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Combining design and high-tech in knowledge cities: the case of Eindhoven

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Abstract

Theories of urban competitiveness have had disagreeing views about the most important factors influencing city growth and development. The business-oriented view has focused on economic qualities, assuming that proximity of firms and institutions generates (technological) innovation. The people-oriented perspective claims that the socio-spatial qualities of a place have become the most important factor for urban competitiveness in the current economic context.

The awareness of the nature of knowledge-based development, in which cultural considerations become much more important, has led to new notions considering the importance of attracting both firms and investments, and human capital for urban competitiveness. In practice, however, these comprehensive notions are not so easy to implement, and local strategies tend to engage in business-oriented approaches.

The present work focuses on ways to combine these apparently opposing theoretical views, by presenting the case of Eindhoven, in the Netherlands. Eindhoven has performed a great achievement incorporating the creative design sector into its traditional high-technology production sector. This paper will describe the role of the main stakeholders – government, firms, research sector – in producing this strategic shift towards the creative design sector. It will pay attention to both the organizational changes as well as the significant spatial transformations that the city of Eindhoven is realizing in its attempt to materialize its objective of transforming from a traditional industrial region into a "top-technology and design region".

The success of Eindhoven in reinventing itself to become a design destination and the high-tech capital of the Netherlands shows that it is possible to bridge the difficulties to combine these two apparently separate sectors, implementing strategic actions to improve a place's socio-spatial qualities. Findings from the approach taken by Eindhoven, specifically in the field of strategic planning and urban projects, may serve as inspiration and be broadened into recommendations for other (high-tech) cities and regions with similar ambitions and aims.

Keywords – knowledge cities, design, high-tech, knowledge economy, Eindhoven.
Paper type – Academic Research Paper

1   Introduction

Academics have held disagreeing views about the most important factors influencing city growth and development to achieve urban competitiveness. The traditional view is

the business-oriented one, which focuses on economic qualities, stating that cities should attract new firms and institutions. It assumes that their proximity generates (technological) innovation. The people-oriented perspective that became popular during the last decade states that cities should attract human capital, the most important factor for competitiveness. This perspective claims that the socio-spatial qualities of a place have become a key issue for urban competitiveness in the knowledge-based economy. Issues linked to the creative city or the creative class popularized by Charles Landry (2000) and Richard Florida (2002) have been widely discussed, criticized and studied in the US and European cities.

Gradually, it has become clear that both firms and people are important, so comprehensive views are gaining ground. Many cities worldwide have developed policies to nurture local creativity. But the practice shows that many of the requirements and conditions of the social climate for creative environments are fuzzy and difficult to achieve or to measure (Trip, 2009). Accordingly, most local policies still tend to engage in the business-oriented perspective, easier to implement in practice (Kooijman and Romein, 2007).

The present work focuses on ways to combine business and people oriented perspectives in the practice, by presenting the case of Eindhoven, a city with a high-tech profile which is the economic engine of the Netherlands. Aware that the synergy between high-technology and creative sectors has become crucial in the international competitiveness of knowledge-based regions, Eindhoven has performed a great achievement incorporating the creative design sector into its traditional high-tech production sector. The main features of these initiatives can serve as inspiration for other cities with similar ambitions.

The paper is organized in six sections. The next one addresses the main assumptions of the business-oriented, the people-oriented, and the comprehensive perspectives of urban growth and development. The third section will describe the problems of implementing the comprehensive approaches. Eindhoven's main features is the focus of the following section, while the fifth goes deeper into the aspects related to the design orientation of Eindhoven. The last section presents the main conclusions.

## 2   Theories of urban growth in the knowledge era

The transcendental shift from locally-bounded urban economies into complex knowledge-based economies of global reach has visibly enriched the academic debate in urban and regional economics. Important subjects in this debate have been the identification of the driving forces for city growth and urban competitiveness. Due to the nature of the changes, there is academic agreement about the importance of knowledge, technology and innovation for the success of cities. However, the discussion is not settled and there are disagreeing views about the most important factors influencing knowledge and innovation. For urban professionals, the topic is of great relevance. "Knowledge-based development requires special attention because, as society becomes more knowledge-based and the role of knowledge increases, the basic nature of development changes, particularly in cities where knowledge resources are concentrated." (Knight, 1995, 225).

Two main views can be distinguished in the theoretical discussion, the business-oriented and the people-oriented perspectives, considering financial capital or human capital, respectively, as the main engine of growth of cities and regions. Due to these

different views, the dichotomies between (high-tech) innovation and (design) creativity; industrial districts and creative cities; hard and soft factors; and cluster of firms and talented people have been frequently mentioned in the urban literature.

2.1 *The business orientation to knowledge-based development*

Some scholars highlight the importance of the 'hard' factors that are linked to high technology and a strong business orientation to local urban development. Storper (1997) claimed that in the new economic paradigm – which established itself in the mid-1908s and 1990s – technology, organizations (firms and production systems) and territories became the 'holy trinity of regional economics'. Figure 1 shows how these three factors would work, without any reference to people's aspects.
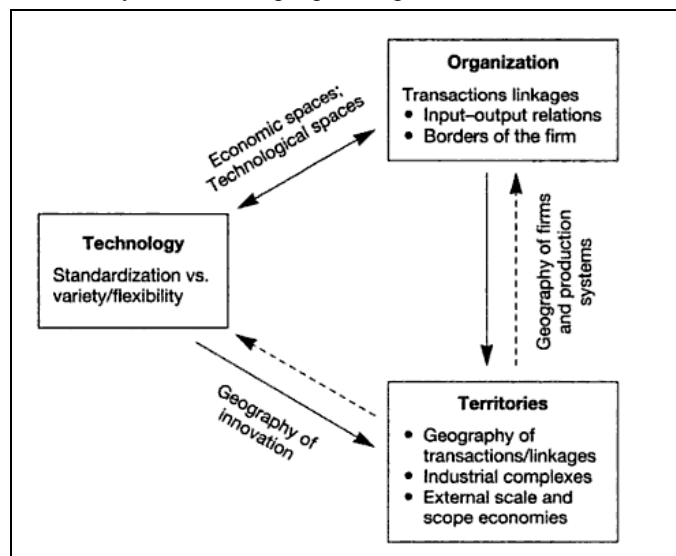
Figure 1. The 'holy trinity' of the heterodox paradigm of regional economics (Source: Storper, 1997)

For spatial planners and urban researchers, the focus on territories is the usual way to approach the topic. Spatial strategies to promote technological innovation based on the scale advantages produced by agglomeration or clustering of economic activities have been among the most common tools by which cities and regions have attempted to improve their local economies. 'Neo-Marshallian nodes' (Amin and Thrift, 1992), 'technopoles' (Castells and Hall, 1994), 'milieux of innovation', 'technology districts', 'high-tech spaces' and 'science parks' can be counted among this type of spatial strategies. Cluster theory (Porter, 1998), which considers regional clusters of linked industries and institutions in certain (high-tech) production sectors as crucial for success in territorial competition, also belongs to a spatial perspective for technological innovation. These stress the role of technological spillovers in generating growth, something easier to achieve in urban agglomerations.

Some other scholars have relativized the importance of territories claiming that the most important factor is a process of interactive learning to promote the exchange of knowledge within and between local clusters. To be able to transform knowledge into innovative goods and services there should be easy interactions between producers of

theoretical knowledge (research) and practical knowledge (industry). This would depend upon relationships based on mutual trust, but also on the 'most fundamental aspect of proximity': face-to-face contact, indispensable for the exchange of 'tacit' knowledge (Storper and Venables, 2004).

Furthermore, those who focus on governance issues have found that governments can promote innovation by gearing the cross-fertilization of theoretical knowledge and practical knowledge with policy instruments. Such processes – which focus on university–industry–government relations – have been called a 'triple helix' interaction because they do not respond to linear process but to interactions among the constitutive elements (Etzkowitz, 2003). Indeed, the role of institutions in promoting long-term economic growth has also attracted considerable academic attention (Glaeser et al., 2004; Acemoglu et al., 2004). "Institutional thickness" has been considered as the secret ingredient of competitive places (Amin and Thrift, 1995). Formal and informal institutions can indeed shape the local business climate to promote interactive learning and mutual trust, for example; they can improve labour force participation and effort levels; and they can seize new opportunities and adjust to changing technological and economic contexts (Storper, 2010).

The imperative of striving for a sustainable kind of urban development, however, has made urban planners cautious about approaches that are too much biased towards the role of firms, organizations, and the economic aspects of growth and development, considered incomplete and unsatisfactory to explain city growth and development. On the other hand, the awareness of the growing importance of consumer markets and demand-driven activities in the new economic context, has increased the academic interest toward the symbolic and cultural aspects of economic development.

2.2   *The people-orientation to knowledge-based development*

Although Jane Jacobs (1961) gave an impulse into cultural considerations in economic thought – when she advocated diversity as a driven force for urban prosperity in "Death and Life of Great American Cities" – cultural considerations were generally neglected in urban economics until relatively recently (Kunzmann, 2004). However, the new century witnessed a 'cultural turn' in the social sciences (Amin and Thrift, 2007). Paying attention to the role of cultural industries in UK cities, Hall (2000) advocated the marriage between arts and technology. Gradually, people-oriented approaches for urban development and competitiveness became widely held.

This new focus came from the US, linked with empirical studies addressing the role of human capital as driver of urban growth in US metropolitan areas. Glaeser and Shapiro (2001) stated that during the 1990s cities with strong human capital grew faster than those without it. In "The Rise of the Skilled City", Glaeser and Saiz (2003) identified the presence of high-skilled workers, as the main predictor of competitiveness and productivity growth.

But later, "a virus called creativity" (Kunzmann, 2004) entered the scene. This was most visible after Richard Florida's (2002) book on the creative class became an international best seller and received many prizes. Since then, great academic attention is being paid to creativity issues and their impact on the growth of cities and regions. According to Florida, the main drivers of economic growth are original ideas. What cities should do then is nurturing their creative class, the producers of economic value in the form of new ideas, is

Bohemians and artists – including writers, graphic designers, actors, musicians, painters, dancers, etc. – are the most important members of this 'creative class'. They constitute the super creative core, along with ICT workers, engineers, and social scientists. The second group consists of creative professionals, in charge of implementing the ideas of the first group. The latter includes managers, financial and commercial experts, advocates and technicians.

These assumptions change the traditional logic of urban competitiveness: instead of attracting firms, cities should attract creative people. This implies that in the new economic context jobs follow people: creative individuals increasingly choose their place of residence first and then they look for work or start a business of their own (Florida, 2002). A city's success is then linked to the cross-fertilization of ideas and tacit knowledge arising from the effects of face-to-face contacts between creative workers (Storper and Venables, 2004).

Other important scholars that have spread the creative city ideal are Landry (2000) and Clark et al. (2004), who focuses on the role of amenities. It is now more accepted that cultural, artistic, media-related, recreational, and leisure functions boost the local economies. An emphasis on "quality of place" and high-quality amenities is considered necessary for urban competitiveness. It is the way to attract knowledge-intensive workers, who have different spatial demands and consumption patterns than manual workers, and attach great importance to "third places" (neither home nor office) to meet. Cafés, pubs, terraces, cultural events, etc., and other similar spaces acquire a new dimension in the 'experience economy'

Even if creativity and many of its "urban components" are quite elusive concepts, Florida's thesis was rapidly appropriated by urban practitioners and city officials. In the US and Europe, many industrial centres in decay have attempted to rebrand themselves as creative places. "In the beginning of the twenty-first century, culture and creativity have become key concepts on the agenda of city managers, development agents and planners, who are desperately searching for new foundations in city development with dwindling city budgets." (Kunzmann, 2004, 384).

But in academic circles Florida's arguments have been object of great controversy. Several authors have questioned the validity of the data Florida presents to support his thesis; criticized the lack of detail of his explanations; and pointed out the problems of direction of causality of his approach (Glaeser, 2005; Peck, 2005; Montgomery, 2005; Rausch and Negrey, 2006). Recently, Kotkin (2010) has argued that the notion that attracting more talented people will in the long term produce greater economic effervescence would be one of the most damaging misconceptions in urban studies. "…this argument, or at least many applications of it, gets things backward. Arts and culture generally do not fuel economic growth by themselves; rather, economic growth tends to create the preconditions for their development." (Kotkin, 2010: 2).

2.3   *Comprehensive approaches to knowledge-based development*

In the new economic context the future of cities and regions depends on both knowledge-intensive and creative economic activities. Striving for urban competitiveness should include concepts linked to the business orientation – as high-technology, agglomerations, clusters, entrepreneurship – and the people orientation – such as amenities, high education, etc. – in an environment characterized by organizational capacity (Malecki, 2002). In a similarly comprehensive view, Storper (2010) has recently

examined the literature on specialization, human capital and institutions as main factors for city growth in the knowledge economy. He states that the New Economic Geography model considers the causes of urban growth to be "fully simultaneously two-directional."(2010: 2032). This means that jobs follow people, who in turn search for the benefits of large urban (home) markets. At the same time, people follow jobs because firms concentrate at these large urban markets, which allows them to produce more efficiently with economies of scale.

Besides these considerations, new environmental and social challenges have made urban planners and designers aware of the need of a proper balance between the economy, the social and the environmental aspects of city growth. Knight (1995) was among the firsts to link knowledge-based development and sustainability issues. Outlining the policy and planning implications for cities, he claimed that knowledge-based development – understood as the transformation of knowledge resources into local development – may be the best foundation for sustainable development.

The growing interest to issues linked to knowledge-based development has produced several studies which pay explicit attention to the necessary criteria for the successful development of knowledge cities. Ergazakis et al. (2004) have proposed six different categories: technological, strategic, political, environmental, societal and financial criteria (see Figure 2).
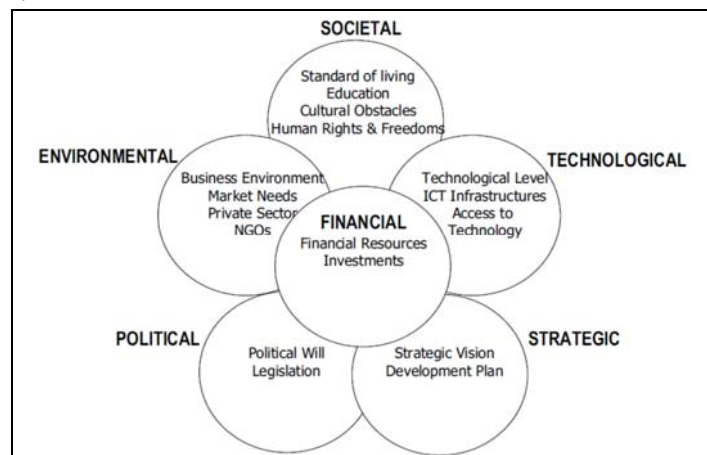

Figure 2. Success factors related to the Knowledge City concept (Source: Ergazakis et al., 2004)

In their study about European cities in the knowledge economy, Van Winden et al. (2007) have advanced seven criteria: knowledge base, industry structure, quality of life, diversity, accessibility, social equity and urban scale. These are considered the foundations to develop human capital and knowledge-based industries, which should be supported by local organising capacities (see Figure 3).
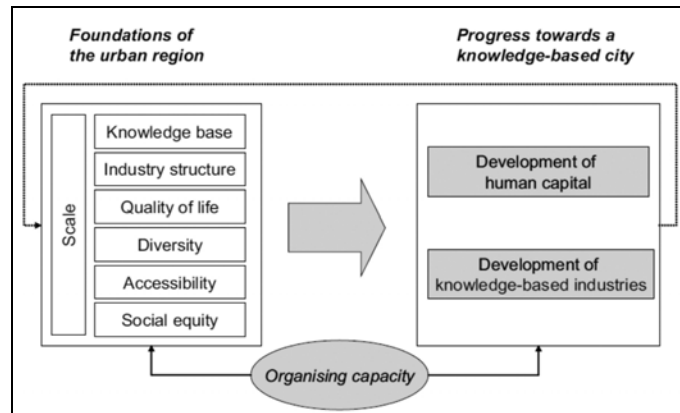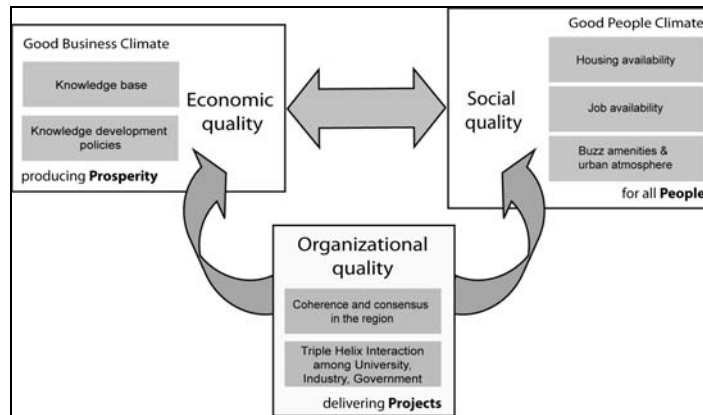
Figure 3. Cities in the knowledge economy: a framework of analysis (Source: Van Winden, 2007)

With an attention to sustainable development, Yigitcanlar (2009) narrows down to three pillars for knowledge-based urban development: society (including quality of life, human and social development and intellectual capital), economy (competitive, creative, innovative and knowledge-based) and environment (sustainable urban development, triple bottom-line sustainability and unique identity) (see Figure 4).
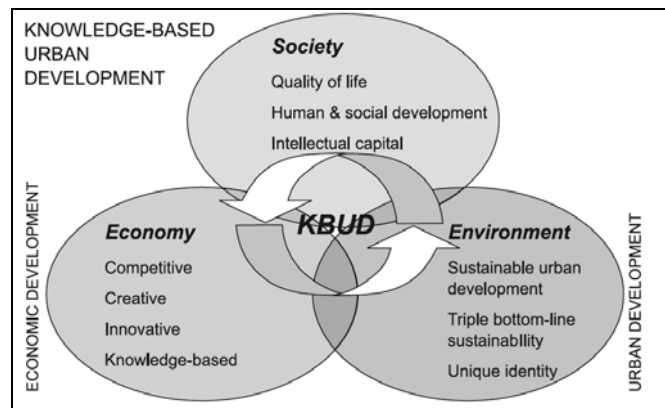
Figure 4. The three pillars of knowledge-based urban development (Source: Yigitcanlar, 2009)

With a similar attention toward sustainability issues, Fernandez-Maldonado and Romein (2010) state economic, social and organizational qualities as main criteria (see Figure 5). Acquiring a good level of quality in each criterion should lead to producing prosperity, delivering projects for all people.

Figure 5. A conceptual framework for sustainable development for cities in the knowledge economy (Source: Fernandez-Maldonado and Romein, 2010).

Besides the academic studies on the necessary conditions for knowledge cities, many cities have also launched initiatives that are labelled as Knowledge Cities, which follow a wide scope of approaches to achieve their goals. In practice, however, most of these initiatives are still focused on the development of spatial business-oriented strategies, as Technopoles, hoping to eventually evolve into a distinctive Knowledge City (Martínez, 2006).

3   From theory to practice

Putting such comprehensive frameworks into practice is not such an easy endeavour. Many former industrial centres have embraced Knowledge City or Creative City initiatives as a way to deal with their problems of economic reconversion. But this requires much more than only re-branding themselves into fashionable slogans. The main question is how have these new notions been translated into policies?

At European level, the Lisbon Agenda does not specifically support creative city development: "it strongly emphasizes knowledge and innovation, but not creativity as the link between." (Trip, 2009:14). At national and regional level, technological innovation is also the main concern in most economic policies.

At local level there is more attention to these issues, however. But even if cities may elaborate a comprehensive and balanced approach, the implementation of this kind of strategies is generally based on business-oriented interventions. In the Netherlands, where Florida's message was particularly well received at local level, Kooijman and Romein (2007) examined the implementation of the creative city concept in local urban policy. They concluded that despite the growing awareness of the importance of cultural and creative aspects among city officials, "the implementation of Florida's ideas has remained limited in the urban policy of the four largest Dutch cities. … Instead, the policy core lays most emphasis on giving explicit, direct support to businesses and creating a 'business climate', as opposed to a 'people-climate'." (2007:32-33).

This economic orientation occurs because the hard infrastructure (airports, digital links, high-tech spaces) can be established almost anywhere, but the establishment of the 'soft' infrastructure – an environment conducive to creativity – is a lengthy and slow process without guarantee of success (Baum, et al., 2008). Many of the elements of creative cities remain imprecise and as such difficult to achieve in practice. How to

capture and measure the "intangibles" associated to creative milieus such as tolerance, identity, authenticity, image, atmosphere, etc.? The main advocates of the creative city notion have not given a special emphasis on how to put their ideas in practice (Kooijman and Romein, 2007). While Florida (2002, 2005) tends to repeat the advices given in 1961 by Jane Jacobs, he does not really address how his ideas actually work in practice (Trip, 2007).

Besides the elusive nature of the elements linked to the creative city strategies, there are two other issues which pose specific problems for the urban practice, especially in those cities and regions which do not possess strong assets for knowledge-based development. These concern the proper urban scale, and path dependency.

Baum et al. (2008) have posed a relevant question regarding the possibilities of success of lower-tier cities in the knowledge economy. With evidence from Australian cities, they show that creative cities cluster settle in major metropolitan regions (Sydney, Melbourne and Camberra). Urban concentration is not only promoting the growth of the creative industries, but also an important element promoting local specialisation. "Generally speaking, geographical concentration and local specialization are highly present in newer or more innovative activities, or those that depend on hard-to-imitate skills or knowledge." (Storper, 2010: 2028). In this context, smaller cities have greater difficulties.

Another thorny problem is for those cities without a strong tradition on industrial production or creative activities. Path dependency means that once local economies get a critical mass in a certain specialization, they get a self-reinforcing structural character. Evidence from industrial areas shows that their growth may also be driven by fortuitous events. But there is no clarity about how to get into this development path (Storper, 2010). This theoretical uncertainty has also important implication for the planning practice in less advantaged cities and regions.

The next sections show the case of Eindhoven, a Dutch city which has had a singular success reinventing itself and by combining its technological base with the creative design sector.

4   The reinvention of Eindhoven as a knowledge city

The Netherlands belongs to the most economically advanced countries of the western hemisphere, and has strong assets in the transition toward the knowledge era. It has a very open economy, in which knowledge-intensive economic activities constitute a large and growing proportion. The Dutch population is highly urbanized and internationally oriented, and has a high education level. Its universities enjoy a good reputation at international level. The country also enjoys a well-developed ICT infrastructure and is among the best digitally connected countries of the world.

The Netherlands' largest concentration of high-technology firm is remarkably located outside the Randstad, the largest urban network of the country, which includes the four largest cities: Amsterdam, Rotterdam, The Hague and Utrecht. It is located in the Eindhoven region. The city of Eindhoven is the fifth largest city of the Netherlands (209,172 residents in 2007), located in the province of North Brabant, close to the borders with Belgium and Germany. At approximately 100 km of the Randstad, Eindhoven is the leading city in the second largest urban network, Brabantstad (see Figure 6).

Figure 6. The location of Eindhoven and main cities of the Netherlands

Thanks to an active regional partnership between companies, knowledge institutions and governments, and the presence of research labs – such as those of Philips, TNO and Eindhoven Technical University – Eindhoven has become the Netherlands' most important place for technology innovation. In 2004, the Dutch government appointed it as national 'Brainport', the main location for the development of a regional innovation system (Ministerie van VROM, 2005), which provides it with additional public funds, granted with the objective to strengthen the Netherlands as a dynamic and competitive economy.

4.1 Industrial origin and evolution

By Dutch standards, Eindhoven is a relatively young city. Eindhoven's industrial development at the beginning of the 20th century was driven by a local firm: Philips Electronics, which settled there in 1891. Philips' economic success made the city expand rapidly. Currently, Eindhoven still shows a decentralised pattern due to its origins in 1920, when five neighbouring villages were incorporated as suburbs.

Although its economic base has grown and diversified, Philips is still a dominant firm in Eindhoven, which is why it is still known in the Netherlands as Philips company town. Eindhoven calls itself the City of Light (*Lichtstad*) after Philips' initial business: a factory for incandescent lamps. With the hardware production sections and laboratories of Philips Electronics and other important electronic firms, Eindhoven scores the highest on high-tech industry employment and R&D activities in the Netherlands.

After the war, Eindhoven developed into the most important industrial centre of the Netherlands. As many other industrial centres, it was affected by a process of de-industrialization since the 1980s, which caused job losses in the city and the whole region. Philips declared 6000 workers redundant, and DAF (vehicle manufacturer) 2500, while other firms closed, what deeply affected the region's economic situation.

The process of restructuring of the regional economy was developed with the support of successive regional programmes. The first was the Stimulus programme (1993) for job

creation and strengthening of the industrial fabric, partly funded by the European Union. To face the industrial downturn, a regional approach was sought, in which Eindhoven worked together with other municipalities in the region. "The 34 municipalities in the Eindhoven region matched the European subsidies with a contribution of 11.50 Dutch guilders per inhabitant per year to create jobs in the area. Such a high municipal contribution to regional cooperation is unique in the Netherlands." (Van der Veer, 1998:42).

After Stimulus finished, the main regional stakeholders – in government, industry, and research and education – decided to cooperate closely with the objective to continue with the process of transition of Eindhoven's traditional industries toward into a knowledge-based and high-tech centre. In 2001, the Horizon programme replaced Stimulus, focusing on industrial innovation, reduction of shortages of skilled labour, diversification of the knowledge industry, and international branding. These two programmes produced a significant economic restructuring and economic recovery, upgrading its industrial structure to make it more high-tech and in line with its knowledge base.

The current structure of the regional economy consists of a few large firms – such as Philips, DAF and ASML (a joint venture of Philips and ASM International dedicated to electronics) – working closely with medium- and small-scale suppliers of specialized knowledge and design, and knowledge institutes. In Eindhoven only, the numbers of firms, institutes and jobs increased with one-third to a half between 1995 and 2000, and has increased a bit further in more recent years.

One of the best assets of Eindhoven is its organizational capacity, embodied in the high synergy between business, university and local government (Fernandez-Maldonado and Romein, 2010). The so-called triple helix is a very positive feature of this city-region, in which "personal and institutional networks are very dense; there is a shared feeling of local pride and identity." (Van Winden et al., 2007: 542). This close collaboration between the main regional stakeholders has been institutionalized in the Foundation Brainport (Stichting Brainport). This has elaborated an ambitious and comprehensive programme, "Brainport Navigator 2013" (Stichting Brainport, 2005), whose mission is to promote economic and social development toward a high quality of life for people in the region and, through this, to achieve a sustainable and globally competitive region.

This programme has replaced Horizon, and aims to the development and completion of the value chains of spearhead sectors. These are life-tech (life sciences, medical technology), high-tech systems (ICT, micro-electronics, nanotechnology, automotive and mechatronics) and creative industries.

4.2   Eindhoven's position in the knowledge economy

Confronted with the challenges that cities have in the knowledge economy, Eindhoven has many advantages but also some clear disadvantages. According to the typology elaborated by van Winden et al. (2007) for European cities in the knowledge economy, Eindhoven is considered a Star Nicheplayer. This typology considers two main criteria to define typologies of knowledge cities: urban scale and progress towards the knowledge economy. The Star Nicheplayer qualification of Eindhoven means a clear advantage in terms of knowledge base and economic base and a certain disadvantage in terms of urban scale.

Indeed, these two features characterize Eindhoven's development. On the one hand, it has great assets, due to the high quality of its industrial, economic, and knowledge base. It has the highest innovation index among the Dutch provinces. Its city-region is where most of the private R&D expenditures of the Netherlands is located (45 percent of the national R&D expenditures). Further, the level of synergy between high-level education and high-tech local firms is remarkable. An examination of university-industry co-authored research publications among the 350 largest research universities worldwide concluded that the Eindhoven Technical University (TU/e) had the largest percentage of co-authorship with industry (Tijssen et al., 2009).

Eindhoven's synergy is, however, much more than co-authored publications. "The technical university is considered highly important by local high-tech firms as a partner for contract research and as a supplier of new staff and trainees. Also, it is the cradle of new businesses and start-ups. The environment for these new firms is favourable, as the urban region has a rich pool of potential clients, suppliers and dedicated service providers. Several well-functioning business support networks are in place, with active participation of the local technology sector and academic institutions." (Van Winden et al., 2007: 538).

On the other hand, Eindhoven has evident problems related to its modest urban scale and its location outside of the Randstad. In the knowledge economy proximity matters for access to and exchange of ideas. But Eindhoven does not possess the advantages of agglomeration required for attracting creative sectors. The 125 km that separates it from Amsterdam are not much, which is why some creative people that work in Eindhoven decide to live in Amsterdam. Furthermore, in the Netherlands, Eindhoven has the image of a provincial city, due to its development from several villages. This is also because its city centre lacks the historic architectural heritage that characterizes most Dutch cities, which constitutes an additional constraint to attract creative workers.

5   The marriage of technology and design in Eindhoven

In the knowledge era, the synergy between technology and design has become crucial for international competitiveness. Economic growth does not only depend on high technology, but also the ability to incorporate cultural knowledge and design distinctiveness into products and services. The awareness of these new economic trends has led to attempts to combine technology and design not only at the level of the urban economy but within the high-tech sector itself. A gesture that illustrates this design orientation was done in 2004 by Philips Electronics, when it decided to change its traditional motto 'Let's make things better' – which referred to technical innovation – into 'Sense and Simplicity', which refers to those "soft aspects" of everyday life.

The new orientation of the Eindhoven city-region's economy stems from the deep awareness of its own strengths and weaknesses. Eindhoven's technologically advanced production industry is very much export-oriented. Its export orientation and specialization makes it vulnerable to the usual fluctuations of the global economy. To tackle these issues, the production structure has been gradually diversifying. The existing clusters strive towards the completion of their value chains. This means a R&D starting point, but also includes the design, testing, producing, marketing and distribution of advanced goods.

The concept of design in Eindhoven is, then, a comprehensive notion that includes industrial design, artistic design, as well as the design of innovative ways to tackle their own development problems. The orientation toward the creative sector in Eindhoven has

not been the fruit of fashionable urban trends that may be valid in large metropolis, but difficult to implement in different contexts. Eindhoven's design orientation is a necessity coming from its endogenous economic development and as such it has a certain tradition.

Two design institutions of international prestige constitute solid foundations of Eindhoven's design orientation. The first is the Design Academy Eindhoven (DAE), the former design school of Philips, *alma mater* of the most well-known Dutch designers, and where many prestigious designers teach. Recently, the Ministry of Culture has granted the Design academy a monetary prize as one of the three institutions of 'international excellence' in the Netherlands. The second design asset of Eindhoven is precisely Philips Design, the design department of Philips Electronics, which is one of the largest and longest-established design organizations in the world. It counts with more than 400 workers which work not only for Philips but also for other prestigious brands as Nike, Levi's, Orange and Securitas (Van de Sande, 2005).

Another asset in this option for design is the consensual character of this orientation. Local government, educational institutes and firms in Eindhoven agree with this strategic shift toward design, so the changes required for this orientation have developed at the level of institutions, which are now delivering concrete spatial interventions.

5.1 Organizational changes

There are many public and private efforts of stakeholders to support the design orientation of Eindhoven, trying to link Eindhoven's national and international image with creative design. However, the city does not try to do it by attracting designers with cafés and discotheques, but, more seriously, by showing the other side of design: designers, processes, links with technology and innovative materials, and good communication. "Policy makers, business sector, the Technical University, TNO Industry, the Design academy, everybody in Eindhoven invests in the design dance" (Van de Sande, 2005: 3).

The largest projects are coordinated by Design Connection Brainport, the agency of the Brainport Foundation in charge of giving an impulse to the dynamics of the design sector. The local business sector, the creative industry, and knowledge institutes work together in this agency for the implementation of the programme 'Design in Brainport 2005 – 2010'. Its mission is to reinforce the position of Eindhoven's city-region in the field of design in combination with technology. Design Connection Brainport manages several projects in three main areas (Design Connection Brainport, 2010):

- get connected – aimed at giving designers, firms, technology institutes, and market partners the opportunity to meet and develop new ideas for innovative products;
- get noticed – aimed at showing the design strengths of the region at international level; and
- get support – aimed at assisting design starters on their way to entrepreneurship.

An important activity under the umbrella of the Design Connection Brainport is the organization of the Dutch Design Week (DDW), for the ninth time in 2010. This is an annual nine-day event to show Dutch design and Eindhoven design to the world. The DDW hosts lectures, workshops, fashion shows, seminars, and design exhibitions. These include the Graduation projects of the Design Academy Eindhoven, and the award ceremony of the Dutch Design Awards (DDW, 2010). The DDW attracts an international audience that grows every year.

Another important supporter of design activities in Eindhoven is the Foundation ALICE, Creative Connection Eindhoven. This is a local lobby group for the creative and cultural industries which emphasizes the technology-design synergy. In 2003, a study on the creative sector was conducted in the Eindhoven region at the initiative of ALICE. It found that the creative industries provide employment for at least 30,000 people (8% total regional employment), while the construction sector employs 7% and the education and ICT sectors provide 5.5% of jobs each (ALICE, 2010).

ALICE provides information – mainly through electronic media – about the many other design and creative initiatives as well as about design education, clusters, festivals, organizations, subsidies and support, and European art spaces. Main subjects are architecture, art, writing and publishing, film and video, (leisure) software, music, television and radio, performing arts, advertising and industrial design.

The Eindhoven Council, on the other hand, has also developed a cultural policy, "Total culture" (Cultuur totaal), launched in 2008. "Total culture encourages the contribution of culture to the top position of the city, accommodates talent and brings broad social groups in contact with art and culture." (Commissie Cultuur Totaal, 2010:3). The council decided that art, music, design and urban activities would be the spearheads of the cultural policy.

5.2 Socio-spatial transformations

Eindhoven eagerly wants to attract creative people and visitors with a good quality of place. Despite its lack of urban atmosphere, the region has an attractive regional landscape. In 2005, the Architecture Centre Eindhoven (ACE) organized "Eindhoven SUPERvillage" – an exhibition, a publication and several workshops – (ACE, 2005). Its objective was to identify the most adequate residential environments to make Eindhoven an internationally competitive region. They recommended strengthening the existing characteristic of the regional landscape, combining a gradual scale of urban and rural environments in a fine-grained network of medium-sized towns, villages and open land.

But the centre still struggles with its provincial image and the lack of architectural heritage. An attempt to change this image is formulated in '*Eindhoven as a city with an attractive heart*' policy. This is one of the four spearheads of the city's vision for its future development, which aims to attract mobile investment capital and skilled knowledge-workers, and to retain young people after graduation (Gemeente Eindhoven, 2004b).

Eindhoven may not have a rich medieval past, but it has a rich industrial past, which in the current economic context is also regarded as a valuable asset for quality of place. Therefore, the spatial strategy has been to redevelop the city centre and to reuse the Philips' obsolete factory buildings for residential and cultural purposes. The new living spaces will bring to Eindhoven the "urban atmosphere" that it needs.

The transformation of Eindhoven has been developed in three phases. The first one was the redevelopment of the Stadhuis (Municipality) and its surroundings, to provide them with more urban quality. The second phase consisted on the renovation of the White Lady (Witte Dame), a large (white) building in the centre of Eindhoven. The White Lady, built in the 1920s, used to accommodate Philips' factory of incandescent lamps, the initial business of Philips. It is an emblematic building for the city and its residents, due to its former use – the origins of the city development – and because its "Light Tower" dominates Eindhoven's urban landscape.

As a result of the de-industrialization process, the building became empty in the 1980s. It was saved from demolition by artists and designers who made a redevelopment plan which stated that the main functions should be related to design, ICT or culture. In this way, the most important design icons of Eindhoven, the Design Academy and Philips Design were accommodated in the White Lady (see Figure 7).

Figure 7. The White Lady and its Light Tower (Own archive).

The third phase, currently developing, is the most spectacular. It concerns the reuse of Strijp-S, an industrial area of 27 hectares close to the city centre, which began in 2004. The entire area used to be part of the Philips industrial complex, a forbidden area for those who did not work there. The regeneration of Strijp-S is turning the area into a mixed-use complex of residential (2500-3000 dwellings), 90,000 m^2 of office space, and 30,000 m^2 of commercial, cultural and leisure facilities. The redevelopment of Strijp-S is also the fruit of cooperation between private and public partners. Park Strijp Beheer is the developer, in which the municipality and Volkers Wessels construction firm participate (Van Geel, 2009).

Figure 8. Strijp-S, the former Philips complex (Source: Strijp-S, 2010)

The Clock Building (Klokgebouw), is another emblematic building of Eindhoven, which was assigned to the function of "culture factory" due to its large-scale halls that provide great spatial possibilities. It has been the first phase of the transformation of Strijp-S and it currently accommodates more than a hundred creative businesses. Woonbedrijf, a local housing corporation, is now offering 198 dwellings – most of them for rent – in the E area along the Kastanjelaan. The building activities began in June 2010. Furthermore, TRUDO has plans to offer "industrial lofts" in the SAN and SBP buildings.

Another historic building of Strijp-S that will be renovated is the old Philips' NatLab (Natuurkunde Laboratorium/Physics laboratory), opened in 1922, and where Albert Einstein worked as guest. In this building, the Queen Wilhelmina gave her first radio speech in 1927 (Van Geel, 2009).

Strijp-S has several ambitious initiatives (see Figure 9). One of the most interesting is Light-S linked to Eindhoven's City of Light motto. Strijp-S aspires to become a unique environment to show the role of public lighting and the latest innovations in the field to the visitors and residents. The new lighting solutions will create experiences that are related to the individual characteristics of the area. Light-S is a collaboration of Park Management Strijp, NRE Network and the City of Eindhoven, in which Philips Design designs the lighting. (Strijp-S, 2010).

Figure 9. The main initiatives of Strijp-S (Source: Strijp-S, 2010)

Furthermore, Strijp-S has become an important place for events, concerts and festivals. It is an important place for the Dutch Design week, but also for Flux/S, an annual international art festival, and STRP, an annual festival linking art and technology.

Besides these three important steps towards the improvement of the quality of place of Eindhoven, the municipal department of Art and Culture has developed the concept 'Eindhoven laboratory city'. Among the different initiatives, it includes efforts to acquire empty buildings and to make these available for starting businesses in the creative and cultural sector (Gemeente Eindhoven, 2004a).

But private initiatives are also providing accommodation and work space for artists and students. In December 2008, the HCZ building, another former Philips building which was vacant, was occupied by a group of young artists with the idea was to use the building not only for residential purposes but to convert it into a huge cultural stronghold. The organizers then followed a strict selection procedure to avoid persons that might use the building for other uses that would not combine with the cultural purposes. There are now 120 users of the 360 rooms (11,000 m^2). The users – students of the Design

academy, of the Technical University, artists of different disciplines and some families – are well organized and pay a low monthly fee for maintenance (de Graaf, 2009).

These different initiatives, at regional, local and neighbourhood scale, show that the aim of turning Eindhoven into a city that properly receives and attracts the creative sector is shared by all sectors of society. As such, it has great possibilities to succeed.

6   Conclusion

In the last years, knowledge-based urban development strategies have attempted to implement policies which give attention to both economic and socio-spatial aspects of city growth and development. However, some of the elements related to the socio-spatial aspects are difficult to implement in practice. To change and improve the "urban atmosphere" of a city in order to become attractive to creative workers is not only a matter of improving the commercial and entertainment functions of the city and branding it as creative. The practice shows that this should be the matter of a long-term strategy supported by all sectors of society.

This is precisely the case of Eindhoven, whose efforts in that direction are highly commendable. Eindhoven's strategy and corresponding projects and initiatives to make the city a design capital are not the fruit of top-down decisions, but are firmly embedded in dense and close networks among stakeholders from the different elements of the Triple Helix. Eindhoven has experience in overcoming its own problems, and was able to reinvent itself as a high-technology region after de-industrialization processes deeply affected its economy in the 1990s and 1980s. This has given stakeholders and residents the necessary confidence and experience to undertake new endeavours, such as the orientation to the creative sectors.

Despite their natural modesty, residents and stakeholders of Eindhoven exhibit a regional pride that motivates them to cooperate towards their clear and common objective to make Eindhoven a 'top-technology and design region". The interviews with the different stakeholders rapidly revealed their awareness of the region's strengths and weaknesses in the new economic context. Design is widely considered as the instrument to improve the local knowledge-based development. There is a clear consensus about the position and ambitions of Eindhoven within this new context, a fact which has facilitated the orientation toward the design direction.

Eindhoven has put an enormous amount of energy to implement urban projects that are gradually improving its attractiveness and "urban atmosphere" by mixing residential, work and cultural functions. At the same time, the agencies and organizations in charge to put Eindhoven in the map of design at national and international level and to link the creative sector with high technology have done a good job.

Thanks to the multiple public and private efforts, Eindhoven is gradually becoming an international attraction point in the field of design. It has a dense network of associations and organization dedicated to link technology and design. Local stakeholders note that students of the Design academy do not immediately leave the city as in the past (Van de Sande, 2005). The share of workforce in the creative sector in Eindhoven has increased, being among the highest in the ranking of Dutch cities (Marlet and van Woerkers, 2007). This suggests that, despite that this is a slow and difficult process, the strategic orientation towards design has already achieved an own development dynamic in Eindhoven.

The case of Eindhoven can serve as inspiration for other cities and regions with similar characteristics. But to implement the lessons learned from the Eindhoven case in

other realities, however, a special care should be given to other indispensable elements of Eindhoven's success story, such as the strong regional identity and the organizational qualities of the region.

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