – which is rather common in business administration and industrial organization, but less in regional science – is based much more on in-depth case study investigations from which categorical information has to be translated into standardized data, for instance, a Likert scale. It should be noted that the number of firms that have introduced a mature SPM system is not excessively large, and hence the sample is by definition limited in size. Clearly, the collection of 240 information files was a major effort requiring many person-months of skilled work. As a consequence, in this type of face-to-face research the number of interviewees can never be very large, for obvious reasons. This may, of course, prompt a discussion on the representativeness of the

[3] Creative industries in our study refer to a range of selected economic activities in the sectors of advertising, architecture, arts, culture tourism services, design, fashion, film, R&D, high-tech, games, and media.

[4] The questionnaire was first tested at a company level, after which some adjustments were made in the formulation of several questions. As mentioned, a total of 240 representative people (organizational staff members, key functionaries) of 60 creative business firms (19 large firms and 41 SMEs) were interviewed. The interview reports were sent to the interviewees for confirmation of their responses. After the interviewees had approved the interview reports, the answers given were averaged for each company so as to obtain a representative robust picture.

findings. But it should be noted that in advanced case study research a good stopping rule is reached when the marginal new information content of any additional interviewer is rapidly declining (see Yin, 2003). And this also formed the basis for deciding on the size of the sample. Ultimately, a sample size of 240 interviews on 60 firms turned out to be satisfactory.

The precise geographical coordinates of these firms were, of course, known. And therefore, it was possible to assign the location of each individual firm unambiguously to the local or regional level employed in our study. Next, a spatial GIS-oriented statistical analysis was applied to integrate the variety of original micro- and meso-scale data formats to uncover geographically-discriminating factors in the firms' performance. In order to avoid the collection and use of an overwhelming amount of unstructured micro- and meso-scale data, and to obtain a better insight into the achievements of the Dutch firms in the period considered, as well as to get a systematic idea about the most crucial characteristics of the different regions and firms in our subsequent statistical analysis, the long list of indicators was systematized and summarized by means of a Principal Component Analysis (PCA). This was done in two steps, namely for both the input and the output (performance) variables.

The first step was based on a multivariate analysis of the wealth of regional meso-input indicators and variables that altogether made up the eight classes of capital mentioned in Section 3 (see the '*flying disc'* model). Each type of capital was described by a collection of relevant indicators (ranging typically from 20 to 40 in number). Next, a PCA was applied to each of these eight multivariate constructs so as to identify the most characteristic orthogonal components for each of these eight input categories. Typically, for each of these eight capital classes, we extracted the two most important components from the PCA, so that altogether our multiregional data set on the regional input indicators for the SPM of individual firms was reduced to 16 independent indicators.

The next step was to collect and digest the detailed SPM micro-information on performance data obtained from the interviews with all firms under consideration. Altogether, for each firm 26 appropriate covariates were selected and used that may be seen as representative indicators which map out the constituents of the firm's business performance (***BPF***). In this case, again a PCA was applied. An analysis of these results led − as already mentioned in Section 3 − to the identification of three prominent factors, called Profitability Goals (***Prof***), Quality Orientation (***Qual***), and Business Commitment (***Busc***).

The integration of the transformed spatial meso-data and the transformed micro-data led to a new structured analysis framework, which was next used for two subsequent stages of the research: (i) an exploratory comparative DEA benchmark analysis of the differences in business performance of firms (in search of *'creative champions'*); and (ii) an explanatory analysis based on Structural Equations Modelling in order to trace the regional drivers in the performance analysis of individual firms. The multilevel operational structure of the resulting measurement model is presented in Figure 3. As explained earlier, the foundation of this figure is formed by the conceptual '*flying disc*' model (Figure 1). Figure 3 offers more detail on the methodology employed in our research. This figure combines the input variables (comprising the determining socio-economic and contextual covariates) with the output variables (comprising the business performance results). It thus forms an operational analytical framework for the assessment of the firms' performance using DEA, while correcting for the impact of regional moderator variables. Clearly, Figure 3 contains our '*flying disc'* model as a basic subsystem.

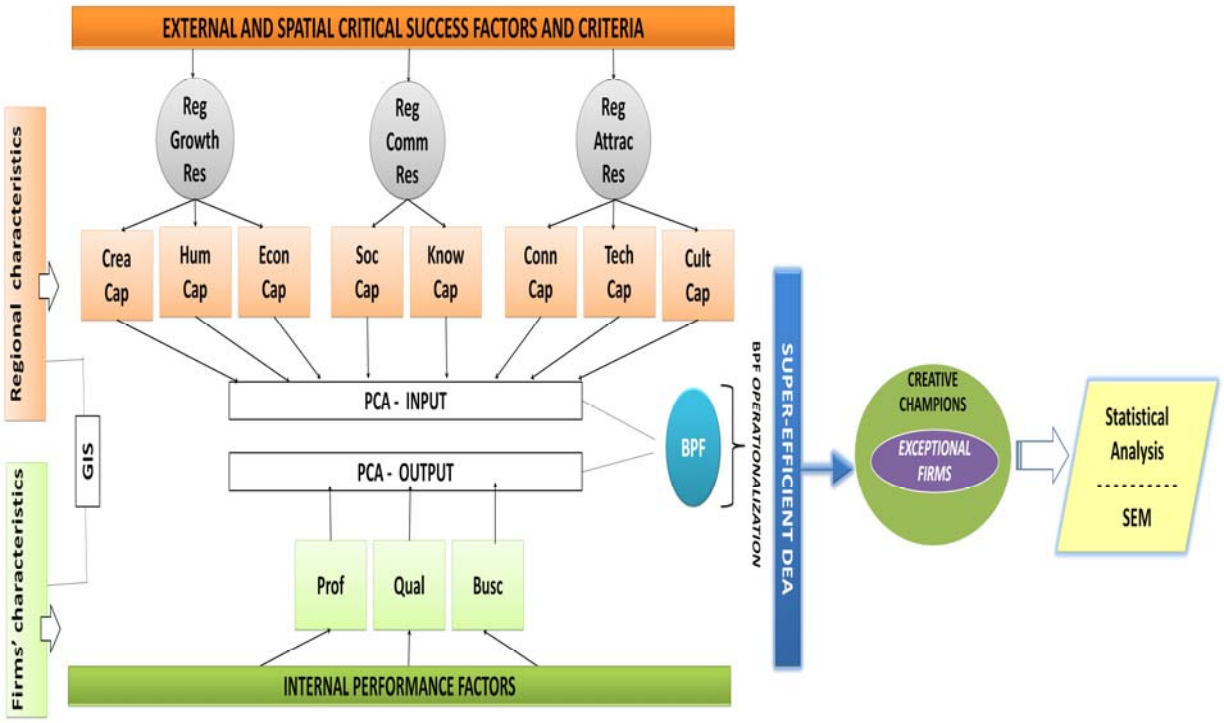

Figure 3: Architecture of the measurement model on 'exceptional firms'

5 DEA Benchmark Analysis of Creative Champions[5]

We now analyse the business performance of our sample of Dutch firms. As mentioned, we employ DEA to judge the efficiency (or relative performance levels) of the firms concerned, in our search of *'creative champions'*. This comparative analysis of the efficiency of organizations ('benchmarking') takes place through a study of inputs (including geographical and locational variables) in relation to outputs (including business performance results).

DEA has become an important analytical tool for the quantitative assessment of the performance or efficiency of organizations, and has had many applications in both the private and the public sector. The applications serve mainly to enable a comparative investigation of the efficiency – in terms of the ratio of output to input – of decision-making units (DMUs). DEA has quite a long history, mainly dating back to the seminal article of Charnes, Cooper and Rhodes (1978), and is therefore often referred to as a CCR analysis. The main idea is to determine the quantitative distance between the input position of a given DMU and the production possibility frontier (i.e. the efficiency frontier) formed by the input profiles of all DMUs under consideration. If the DMU concerned is located on this frontier, its efficiency is 1; otherwise, it falls in between 0 and 1. This standard DEA approach, based on input efficiency, is usually called the CCR-I model. Clearly, one may also analyse the output efficiency, which is just a complementary operation. In the CCR-I model, a DMU may become more efficient by reducing its inputs for a given output vector (or, alternatively, by increasing its outputs for a given input vector). It is clear that DEA has a close resemblance to multi-objective

[5] The authors wish to thank Soushi Suzuki for his great help in carrying out the various DEA calculations.

programming (see Golany, 1988). How this improvement of efficiency may be achieved depends on the distance function between the input profile of a given DMU and the efficiency frontier. In addition to a standard radial distance function in the CCR-I model, alternative distance functions have also been proposed in the literature, viz. a context-dependent (or stepwise improvement) distance model (see Seiford and Zhu, 2003), a distance friction minimization model (see Suzuki et al., 2010, 2011), or a mix of both approaches (see Suzuki and Nijkamp, 2011).

DEA has seen a great diversity of applications to the performance assessment of both private and public organizations. A review of DEA applications by Seiford in 2005 already mentions more than 2800 applications. In addition to determenatic also stochastic DEA models have been developed. DEA has also been applied several times in regional performance studies (see, e.g., Afonso and Fernandez, 2006; Athanassopoulos and Karkazis, 1997; Halkos and Tzeremes, 2010; Kourtit et al., 2011c; Macmillan, 1986; Maudos et al., 2000; Suzuki et al., 2010, 2011; Zhu, 2001). For a more recent interesting contribution on a joint use of DEA and an SPM approach we refer to Medina-Borja et al. (2007). In our study on the relative business performance of firms in the Netherlands, we extend the conventional DEA approach to create a new version, which is briefly explained here. In standard DEA models, high performers all have a unit efficiency-score, so that it is hard to discriminate between them. Adler et al. (2002) have provided an overview of various ranking methods for identifying unambiguously high performers (i.e. to identify '*exceptional firms'*, viz. super-efficiency analysis, benchmarking, multivariate statistical analysis, proportional measurement of inefficiency, preference elicitation, and cross-efficiency analysis). In our approach, we use a super-efficient DEA, as this method involves a minimum of additional assumptions to generate unambiguous results. A super-efficient DEA uses the multi-objective linear programming nature of DEA. It is based on the elimination of a given DMU from a dual linear programming system and a subsequent assessment of its consequences in the efficiency set.

Super-efficiency aims to address the limitation that in most DEAs a set of multiple, equally high-ranking efficient DMUs is found (each with an efficiency score of 1). And this prompts the question whether it is possible to identify among this class of high-performing DMUs (i.e. *'creative champions'*) the most successful DMUs, known as 'super-efficient DMUs', or, in our case, the '*exceptional firms'*. Hence, there is a need for a more sophisticated analysis based on the concept of super-efficiency. The super-efficiency notion seeks to arrive at a complete ranking in terms of amended efficiency rates for all firms (meaning a differentiation among efficient firms with an initial score of 1). It successively eliminates (one by one) each firm from the efficiency frontier, and then measures the new distance from that firm to the adjusted production possibility frontier. If the distance is small, then the super-efficiency is also small, and vice versa. A good exposition on super-efficiency can be found in Anderson and Petersen (1993), who have laid the basis for super-efficiency analysis in order to get a complete ranking of all efficient DMUs. This approach was subsequently remodelled by Tone (2000, 2002) into a slacks-based model. The efficiency scores from their super-efficiency model are then obtained by successively eliminating the data on the DMU to be evaluated from the solution set. For the input model this can result in efficiency scores which may be interpreted − according to the DMU position – as a numerical rating of super-efficient DMUs. Such values are then used to rank all efficient DMUs; this operation may then lead to efficiency scores above 1. The super-efficiency model is therefore suitable to find unambiguously the highest performing DMUs, i.e. those having a

score above 1. In the remaining part of our study, these firms are called '*exceptional firms'*. These are the targets of our empirical analysis.

6 DEA Results on Creative Champions

6.1 Results from a standard DEA model

In this section we present the results from the DEA analysis applied to the data set with the above mentioned eight inputs of both a regional and firm-intrinsic nature (***Crea Cap***, ***Hum Cap***, ***Econ Cap***, ***Soc Cap***, ***Know Cap***, ***Conn Cap***, ***Tech Cap,*** *and* ***Cult Cap***) and three outputs (***Prof***, ***Qual,*** and ***Busc***) for the DMUs under consideration. The DEA thus provides a measure of the relative performance of each DMU, using the highest performing DMU as a benchmark. By employing the 2008 Dutch CBS input database and individual performance information on firms as output variables, our DEA approach is able to classify efficient and inefficient firms (by identifying the maximum business performance (output) using a minimum input), followed by a sensitivity analysis to rank firms according to the robustness of the efficiency classifications. The efficiency evaluation results from our sample of Dutch firms − large and SMEs − based on the standard CCR-I model are given in Figures 4 and 5, respectively.

Figures 4 and 5 show a stability in the relative efficiency levels and scores of the business performance of both large and SME firms in 2008. A closer geographical analysis of the first group of '*large firms'* (see Figure 4) brings to light that the efficient DMUs (with a score of 1), i.e. the *'creative champions'* among large Dutch firms, are mainly located in the Western part of the Netherlands, namely, the Randstad. A further examination of these *'creative champions'* shows that most of them have a complete and mature SPM system. They use a relatively small amount of inputs (i.e. the resources ***Crea Cap***, ***Hum Cap***, ***Econ Cap***, ***Soc Cap***, ***Know Cap***, ***Conn Cap***, ***Tech Cap,*** and ***Cult Cap***); nonetheless, these firms appear to provide a relatively large amount of outputs (i.e. quantitative and qualitative benefits ***Prof***, ***Qual,*** and ***Busc***) compared with firms that have a low (inefficiency) score, which are more often located in the Intermediate Zone of the country.

For the second group of firms, the SMEs, the results also show that the majority may be seen as *'creative champions'* among Dutch SMEs, as they achieved many efficiency scores of 1. Furthermore, these efficient firms have largely introduced and adopted a complete SPM system. These firms appear to be in particular located in the Intermediate Zone of the Netherlands.

In general, we can conclude that the overall efficiency level of large and SME firms shows a stable pattern. There is apparently little variation in the efficiency performance of Dutch firms according to the CCR-I model. Clearly, the majority of these firms can be identified as *'creative champions'*, with most of them having a relatively complete SPM system (see also Table 1).

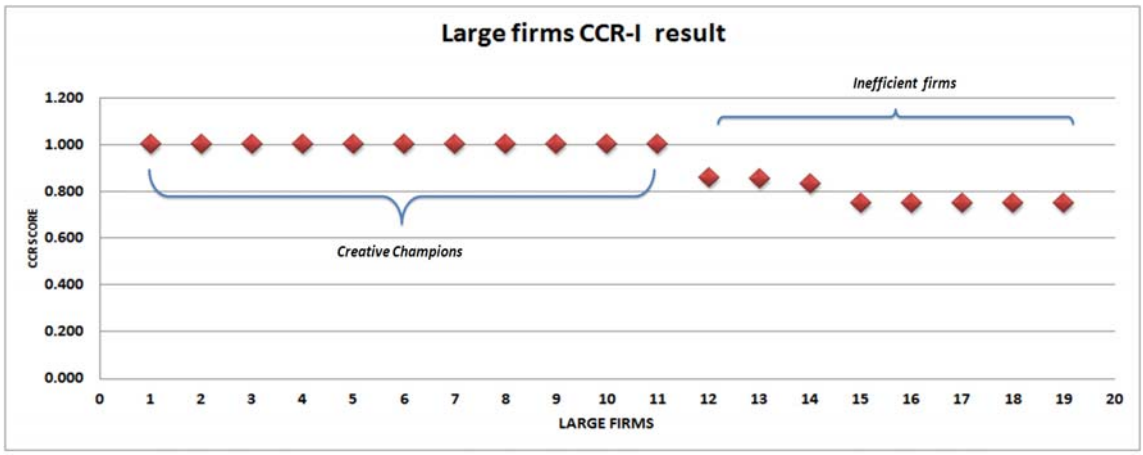

Figure 4. Standard DEA (CCR-I) score of large firms (2008)

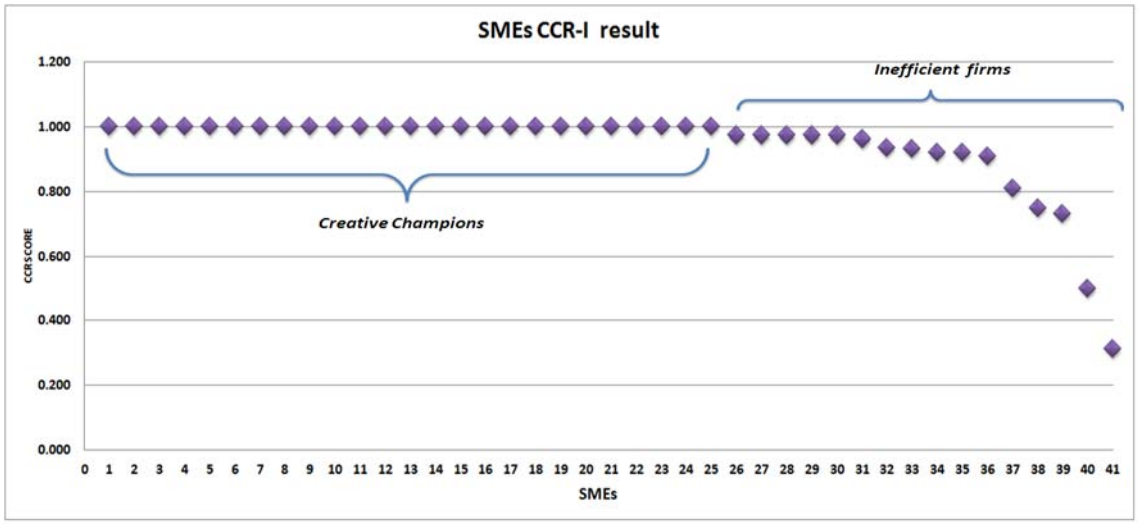

Figure 5. Standard DEA (CCR-I) score of SMEs (2008)

6.2 Super-efficient DEA results: identification of *'exceptional firms'*

An intriguing question in DEA is: Are all firms equal when their efficiency rate equals 1? Therefore, we now present the super-efficient DEA results obtained by a ranking of efficient DMUs, so that we are able to identify from the class of efficient DMUs firms (i.e. *'creative champions'*) a subset of firms that have a super-efficient score higher than 1 (i.e. *'exceptional firms'*).

Consistent with the ranking of the super-efficiency values, Figure 6 shows that a significant share of the class of *'creative champions'* have a super-efficiency score above 1, mostly with a complete SPM system. This super-efficient class contains the business firms which we call '*exceptional firms'*. The ranking of the super-efficiency values for SMEs in Figure 7 shows that a considerable proportion of the *'creative champions'* among SMEs may be identified as '*exceptional firms'*, as they have a super-efficiency score higher than 1, with a complete SPM system.

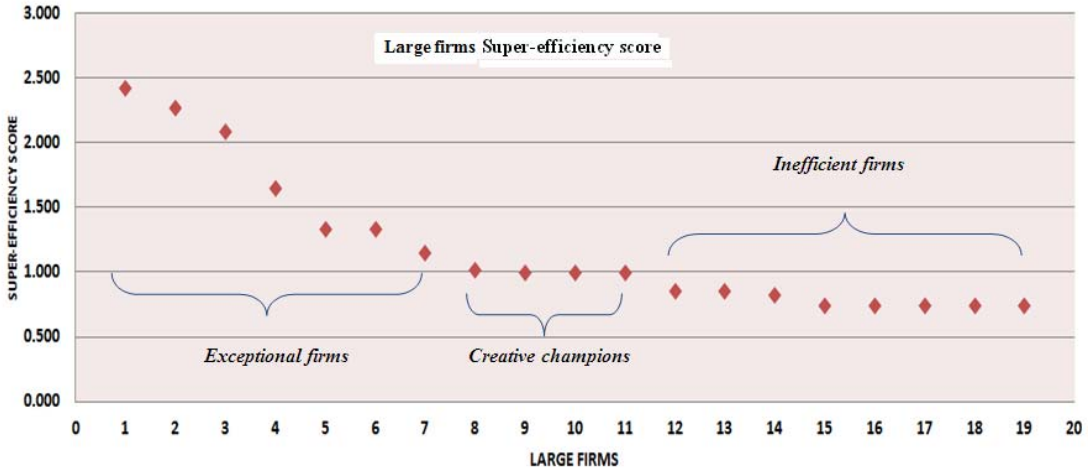

Figure 6. Super-efficiency score of large firms (2008)

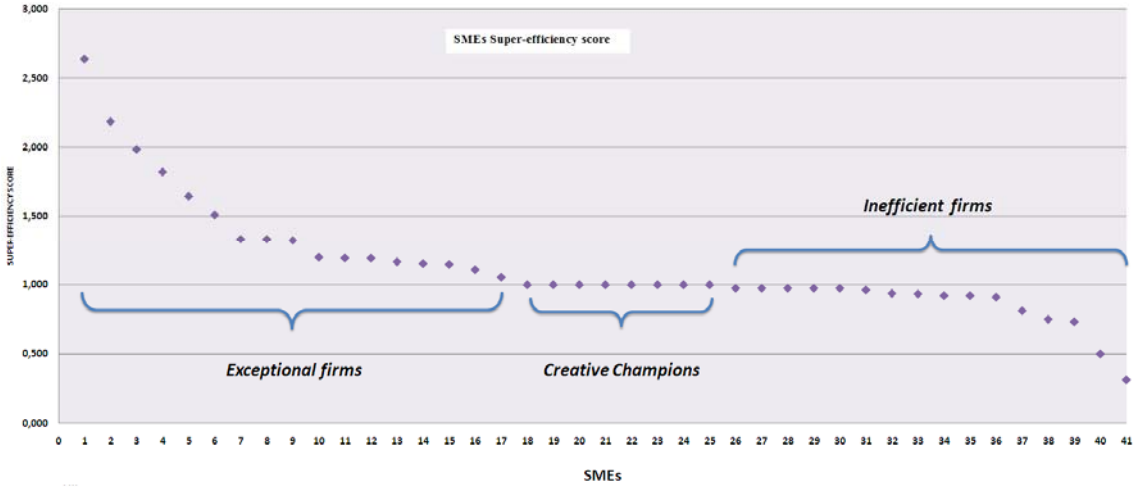

Figure 7. Super-efficiency score of SMEs (2008)

Finally, it is now an important question whether the above DEA results can be linked to the stage of SPM introduction in each individual firm, as well as to the geographical environment of these firms. This will be further investigated in the next section.

7 Geographical Location of Creative Champions

The spatial and logistic components of the strategy formation of firms are increasingly receiving serious attention (Glaeser et al., 1992; Henderson et al., 1995). In our exploration of how a firm's geographical location influences the firm's performance, we differentiated the firm's location according to its degree of centrality and urbanization. Accordingly, two types of classification were used, namely: (i) the Randstad Core Region, Intermediate Zone, and Periphery; and (ii) degrees of regional urbanization, on a scale from 1 to 5. In addition, we used dummies for the completeness (maturity) of the implementation of an SPM system in firms. The combined results are included in a comprehensive way in Tables 1 and 2, for both large and SME firms, respectively. The frequency of

firms located in the various regions in relation to their performance profile (viz. exceptional firms, creative champions, and inefficient firms) is given in the right-hand side of these tables. The left-hand side of Table 1 contains information on the degree of maturity of SPM implementation in large firms, subdivided into three classes: full implementation (maturity); almost finished implementation (semi-maturity); and early-stage implementation (introduction). The left-hand side of Table 2 contains information on the degree of completion of SPM implementation in SME firms, subdivided into two classes: completion; and start-up of SPM. In practice, according to the completion and start-up stages of SPM, the score for the benefits per level of completeness category may vary, with possible responses from 1= *not at all* to 5 = *very strong*.

Tables 1 and 2 show that the more complete the SPM system implementation is, the higher the number of large firms and SMEs with a super-efficient score higher than 1 (i.e. the '*exceptional firms'*) which had experienced benefits, in particular, qualitative advantages (i.e. ***Qual*** and ***Busc***). Concerning their performance profile, our results show less difference in these firms' locations according to centrality and urbanization. Large '*exceptional firms*', with a completed SPM system, tend to be located in both the Randstad Core Region and the intermediate zone, with a small difference in relation to urbanization, compared with creative champions and inefficient firms, with a semi-finished implementation and early-stage implementation (introduction) of SPM. These latter firms are mainly found in fairly and strongly urbanized areas in the country. Small '*exceptional firms*' with a completed SPM system appear to be found in many regions, but with a concentration in low and strongly urbanized areas. This means that SPM may generate additional benefits in terms of efficiency and competitiveness for firms, and that geographical centrality is not necessarily an essential component of their prevailing business.

From a GIS perspective, our study is able to explore how creative firms are strategically located in the country. This approach creates a statistical space in which the firms' locations in the Netherlands are mapped according to their geographical coordinates, so as to visualize and to identify geographically-discriminating factors in the firms' performance. In Annex A, Figure A1 shows the firms' locational patterns according to their degree of centrality, defined by the area types Randstad Core Region, Intermediate Zone, and Periphery.

Tables 1 and 2 show that, in general, the creative champions and inefficient firms are overrepresented in the central and semi-central areas (i.e. Randstad Core Region and Intermediate Zone), in contrast to exceptional firms. They are more likely to move to dense economic regions in terms of easy access to, and high availability of, a local specialized labour pool, the existence of local inputs, infrastructure, financial institutions, buyer and supplier networks, and knowledge spillovers (in the spirit of 'industrial districts' advocated by Marshall, 1920). This suggests that access to alternative goods, such as a prestigious business climate, clients and markets, dominates the reasons why firms are located in these central areas (see also the early seminal work of Levitt, 1965; Vernon, 1966; Utterback and Abernathy, 1975). Thus, local economies and conditions appear to play an important role in firm location; in the early-stage implementation of SPM, these firms are as yet insufficiently knowledgeable and sophisticated about applying this knowledge to the day-to-day management of the firm.

Table 1. *'Flying disc'* frequency results in relation to the degree of completeness of SPM implementation for large firms

Class: degree of completeness of SPM implementation	Average score for benefits per level of completeness[6]		*Super-efficient DEA score (X)*	Geographical space							
				Centrality			Urbanization				
	Prof benefits	*Qual* and *Busc* benefits		*Randstad Core Region*	*Intermediate Zone*	*Periphery*	*Non-urbanized*	*Low urbanized*	*Fairly urbanized*	*Strong urbanized*	*Very urbanized*
SPM Maturity	3.39	3.40	X> 1.000: Exceptional firms	2	2	0	0	1	1	2	0
			X= 1.000: Creative champions	0	0	0	0	0	0	0	0
			X< 1.000: Inefficient firms	1	2	0	0	0	0	1	2
SPM Semi-maturity	3.26	3.51	X> 1.000: Exceptional firms	1	0	1	0	0	1	1	0
			X= 1.000: Creative champions	2	0	0	0	0	1	0	1
			X< 1.000: Inefficient firms	2	1	1	0	0	1	2	1
SPM Introduction	3.11	3.37	X> 1.000: Exceptional firms	0	2	1	0	0	1	2	0
			X= 1.000: Creative champions	0	0	0	0	0	0	0	0
			X< 1.000: Inefficient firms	1	0	0	0	0	0	0	1
Total Large firms				9	7	3	0	1	5	8	5

Table 2. *'Flying disc'* frequency results in relation to degree of completeness of SPM implementation for SMEs

Class: degree of completeness of SPM implementation	Average score for benefits per level of completeness category		*Super-efficient DEA score (X)*	Geographical space							
				Centrality			Urbanization				
	Prof benefits	*Qual* and *Busc* benefits		*Randstad Core Region*	*Intermediate Zone*	*Periphery*	*Non-urbanized*	*Low urbanized*	*Fairly urbanized*	*Strong urbanized*	*Very urbanized*
SPM Completion	3.16	3.56	X> 1.000: Exceptional firms	4	3	5	1	5	1	4	1
			X= 1.000: Creative champions	4	2	1	0	1	1	2	2
			X< 1.000: Inefficient firms	2	7	1	0	5	0	4	1
SPM Start-up	3.03	3.21	X> 1.000: Exceptional firms	3	2	0	0	2	0	3	1
			X= 1.000: Creative champions	1	0	0	0	0	0	0	1
			X< 1.000: Inefficient firms	2	3	1	0	0	0	5	1
Total SMEs firms				16	17	8	1	13	2	18	7

The Randstad area, where various forms of capital (e.g. creative, human, infrastructure, financial, institutions, knowledge) are more abundant, are more likely in their early stages to host more firms which exploit these attributes for not only their current organizational performance but also their

[6] For each class (degree of completeness of SPM implementation), the scores for ***Prof*** (the score of increased revenue, increased profit, reduced costs) and ***Qual*** and ***Busc*** (the score of higher efficiency, higher pro-activity, better result achievement, better strategic alignment, better goal achievement, higher quality) for all firms in the group were averaged, using a scale of 1 to 5. The higher the score in Tables 1 and 2, the more strongly the firms experienced the benefits.

future performance and (strategic) directions. This can also further be explained in terms of the exploratory stage of these firms' performance (related to their positioning strategy) and the low maturity level of SPM. At this stage, regional contextual factors, such as technological possibilities and the preferences of various stakeholders in the market and external resources, are less well perceived by these firms. However, the differences in the location of large exceptional firms across the metropolitan core and the Intermediate Zone, as well as in the Periphery, are rather small. Where there is a progressive fully implemented SPM system, this improves the firms' competitive advantages by better anticipating and managing the rapidly changing circumstances within the industry through creative and innovative responses. This marks the transition from the exploratory stage to the mature stage in their business performance life cycles (i.e. the implementation of the SPM process), and their informal and formal business networks. This suggests that access to agglomeration and regional economies does not dominate in a firm's location in the later stage of the SPM implementation process.

On the other hand, *urbanization level economies* reflect external economies passed on to firms as a result of the returns from the large-scale operation of agglomerations as a whole. Tables 1 and 2 also show, however, that, while creative champions are more overrepresented in the metropolitan areas, the difference in the level of urbanization is rather small, in particular, for large creative champions and exceptional firms. In contrast, inefficient firms are more overrepresented in strongly or even very urbanized levels of the central areas. In Annex A, Figure A2 shows the firms' locational patterns according to degree of urbanization, divided into five grades ranging from non-urbanized areas to very urbanized areas.

The previous results demonstrate clearly that particular types of regions (based on, for example, centrality or urbanization) – in combination with a high availability of external regional resources − can play both a strong discriminating role for specific firms and a weak role for others, a finding also obtained by Duranton and Puga (2000). Table 3 presents in a nutshell an overview of the most important results of our analysis.

Table 3. An overview of the firms' location patterns in relation to centrality and urbanization

FIRMS	BUSINESS PERFORMANCE	CENTRALITY	URBANIZATION
Total firms	Inefficient firms	Intermediate Zone	Strongly urbanized zone
	Champion firms	Randstad Core Region	Very and strongly urbanized zones
	Exceptional firms	Randstad Core Region, Intermediate Zone and Periphery	Strongly and low urbanized zones
Large firms	Inefficient firms	Randstad Core Region	Very urbanized zone
	Champion firms	Randstad Core Region	Fairly, strongly, and very urbanized zones
	Exceptional firms	Randstad and Intermediate Zone	Strongly urbanized zone
Small firms	Inefficient firms	Intermediate Zone	Strongly urbanized zone
	Champion firms	Randstad Core Region	Very strongly and low urbanized zones
	Exceptional firms	Randstad Core Region, Intermediate Zone and Periphery	Strongly and low urbanized zones

8 Spatial Data Analysis: A Structural Equations Model[7]

The previous analyses were partly exploratory, partly explanatory in nature. We will now present a full explanatory model for the performance of individual firms in relation to contextual moderator variables, where we use a Structural Equations Model (SEM) for an integrated cause-effect system in order to identify the best-fitting structural path model between different contextual variables and super-efficient DEA results for the firms under consideration. On the basis of the previous results, three main hypotheses will be envisaged and tested, which centre on the question whether the achievement of a super-efficient score by firms is – as in the case of spatial-contextual variables – co-determined by the level of completeness of SPM implementation. To the best of our knowledge, our study is the first to test this proposition. Thus, our final aim is to test the SPM impact assumption empirically, on the basis of the following three hypotheses:

Hypothesis 1: *The super-efficient class of creative firms is positively related to the level of completeness of their SPM implementation.*

Clearly, we also have to consider the regional impact mechanism, and therefore the SPM concept for individual firms has to be extended with spatial attributes related to the geographical location of these firms. It seems now plausible to assume that a super-efficient score of both large firms and SMEs is also influenced by geographical space in terms of centrality and urbanisation. This leads to the following hypothesis:

Hypothesis 2: *The super-efficient class of creative firms is positively influenced by region-specific resources, and partly by centrality and/or urbanisation.*

Next, it is plausible that an *'exceptional firm'* is endowed with a mature SPM system which improves and increases the ability to understand how to steer a business in a challenging and turbulent business environment. This may at a certain stage lead to a higher business performance in terms of growth, operational efficiency, and value of capital assets. And it is therefore, likely that large firms have an advantage in having a speedy introduction of SPM. This leads to the following hypothesis:

Hypothesis 3: *The super-efficient class of creative firms is positively influenced by firm size.*

In order to test the relations between business super-efficiency performance, SPM acceptance, and critical resources in geographical space, we use a Structural Equations Model (SEM) that is capable of combining a confirmatory factor analysis with a regression path model. Furthermore, the large range of model fit indices is instrumental in identifying the best-fitting model that links the empirical data to the assumptions made (Byrne, 2010; Hooper et al., 2008; Mulaik and Millsap, 2000; Neuts et al., 2012). The SEM used in our study is of course inspired by the '*flying disc'* model and has

[7] The authors wish to thank Bart Neuts for his great support in the SEM analysis.

the following constituents: super-efficient DEA scores of the firms concerned (***SEC***), in relation to centrality in geographical space (***CGS***) (viz. Randstad Core Region, Intermediate Zone, and Periphery – and/or urbanization levels (***UBL***) – complemented with firm size (***FS***) and the implementation stage of the SPM system (***SPM***). In this way, we are able to produce a comprehensive econometric estimation of the champions-regions nexus described extensively above. Thus, our model is constructed to identify and estimate the following structural relationships between these factors:

$$SEC = f\,(CGS, UBL, FS, SPM), \qquad (1)$$

with: ***SEC*** = Super-efficiency DEA score;
CGS = Centrality in Geographical Space;
UBL = Urbanization levels;
FS = Firm size;
SPM = Maturity of SPM system.

A clear assumption in model (1) is that the firms' super-efficiency performance depends on the geographical areas ***(CGS*** and or ***UBL)*** where they are located, so that they can benefit from these external (geographic, locational and urbanization) economies, and from the available and supporting regional resources. Therefore, it is important to test whether a firm's geographical location influences its performance and its operational efficiency. The degree of success of SPM implementation might presumably also depend on firm size ***(FS)***. The structural model estimated in a first round addresses SPM and is based on the conceptual model of Figure 3 including PCA-Input indicators and PCA-Output indicators, which are both used in the calculation of the super-efficiency indicators. Such a multifactorial SEM structure might, in principle, be modelled in a structural equations analysis, but the statistical possibilities are limited by the sample size (n = 60), compared to the amount of free parameters that would need to be estimated in a multifactorial design. Therefore, a composite formation of different items was used in order to decrease the number of necessary parameter estimates (Hoe, 2008; Landis et al., 2000). More specifically, the eight above mentioned capital categories distinguished above were combined into the three regional resource classes mentioned before. Figure 8 offers the SEM results[8]. It shows that the structural model provides a significant relationship between the maturity of the SPM system and super-efficiency values (.281; p-value < .001), and between Centrality and Super-efficiency values (-.386; p-value < .001). Urbanity was found to be significant at an α-level of 0.1 (-.051; p-value = .087), while Firm size was not found to be significant. The results suggest that firms with a more mature SPM system generate higher super-efficiency values, while firms located in the Intermediate zones or the Periphery are also more likely to have a higher efficiency score.

[8] The software package used for estimating this SEM is AMOS.

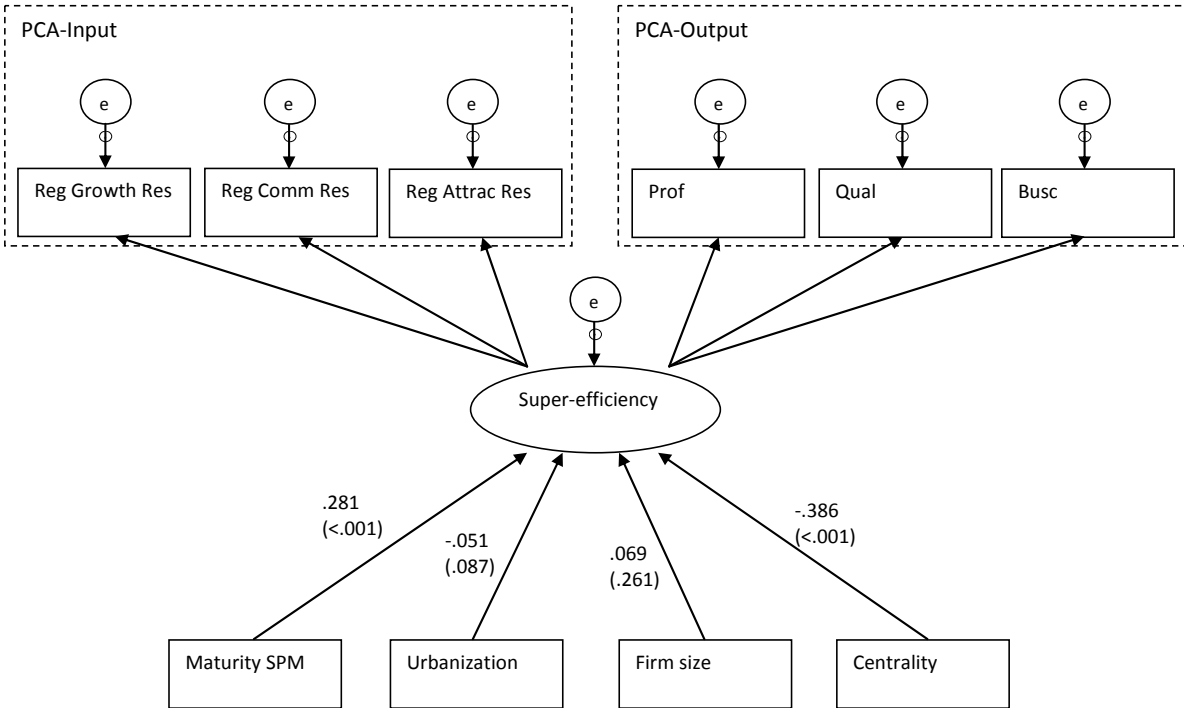

Figure 8: Structural equations model of the relationships between the maturity of the SPM-system, centrality or urbanization, and super-efficiency

Legend: The p-value is a test-statistic representing the significance level of the corresponding coefficient in this path model; if $p<0.01$, the relationship is significant at the 99% confidence level; if $p<0.10$, the relationship is significant at the 90% confidence level.

The Bollen-Stine bootstrapped chi-square test appears to accept our model with a p-value of .133. Other model fit indices include the σ^2/Df (= 1.613), CFI (= .978), RMSEA (=.102) and PNFI (= .190) (for an overview of model fit indices and threshold values, we refer to Barrett, 2007; Hooper et al., 2008). The findings of our SEM analysis indicate clearly a significant effect of the maturity of the SPM system, urbanization and/or centrality on the performance of creative firms. However, the significance of the ordinal scores may disguise differences in significance between levels of a variable. In order to identify the possible significance of each level of the regional contextual variables, a further complementary SEM analysis with dummy-coded indicators was used. These results are mapped out in Figure 9.

The final findings of the SEM in Figure 9 show that the Randstad area (centrality) and a high degree of urbanization (density) have a limited statistically significant impact (mostly with a p-value>.10) on the efficiency or success of the business strategy of firms in general. However, firms with a completed implementation of SPM experience a higher statistically significant impact ($p<.01$) on their performance than firms that are still in the process of implementing or introducing such a system. The first mentioned class of firms are more footloose and less dependent on place and distance; they have – even when located in the Periphery – apparently easier access to metropolitan areas, and also to available resources, knowledge and financial institutions, trade associations, and the like. Consequently, Hypotheses 1 and 2 receive conditional support from our empirical findings, while Hypothesis 3 cannot be shown to have a demonstrable effect.

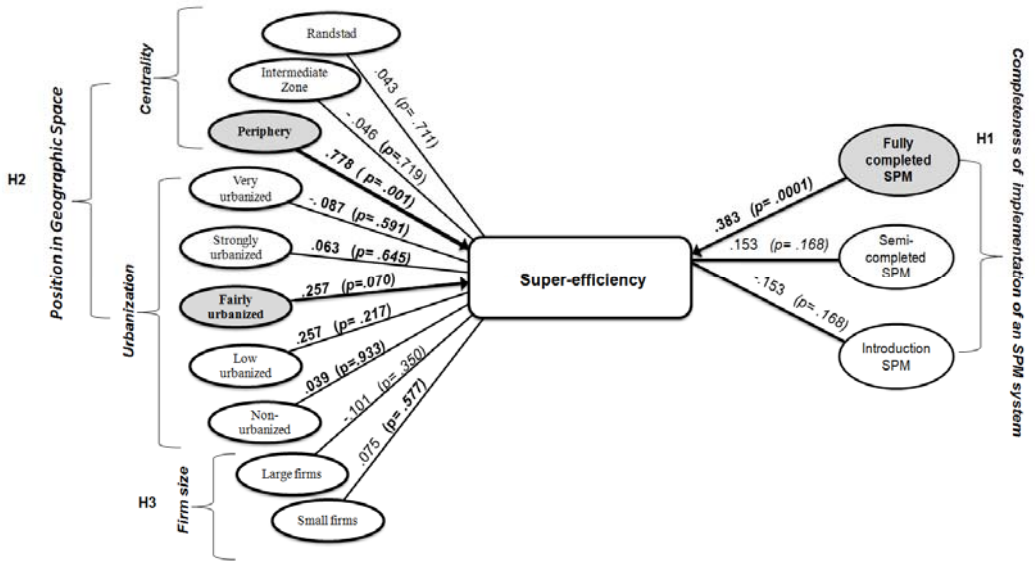

Figure 9: A structural equations model for super-efficient creative firms using SPM in high-tech spaces

Legend: The light grey colour of the ellipses denotes a significantly positive effect with a 99% confidence interval, while the dark grey colour of the ellipses denotes a significantly positive effect with a 90% confidence interval.

9 Concluding Remarks

The creative business and the region are closely intertwined phenomena. A rapidly growing number of cities and regions regard creativity, innovation, and learning as the centrepiece of novel development strategies. Our research has addressed in particular the combined importance of management strategies and spatial positions for the performance of innovative firms. In our study we have focussed attention on the performance and spatial position of creative high-tech firms in the Netherlands. The over-arching and central research question in our study was whether such firms – subdivided into large and small firms – perform better if they adopt a professional SPM system. And therefore, our study has tried to link elements from the SPM literature to both location theory and cultural organization theory. In this way, the process through which business firms realize their mission, strategy and objectives (measured by means of critical success factors and key performance indicators) is associated with the geographical profile of the place where the firm concerned is located, as well as with the cultural complex values and attributes of this firm (in particular, the 'creative mind' of the firm). In this context, several measurable performance indicators (e.g. turnover, profit, cost), as well as relevant background variables (both internal, such as managerial quality, or employee satisfaction, and external, such as innovative milieu, industrial networks, spatial accessibility), were all taken into consideration.

The analysis framework – succinctly presented in the '*flying disc'* model – was able to include the impact of both the geographical location and the industrial profile of business firms (both SMEs and large firms) on their market achievements. Our research has brought to light various new and relevant findings, in particular:

- SPM implementation is critical in distinguishing between high and low performance;
- Firms with a fully implemented SPM system are gaining more financial and non-financial benefits than firms that are still implementing such a system;
- High-performance versus low-performance firms can be identified in terms of their focus on internal and external strategy, markets and customers, leadership and management,;
- Various spatial factors ('input') that influence business performance ('output') are linked with particular geographical areas;
- Low-performance firms are likely to be able to profit more from localization and density economies in the Randstad Core Region and the Intermediate Zone;
- Location does matter, but not to the same extent for all firms;
- Distance matters more for some businesses than for others.

A trend seems to emerge that firms move to core areas as they mature, so that this phenomenon supports the hypothesis that the specific conditions of cities generate creativity. However, it may be the case that creativity does not need cities in the first instance, but tends to flow to cities in order to access alternative goods, such as prestigious locations, clients, and markets (a sorting effect). Hence the city would not necessarily generate more creativity than elsewhere, but it would fundamentally benefit from the economic consequences of creativity more than anywhere else.

Finally, the super-efficient class of *'exceptional firms'* appears to achieve better (quantitative and qualitative) results; it needs only a relatively smaller amount of inputs (resources), in providing a relatively larger amount of outputs (production). Clearly, SPM helps to lift a firm to an exceptional performance by facilitating the firm with competitive advantages to outperform current or potential firms (see for similar findings, Passemard and Kleiner, 2000), especially in competitive markets or in an appropriate region, as compared with the same industry in a different region. We may therefore conclude that an integrated analysis mix of both SPM measures at the micro firm level and supporting regional moderator variables are critical for the firm's performance. In a more general perspective, one may argue that a closer connection between industrial organization research and locational behaviour research may be fruitful for advanced insights into regional dynamics and creativeness.

References

Acs, Zoltan J., *Innovation and the Growth of Cities*, Edward Elgar, Cheltenham, 2002.

Acs, Zoltan J., and A. Varga, Geography, Endogenous Growth, and Innovation, *International Regional Science Review*, vol. 25, 2002, pp. 132-148.

Acs, Zoltan J., and C. Armington, *Entrepreneurship, Geography, and American Economic Growth,* Cambridge University Press, New York, 2006.

Adler, Nicole, Lea Friedman and Zilla Sinuany-Stern, Review of Ranking Methods in the Data Envelopment Analysis, Context, European *Journal of Operational Research*, 2002, vol. 140, pp. 249-265.

Afonso, Antonia, and Sonia Fernandes, Measuring Local Government Spending Efficiency: Evidence for the Lisbon Region. *Regional Studies*, vol. 40 (1), 2006, pp. 39-53.

Arikan, Andas, and Melissa Schilling, Structure and Governance in Industrial Districts: Implications for Competitive
Advantage. *Journal of Management Studies*, vol. 48, 2011, pp. 772-803.

Anderson, Per, and Niels Petersen, A Procedure for Ranking Efficient Units in Data Envelopment Analysis, *Management Science*, vol. 39, 1993, pp. 1261-1264.

Ansoff, Igor, Strategies for Diversification, Harvard Business Review, vol. 35, no. 5, Sept-Oct 1957, pp. 113-124.

Athanassopoulos, Antreas, and John Karkazis, The Efficiency of Social and Economic Image Projection in Spatial Configurations, *Journal of Regional Science*, vol. 37 (1), 1997, pp. 375-397.

Barrett, Paul, Structural equation modelling: Adjudging Model Fit, *Personality and Individual Differences*, vol. 42, 2007, pp.815-824.

Bliese, Paul, Multilevel modeling in R: A Brief Introduction to R, The Multilevel Package and the nlme Package, (2009). Available at: http://cran.r-project.org/doc/contrib/Bliese_Multilevel.pdf

Bögenhold, Dieter, Uwe Fachinger, and Rene Leicht, Self-employment and Wealth Creation, *International Journal of Entrepreneurship and Innovation,* vol. 2, 2001, pp. 81-91.

Boschma, Ron, and Michael Fritsch (2007), Creative Class and Regional Growth in Europe. In: P. Jakubowska, A. Kuklinski and P. Zuber (Eds.), *The Future of European Regions*, Warsaw: Ministry of Regional Development, pp. 243-253.

Brakman, Steven, Harry Garretsen, and Charles van Marrewijk, *An Introduction to Geographical Economics*, Cambridge University Press, Cambridge, 2001.

Byrne, Barbara M., *Structural equation modelling with AMOS: Basic Concepts, Applications, and Programming* (2nd Edition), Routledge, New York, 2010.

Capello, Roberta, Andrea Caragliu, and Peter Nijkamp, Territorial Capital and Regional Growth: Increasing Returns in Knowledge Use, *Journal of Economic and Social Geography*, vol. 102 (4), 2011, pp. 385-405.

Capello, Roberta, New Directions in Economic Geography, *Growth and Change*, vol. 39, 2008, pp. 370-372.

Capello, Roberta, and Peter Nijkamp (eds), *Handbook of Regional Development and Growth Theories*, Edward Elgar, Cheltenham, 2009.

Charnes, Abraham, WilliamW. Cooper and Edwardo Rhodes, Measuring the Efficiency of Decision Making Units, *European Journal of Operational Research,* vol. 2, 1978, pp. 429-444.

Corrado, Luisa, and Bernard Fingleton, Where Is The Economics In Spatial Econometrics?, *Journal of Regional Science*, Wiley
Blackwell, vol. 52(2), 2012, pp. 210-239.

Covey, Stephen R., Focus, *Achieving Your Highest Priorities*, 2003.

Crescenzi, Riccardo, and Andres Rodriguez-Pose, *Innovation and Regional Growth in the European Union*, Springer, Berlin, 2011.

Czarnitzki, Dirk, and Hanna Hottenrott (2009), Are Local Milieus the Key to Innovation Performance, *Journal of Regional Science*, Vol. 49 (1), pp. 81–112.

Davis, Stan, and Tom Albright, An Investigation of the Effect Of Balanced Scorecard Implementation on Financial Performance, *Management Accounting Research*, vol. 1, no. 2, 2004, pp. 135-53.

Duranton, Gilles, and Diego Puga, Diversity and Specialisation in Cities: Why, Where and When Does it Matter?, *Urban Studies*, vol. 37, no. 3, 2000, pp. 533-555.

Florida, Richard, *The Rise of the Creative Class*, Basic Books, New York, 2002.

Florida, Richard, Entrepreneurship, Creativity and Regional Economic Growth, in: D.M. Hart (ed.), *The Emergency of Entrepreneurship Policy*, Cambridge University Press,Cambridge, 2003.

Fujita, Masahisa, and Jacques-François Thisse, Does Geographical Agglomeration Foster Economic Growth? And Who Gains and Loses From It?, *The Japanesse Economic Review*, vol. 54, 2003, pp. 121-145.

Glaeser, Edward, and Resseger, Matthew (2010), The Complementarity Between Cities and Skills, *Journal of Regional Science*, Vol. 50 (1), pp. 221-244.

Glaeser, Edward, Hedi Kallal, Jose Scheinkman and Andre Shleifer, Growth in Cities, *Journal of Political Economy*, vol. 100, 1992, pp. 1126-1152.

Gelman, Andrew, and Jennifer Hill, *Data Analysis Using Regression and Multilevel/Hierarchical Models*, Cambridge University Press, Cambridge, 2007.

Golany, Boaz, An Interactive MOLP Procedure for the Extension of DEA to Effectiveness Analysis, *Journal of the Operational Research Society*, vol. 39, 1988, pp. 725-734.

Goldstein, Harvey, *Multilevel Models in Educational and Social Research*, Oxford University Press, New York, 1987.

Goldstein, Harvey, Multilevel Statistical Models, Arnold, London, 2003.

Grimes, Seamus, and Mark White, The Transition to Internationally Traded Services and Ireland's Emergence as a Successful European Region, *Environment and Planning* A, vol. 37, 2005, pp. 2169-2188.

Haas, Marco, and Ad Kleingeld, Multilevel Design of Performance Measurement Systems: Enhancing Strategic Dialogue Throughout the Organization, *Management Accounting Research*, vol. 10, 1999, pp. 233-261.

Halkos, George, Nickolaos G. Tzeremes**,** Measuring Regional Economic Efficiency: the Case of Greek Prefectures, *The Annals of Regional Sciences*, vol. 45, 2010, pp. 603-632.

Henderson, J. Vernon, Ari Kuncoro and Matthew Turner, Industrial Development in Cities, *Journal of Political Economy*, vol. 103, no. 5, 1995, pp. 1067-1090.

Hoe, Siu Loon, Issues and Procedures in Adopting Structural Equation Modeling Technique. *Journal of Applied Quantitative Methods*, 3(1), 2008, 76-83.

Hooper, Daire, Joseph Coughlan and Michael R. Mullen, Structural Equation Modeling: Guidelines for Determining Model Fit, *Electronic Journal of Business Research Methods*, vol. 6 (1), 2008, pp. 53-60.

Islam, M.Kamrul, Juan Merlo, Ichiro Kawachi, Martin Lindström, Kristina Burström and Ulf G. Gerdtham. Does it Really Matter Where you Live? A Panel Data Multilevel Analysis of Swedish Municipality-level Social Capital on Individual Health-related Quality of Life. *Health Economic Policy Law,* vol. 3, 2006, pp. 209-235.

Ioannides, Yannis, A Review of Scott E. Page's The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies, *Journal of Economic Literature*, vol. 48 (1), 2010, pp. 108-122.

Jones, Charles I., and Paul M. Romer, 2010, The New Kaldor facts: Ideas, Institutions, Population, and Human Capital, *American Economic Journal: Macroeconomics*, vol. 2 (1), 2010: 224-245.

Karaev, Aleksander, Lenny Koh, and Leslie Szamosi, The Cluster Approach and SME Competitiveness: A Review, *Journal of Manufacturing Technology Management*, vol. 18 (7), 2007, pp. 818-835.

Karlsson Charlie, Borje Johansson, and Roger Stough (eds), *Innovation, Agglomeration and Regional Competition*, Edward Elgar, Cheltenham, 2009.

Karlsson Charlie, Borje Johansson, and Roger Stough (eds), *Entrepreneurship and Regional Development*, Edward Elgar, Cheltenham, 2010.

KEA European Affairs, *The Economy of Culture in Europe*, KEA European Affairs, Brussels, 2006.

Klein, Katherine J., and Steve W.J. Kozlowski, *Multilevel Theory, Research and Methods in Organizations,* Jossey-Bass, San Fransicso, 2000.

Kourtit, Karima, Peter Nijkamp. and Roger Stough (eds), *Drivers of Innovation, Entrepreneurship and Regional Dynamics*, Springer-Verlag, Berlin, 2011a.

Kourtit, Karima, Peter Nijkamp, and Daniel Arribas, Creativity and Diversity: Strategic Performance Management of High-Tech SMEs in Dutch Urban Areas, in: Karima Kourtit, Peter Nijkamp and Roger Stough (eds.), *Drivers of Innovation, Entrepreneurship and Regional Dynamics*, Springer-Verlag, Berlin, 2011b, pp. 45-64.

Kourtit, Karima, P. Nijkamp and R. Stimson (eds.), Special Issue on *Innovation and Creativity as the Core of Regional and Local Development Policy, Regional Science Policy & Practice,* vol. 3 (3), 2011c.

Kourtit, Karima and P. Nijkamp, High Performers in Complex Spatial Systems: A Self-Organizing Mapping Approach with Reference to The Netherlands, *The Annals of Regional Science*, vol. 48 (2), 2012, pp. 501-527.

Krugman, Paul, *Geography and Trade*, Leuven University Press, Leuven, 1991.

Landry, Charles, *The Creative City*, Earthscan, London, 2000.

Landis, Ronald, Daniel J. Beal & Paul E. Tesluk, A Comparison of Approaches to Forming Composite Measures in Structural Equation Models. *Organizational Research Methods*, 3(2), 2000, pp. 186-207.

Leeuw, Sander de, and Jeroen P. van den Berg, Improving Operational Performance by Influencing Shopfloor Behavior via Performance Management Practices, *Journal of Operations Management*, vol. 29, 2010, pp. 224-235.

Levitt, Theodore, Exploit the Product Life Cycle, *Harvard Business Review*, vol. 43, 1965, pp. 81-94.

Macmillan, Will D., The Estimation and Application of Multi-Regional Economic Planning Models Using Data Envelopment Analysis, *Papers of the Regional Science Association*, vol. 60, 1986, pp. 41-57.

Malmberg, Anders and Peter Maskell, Towards an Explanation of Regional Specialization and Industry Agglomeration, *European Planning Studies*, vol. 5 (1), 1997, pp. 25-41.

Marshall, Alfred, *Principles of Economics*, Macmillan, London, 1920.

Martin, Philippe, and Gianmarco Ottaviano, Growing Locations: Industry Locations in a Model of Endogenous Growth, *European Economic Review*, vol. 43, 1999, pp. 281-302.

Martin Philippe, Thierry Mayer and Florian Mayneris, *Spatial Concentration and Firm-Level Productivity in France*, Discussion paper series 6858, CEPR, 2008.

Maudos, Joaquin, Jose Manuel Pastor and Lorenzo Serrano, Efficiency and Productive Specialization: An Application to the Spanish Regions, *Regional Studies,* vol. 34, 2000, pp. 829-842.

McCann, Brian T. and Timothy B. Folta, Performance Differentials within Geographic Clusters. *Journal of Business Venturing*, 26, 2011, pp. 104-123.

McCann, Philip, Sketching out a Model of Innovation, Face-to-face Interaction and Economic Geography, *Spatial Economic Analysis*, vol. 2, 2007, pp. 117-134

Medina-Borja, Alexandra, Kalyan Pasupathy and Konstantinos Triantis (2007) Large-scale Data Envelopment Analysis (DEA) Implementation: a Strategic Performance Management Approach. *Journal of the Operational Research Society* 58(8), pp. 1084-1098.

Millett, Bruce, *Managing the Processes of Organisational Change and Development: Study Book*, University of Southern Queensland, Queensland,1998.

Mulaik, Stanley A., and Roger E. Millsap, Doing the Four-step Right, *Structural Equation Modeling*, vol. 7, 2000, pp. 36-73.

Neuts, Bart, Peter Nijkamp, and Eveline van Leeuwen, Crowding Externalities from Tourist Use of Urban Space. *Tourism Economics*, 2012, forthcoming.

Norreklit, Hanne, The Balanced Scorecard – A Critical Analysis of Some of its Assumptions, *Management Accounting Research,* March, 2000.

Passemard, Dan, and Brian H. Kleiner, Competitive Advantage in Global Industries, *Management Research News*, vol. 23, nos 7/8, 2000, pp. 111- 117.

Porter, Michael E., How Competitive Forces Shape Strategy, *Harvard Business Review*, March/April, 1979.

Porter, Michael E., The Adam Smith Address: Location, Clusters, and the 'New' Microeconomics of Competition, *Business Economics,* vol. 33, 1998a, pp. 7-13.

Porter, Michael E., Clusters and the New Economics of Competition, *Harvard Business Review*, vol. 76, no. 6, 1998b, pp. 77-90.

Porter, Michael E., *Competitive Advantage of Nations*, Macmillan, London, 1990.

Redding, Stephen J. (2010), The Empirics of New Economic Geography, *Journal of Regional Science*, Vol. 50 (1), pp. 297-311.

Romijn, Henny. and Mike Albu, Innovation, Networking and Proximity, *Regional Studies,* vol. 36, 2002, pp. 81-86.

Roberts, Marion, From 'Creative City' to 'No-go Areas': The Expansion of the Night-time Economy in British Town and City Centres, *Cities*, vol. 23 (5), 2006, pp. 331-338.

Ross, Edward A., The Location of Industries, *The Quarterly Journal of Economics*, vol. 10, vol. 3, 1896, pp. 247-268.

Scott, Allen, *Metropolis. From the Division of Labor to Urban Form*, University of California Press, Berkeley, 1988.

Scott, Allen, *The Cultural Economy of Cities*, Sage, London, 2000.

Seiford, Lawrence, *A Cyber-Bibliography for Data Envelopment Analysis (1978-2005),* August, 2005.

Seiford, Lawrence, and Joe Zhu, Context-dependent Data Envelopment Analysis – Measuring attractiveness and progress, *Omega,* vol. 31, 2003, pp. 397.

Snijders, Tom, and Bosker, Roel, *Multilevel analysis*, Sage, London, 1999.

Stimson, Robert, Roger Stough and Peter Nijkamp (eds.), *Endogenous Regional Development*, Edward Elgar, Cheltenham, 2011.

Stough, Roger, Endogenous Growth in a Regional Context. *The Annals of Regional Science*, vol. 32 (1), 1998, pp. 1-5.

Suzuki, Soushi and Peter Nijkamp, A Stepwise-Projection Data Envelopment Analysis for Public Transport Operations in Japan, *Letters in Spatial and Resource Science*, vol. 4, 2011, pp. 139-156.

Suzuki, Soushi, Peter Nijkamp, and Piet Rietveld, Regional Efficiency Improvement by Means of Data Envelopment Analysis through Euclidean Distance Minimization including Input Factors: An Application to Tourist Regions in Italy, *Papers in Regional Science,* vol. 90 (1), 2011, pp. 67-90.

Suzuki, Soushi, Peter Nijkamp, Piet Rietveld, and Eric Pels, A Distance Friction Minimization Approach in Data Envelopment Analysis – A Comparative Study on Airport Efficiency, *European Journal of Operational Research*, vol. 207, 2010, pp. 1104-115.

Teece, Daniel, Gary Pisano, and Amy Shuen, Dynamic Capabilities and Strategic Management**,** *Strategic Management Journal*, Vol. 18 (7), 1997, pp. 509-533.

Thompson, Wilbur Richard, Internal and External Factors in Urban Economies, in: H.S. Perloff and L. Wingo (eds), *Issues in Urban Economics*, Johns
Hopkins University Press and Resources for the Future, Baltimore, 1968, pp. 43-62.

Tone, Kaoru, A Slacks-Based Measure of Efficiency on Data Envelopment Analysis, *European Journal of Operational Research*, vol. 130, 2001, pp. 498-509.

Tone, Kaoru, A Slacks-Based Measure of Super-Efficiency in Data Envelopment Analysis, *European Journal of Operational Research*, vol. 143, 2002, pp. 32-41.

Utterback, James, and William Abernathy, A Dynamic Model of Process and Product Innovation, *Omega*, vol. 3, 1975, pp. 639-656.

Van Oort, Frank, Urban Growth and Innovation: Spatially Bounded Externalities in the Netherlands, Ashgate, Aldershot, 2004.

Vernon, Raymond, International Investment and International Trade in the Product Cycle, *Quarterly Journal of Economics*, vol. 80, 1966, pp. 190-207.

Waal, André de, *Strategic Performance Management. A Managerial and Behavioural Approach*, Palgrave MacMillan, London, 2007.

Waal, André de, Karima Kourtit, and Peter Nijkamp, The Relationship between the Level of Completeness of a Strategic Performance Management System and Perceived Advantages and Disadvantages, *International Journal of Operations & Production Management*, vol. 29 (12), 2009, pp. 1242-1265

Weber, Alfred, *Theory of the Location of Industries,* The University of Chicago Press, Chicago, 1929.

Winters, John V. (2011). Why are Smart Cities Growing? Who Moves and Who Stays. *Journal of Regional Science,* 51 (2), 253-270.

Yamoto, Kyoko, and Kazuhiro, Hirose, Knowledge Spillovers, Location of Industry and Endogenous Growth, *Annals of Regional Science*, vol. 41, 2007, pp. 17-30

Yin, Robert K., *Case Study Research: Design and Methods*, Sage, London, 2003.

Zeng, Daniel, and J.Leon Zhao, Effective Role Resolution in Workflow Management, *Journal on Computing*, vol. 17 (3), 2005, 374-387.

Zhu, Joe, A Multidimensional Quality-of-Life Measure with an Application to Fortune's Best Cities, *Socio-Economic Planning Sciences*, vol. 35 (4), 2001, pp. 263-284.

ANNEX A: Geographical Location of Firms

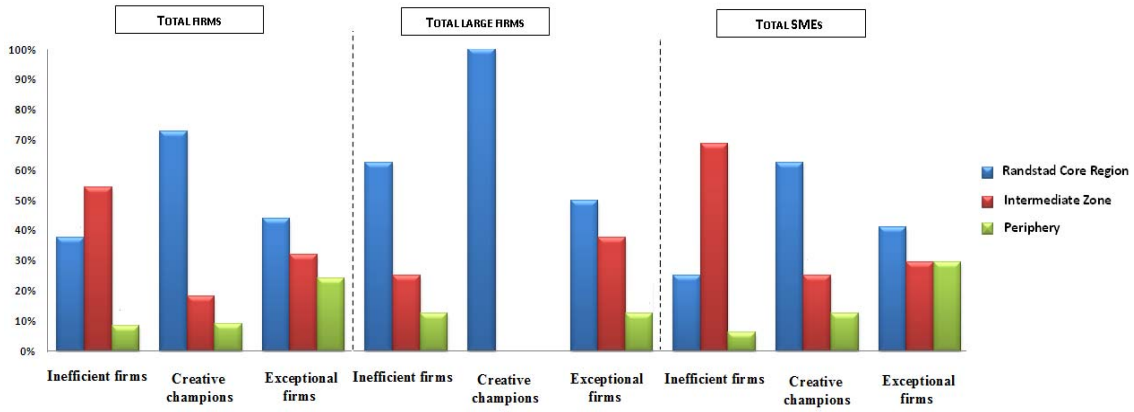

Figure A1. Geographical location of firms according to centrality, differentiated by size

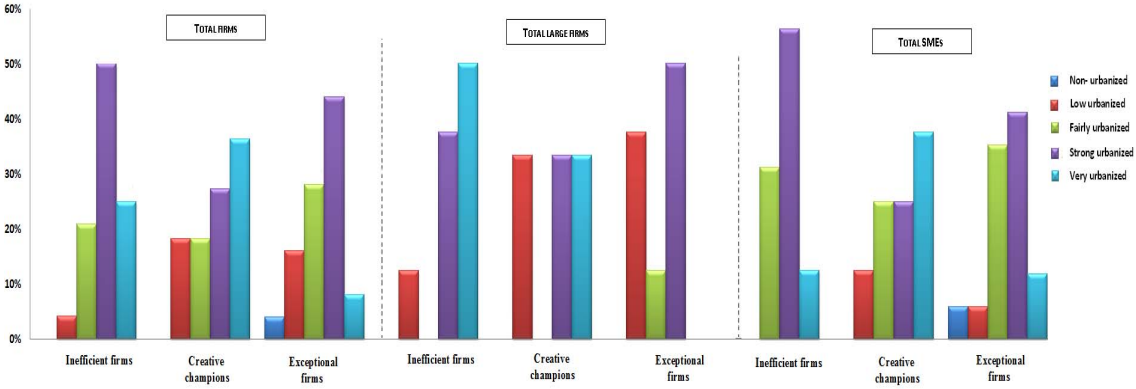

Figure A2. Geographical location of firms according to urbanization, differentiated by size