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## **Does Size Matter? Knowledge-Based Development of Second-Order City-Regions in Finland**

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# Does Size Matter? Knowledge-Based Development of Second-Order City-Regions in Finland

**Abstract:** Achieving knowledge-based urban development (KBUD) profoundly depends on not only encouraging the development of economic activities, but also strengthening the societal, environmental and governance bases of city-regions. In recent years, a number of global city-regions have been investigated from the angle of this multidimensional perspective, which has provided a new comprehension in the development processes of primate city-regions. However, there is a knowledge gap in understanding how KBUD works in the second-order city-region (SOCR) context. This warrants more attention as SOCRs potentially help secure balanced development and territorial cohesion. This paper aims to empirically investigate KBUD performances of SOCRs in order to generate new insights. An assessment framework is utilised in the Finnish context, where the findings provide a nationally benchmarked snapshot of the degree of achievements of SOCRs based on numerous KBUD performance areas. The results shed light on the unique Finnish urban and regional development process, and provide lessons for other SOCRs.

**Keywords:** Knowledge-based urban development; knowledge-based development; knowledge city-region; primate city-region; second-order city-region; Finland.

## 1 Introduction

City-regions have been extensively investigated as the engines of knowledge-based development (KBD) (Pancholi et al. 2014). These investigations were undertaken with considerations from either the ‘economic angle’ (Etzkowitz, Klofsten 2005; Cooke, Leydesdorff 2006; Huggins, Strakova 2012; Hájková, Hájek 2014; Huggins et al. 2014) or the ‘societal angle’ (Klagge, Klein-Hitpass 2010; Yang 2012; Garcia, Chavez 2014). Nevertheless, discourses on sustainable urban development (Nijkamp, Perrels 1994) and climate change (Gough 2002) have been neglected in KBD inquiries (Mieg 2012). Consequently, the ‘spatial dimension’ was largely overlooked in empirical KBD explorations. However, in recent years, this dimension has become an integral part of the KBD conceptualisation along with the ‘governance dimension’ (Maldonado, Romein 2010; López-Ruiz et al. 2014).

Carvalho et al. (2014) and Lönnqvist et al. (2014) underline the critical role of city-regions’ knowledge assets as drivers of KBD progress since performance differences between city-regions are explained by the variance in their asset mix. Other scholars advocate that KBD of city-regions, or ‘knowledge-based urban development’ (KBUD), is a multidimensional and balance-seeking development approach, aiming to form desired places of life, work, study and visit—e.g., knowledge city-regions (Kunzmann 2009; Carrillo et al. 2014). A sustained KBUD requires not only encouraging the development of knowledge-based economic activities, but also strengthening the societal, environmental and governance bases of city-regions (Maldonado, Romein 2010; Carrillo et al. 2014; Fachinelli et al. 2014). Accordingly, KBUD offers for city-regions a multidimensional and balanced development opportunity to achieve viable economies, social justice, environmental sustainability, and good governance (Yigitcanlar 2010, 2011, 2014a).

Although this type of development trend is widely advocated, there is limited empirical research exploring KBUD performances of city-regions (Sarimin, Yigitcanlar 2012). The existing research is either focussed on a single city-region (Yigitcanlar et al. 2008; Zhao 2010; Lönnqvist et al. 2014; Yigitcanlar et al. 2014; Yigitcanlar, Sarimin, 2015) or, if comparative, concentrated on global primate city-regions (Campbell 2009; Yigitcanlar 2009; Yigitcanlar, Lönnqvist 2013; Yigitcanlar 2014a; Yigitcanlar, Bulu 2015). Moreover, second-order city-regions (SOCRs) have not been the primary focus of KBUD research as large and primate city-regions are favoured. While the lessons from primate city-regions provide invaluable generic insights, they only offer limited adoptable lessons for SOCRs due to factors including economic capacity and population size differences (Markusen et al. 1999; Nagy 2001; Mayer 2012). Furthermore, there is no empirical research that targets SOCRs’ comparative KBUD accomplishments. This brings out the knowledge gap in measuring performance

of SOCRs in a multidimensional fashion that is required for determining suitable development pathways.

In the recent period of economic downturn, some SOCRs have recorded annual GDP growth rates much less negative than those of primate city-regions—such as in Austria and Germany (Parkinson et al. 2014). For this reason, inquiring into the KBUD performance of SOCRs is the primary aim of this study. As advocated by Hodos (2007) and Agnoletti et al. (2014), the economic role of a city-region is an important factor (though not the sole one) in distinguishing SOCRs from the global ones. This paper argues that there is a need for interlinking economic, societal, environmental, and governance factors in a multidimensional fashion when assessing KBUD performances of SOCRs. This conceptual argument and its consequences for planning are discussed here in the light of an empirical exploration. The investigation is undertaken to determine the factors that impact KBUD in a globally acknowledged innovation-intensive country (Finland). This research has implications for planning and development as the empirical validation of SOCRs' KBUD performances has thus far received little attention. Drawing on the existing literature and KBUD studies, we set two main objectives for the paper: (a) To revisit and apply the analysis framework as a platform for urban and regional comparison that reveals performance variations among the SOCRs, and; (b) To explore similarities and differences between the cases in regard to their developmental attributes, and thus, expose their unique KBUD characteristics.

Finland was selected as the empirical investigation test-bed for the comparative performance analysis of SOCRs. The reasons behind this selection are as follows: Firstly, Finland has been profoundly encouraging economic competitiveness since the 1990s. This turned the country into a leader in innovation economy (Makkonen, Inkinen 2014a). Secondly, Finnish SOCRs are amongst the prominent city-regions in the world that adopt knowledge economy and society principles and effective KBUD strategies (Kostiainen, Sotarauta 2003; Vanolo 2008). This paper provides a comparative analysis of KBUD conditions in the study locations (Tampere, Turku, and Oulu city-regions), where their performances are benchmarked against a primate city-region (Helsinki city-region—housing the cities of Helsinki, Espoo, and Vantaa).

## **2 Finnish Second-Order City-Regions**

In recent years, there has been a considerable growth of interest among both policymakers and researchers in SOCRs. They are defined as the tier of urban agglomeration immediately below the primate city-region (Parkinson et al. 2012; Champion, Townsend 2013; Champion et al. 2014). Even though concerns about overconcentration in primate city-regions and the economic prospects of SOCRs are evident in Europe; Evans (2015) argues that European SOCRs still warrant more attention, because they could potentially help secure balanced development and territorial cohesion. As Parkinson et al. (2012) point out, if the primate city-region dominates the urban system, the national economy becomes spatially and structurally unbalanced. On the other hand, in the USA, knowledge worker and industry intensity in SOCRs has provided evidence that these city-regions are also in competition for high-tech activity against the world cities (Markusen, Schrock 2006; Yigitcanlar et al. 2007). In this context, Finland is a remarkable example of national government policies significantly improving economic prospects of SOCRs (Parkinson et al. 2012).

Finland provides an internationally inspiring test ground for the KBUD analyses of SOCRs. Despite extensive land area and small population resulting in quite low urban population densities (16 people/km<sup>2</sup>), Finnish SOCRs—i.e., Tampere city-region (in Finnish language Pirkanmaa), Turku city-region (Varsinais-Suomi), Oulu city-region (Pohjois-Pohjanmaa)—along with the national primate city-region—i.e., Helsinki city-region (Uusimaa)—have been displaying promising KBUD progress (Figure 1). As noted by Sotarauta and Kautonen (2007) and Jauhiainen (2008), urban and regional policy played a highly important role during the last three decades in initiating such progress (aimed to expand to all parts of the country as equally as possible). For instance, in Finland, polycentric development is not perceived as dependent on geographical proximity, but rather is seen as cooperation and connection (Eskelinen, Fritsch 2009).

[INSERT FIG.1]

Fig. 1: Locations of Finish City-Regions.

Finnish city-regions have a long tradition in science, technology and innovation (STI) policies comprising a key element in KBUD. Finland has been consistently scoring high positions in the international benchmark studies, for instance, ranked fourth in the 2014-2015 World Economic Forum's global competitiveness index in the overall category, and first in the innovation category. The national structures are divided into two main policy strands existing in Finland—national technology and science. There are agencies, centres and programs to implement the goals set in these policies. The Academy of Finland provides funding for academic and scientific research. Centre of Expertise (1994-2013), Regional Centre (2001-2009) and Regional Cohesion and Competitiveness Program (2010-2011) support SOCRs through specialisation and cooperation initiatives (Tervo 2005). TEKES (Finnish Funding Agency for Technology and Innovation) funds R&D and innovation activities (Lemola 2003; Makkonen, Inkinen 2014b).

Parkinson et al. (2012) list the following crucial features of the Finnish approach to urban and regional development policy: (a) Finland has rapidly urbanised with a dominant capital city-region and a small number of significant SOCRs. (b) Traditionally national policies have been regional (not urban) and focused upon redressing regional inequalities to help declining regions. However, during the past decade, there has been a major shift to economic competitiveness with major implications for urban areas. (c) There has been a concentrated national focus upon modernising the economy, especially through innovation and the triple-helix model of partnership. (d) There has been consistent investment in education at all levels, especially universities are seen as the key drivers of national economic performance. (e) There has been a series of national strategies to support projects that improve regional economic performance. (f) Local authorities have considerable powers and resources and are well positioned to address economic change, and the national government recently has attempted to restructure local authorities to encourage collaboration across cities. Nevertheless, migration and economic processes have concentrated population and development towards a few dominant city-regions (Lehtonen, Tykkyläinen 2010) resulting in a polarised regional pattern led by Helsinki, (Merisalo et al. 2013) and followed by the SOCRs (Antikainen, Vartiainen 2005).

Suorsa (2007) empirically compares innovation and technology strategies and policy implementation tools in Finland, Norway and Sweden. She has pointed out an important notion concerning regional characteristics within Nordic countries, and indicated the importance of the welfare state in the Nordic policy documentation. Considerations of egalitarian opportunities on higher education and entrepreneurship as well as the regional and urban challenges continue to exist in Finland. This is also a wider problem in other Nordic countries that causes regional disparities. Steinbock (2009) has indicated that size matters as the primate city-region of Helsinki hosts the majority of international and large national company headquarters in Finland.

Sabel and Saxenian (2008) provide important insights and reflections to Finnish context on innovation, KBUD and future national development. They delivered extensive background information on Finnish national economy structure that has traditionally relied on forestry and ICT clusters lead by Nokia's extensive R&D efforts and related subcontracting network. The struggling of Nokia (cellular phone division was purchased by Microsoft), particularly in the development of smart phone technology, has provided a challenge for the whole national economy to restructure itself towards new innovative openings. As Sabel and Saxenian (2008, p.114) note, "the dominance period of Nokia from 1997 to 2002 has led to a significant increase in nationally granted patents". They indicated that city-regions of Helsinki, Tampere, Turku and Oulu have benefitted from hosting Nokia's R&D units.

Finnish city-regions have unique KBUD images and profiles. Helsinki city-region has profiled itself strongly as an international metropolis that combines volume and diversity on all aspects of KBUD as well as being the home for Nokia headquarters in Espoo (Inkinen, Vaattovaara 2007). Tampere city-region is an example of an industrial region with strong ties to KBUD programs and activities. A large-scale effort was the e-Tampere program that combined various stakeholders aiming

to promote urban development (Inkinen 2012). Oulu city-region has traditionally highlighted ICT-based growth and engineering technologies as its industrial KBUD spearhead (Jauhiainen, Suorsa 2008). Nokia has had an important role for Oulu as the company and its subcontracting networks have been large employers in the city-region, which at the moment is bad news since Microsoft has announced plans to close down the former Nokia R&D unit in Oulu. Turku city-region has relied mostly on the long urban history as hosting the oldest city in Finland (the former national capital) as well as having knowledge-intensive facilities located in Salo.

Urban contexts and locales have their industrial traditions and histories, which bring forth the need for renewal and transformation (Hodson 2008). Tampere (used to be called the ‘Manchester of Finland’) for example, has a long tradition in industrial development such as textiles, metal and wood, where as Helsinki and Turku have always been more service driven with a smaller industrial capacity (Carrillo et al. 2014). Today, Turku has a strong mindset towards profiling itself as a biotechnology centre (Srinivas, Viljamaa 2008). Biosciences have impacted science policies and particularly regional level authorities in their efforts to identify regional strengths and potentials (Cooke 2004). International connectivity is critical for economic success of knowledge-producing clusters in city-regions. Helsinki-Vantaa airport is the main international hub and the only intercontinental airport (others serve to some regional international locations) and hosts the national airline of Finnair (Inkinen, Pyyhtiä 2013). Table 1 lists salient characteristics of Finnish city-regions.

[INSERT TAB.1]

Tab. 1: Salient Characteristics of Finnish City-Regions.

It is evident that the national innovation system and KBUD are in a transformative stage. The transformation is interlinked with the regionalisation of the Finnish STI policy (Lemola 2003). Regional development initiatives are derived from the pressure of global competition, as nations need innovative cores. Emergence and form of these initiatives, commonly public sector led, transform the practice of traditional regional policy. An interesting example of a changing innovation system is the renewal process of tertiary education and implementation of the new university law in 2010. Not surprisingly, all Finnish city-regions have multidisciplinary universities giving further evidence of the regionally balanced policy goals. SOCRs’ universities have distinctive profiles and aim to contribute to the location-based strengths. The transformation is accumulated by the diminishing significance of Nokia in the national economy. Global market competitiveness requires new efforts to ensure sustaining the prosperity of Finnish city-regions (Steinbock 2009; Ali-Yrkkö 2010). The transformation process within the Finnish national innovation system has lead to visible changes that are currently taking place. The main actors, TEKES and the Academy of Finland, have modified their operating methods in order to easily identify new directions in innovation (Makkonen, Inkinen 2014b). Innovation policy focus has moved towards large-scale projects that require extensive international collaboration.

### 3 Empirical Analysis

The literature findings on Finnish city-regions reveal that most studies have looked at the Finnish context from a limited KBUD standpoint, hence missing the opportunity to provide a comprehensive view. The earlier accounts on Finnish KBUD investigations clearly indicate the challenge for creating more robust and diverse monitoring measures and performance analysis tools to inform policymaking. This requires a combination of multiple datasets from diverse segments of society to be incorporated into KBUD analyses. This approach provides various insights to KBUD as a larger phenomenon than only techno-economic measures are able to produce. Furthermore, the literature on KBUD indicates that becoming a prosperous knowledge city-region requires additional perspectives rather than solely relying on KBD—capitalising on socioeconomic aspects of the development—such as investing on space/place and organisational excellence (Gabe et al. 2012; Carrillo et al. 2014).

This study adopts a multidimensional KBUD conceptual framework as an overall guide to undertake a quantitative analysis of the Finnish SOCRs. The framework (Figure 2) provides a comprehensive investigation opportunity with its multidimensional policy domains—i.e., economic,

societal, spatial, and institutional developments (Yigitcanlar, Lönnqvist 2013). In this framework: *Economic development* aims to build a knowledge economy that produces prosperity (Lever 2002) achieved through strong macroeconomic and knowledge economy foundations, and form good business climate. *Societal development* seeks to establish a knowledge society that produces social equity (Ovalle et al. 2004) achieved through strong human and social capitals, diversity and independency, and form good people climate. *Spatial development* pursues to develop a knowledge milieu that produces sustainability (Knight 1995) achieved through sustainable urban development, quality of life and place, and form good spatial climate. *Institutional development* focuses on generating knowledge governance that produces enablers (Maldonado, Romein 2010) achieved through strong governance and planning, leadership and support, and form good governance climate (Yigitcanlar 2014b).

We gathered relevant information on the policy areas of the conceptual framework to provide an overarching view of the Finnish SOCRs' KBUD performances. As for assigning specific indicators for each of these key areas, we adopted the 'KBUD Assessment Model/Framework' (KBUD-AM). The assessment framework has been applied to a number of international studies, and proven effective as a performance assessment and benchmarking tool (Yigitcanlar, Lönnqvist 2013; Carrillo et al. 2014; Yigitcanlar 2014a; Yigitcanlar et al. 2014; Yigitcanlar, Bulu 2015). Table 2 presents the structure of the analysis framework.

[INSERT FIG.2]

Fig. 2: Multidimensional Conceptual Framework. (Yigitcanlar 2014a, p. 5551)

For accommodating the assessment framework in the Finnish SOCR context, the indicator system was specifically tailored. The assessment framework's overall structure—consisting of a composite index, four indicator categories, eight indicator sets and 32 indicators—was left intact. Only two of the eight indicator sets—in the institutional development domain—were changed due to the Finnish governance environment being different from the previous international study contexts. Out of 32 indicators of the original assessment framework, 21 were kept in the revised framework due to their suitability. 11 new indicators were introduced to better capture and evaluate KBUD of Tampere, Turku, and Oulu, and assess cross-comparison performances against the benchmark Helsinki (Table 2). In the selection process of the new indicators general principles of measurability, analytical soundness, comparability, geographic coverage, data availability, and relevance were considered.

[INSERT TAB.2]

Tab. 2: Second-Order City-Region Analysis Framework.

KBUD-AM assigns equal weightings to indicators and uses the z-scores method for the normalisation protocol of indicators. In order to benchmark indicator values for Finnish SOCRs, we included the primate city-region Helsinki into the assessment framework and executed cluster analysis to understand how these cases group together. Yigitcanlar and Lönnqvist (2013), Carrillo et al. (2014) and Yigitcanlar (2014) extensively discuss the methodological specifics of the assessment framework including its mathematical algorithm and indicator selection process. Rather than repeating how the results of the framework were calculated, in this paper we focus on the findings.

## 4 Results and Discussion

The results of the empirical analysis in four separate KBUD domains are presented in Table 3. The last row of the table shows the overall KBUD scores—normalised values with highest being the best. Figure 3 illustrates KBUD and domain scores of the case city-regions. The raw values for each indicator are listed in Appendix A. As expected the results indicate that the benchmark Helsinki city-region is clearly ahead of the other three. The SOCRs' performances are quite close to each other, although Tampere is confidently leading, and Oulu is lagging slightly. These findings are in line with the observations of Champion et al. (2014)—in the urban resurgence accompanying the growth of

knowledge economy, SOCRs appear to be losing out to the primate city-region, especially where the latter is much larger and benefits from substantially greater agglomeration economies.

[INSERT TAB.3]

Tab. 3: Performance Area Scores.

[INSERT FIG.3]

Fig. 3: Overall Performances of City-Regions.

In terms of specific KBUD domains, Helsinki outperforms the others in three domain areas. However, the performances of Helsinki are roughly on the same level with Tampere in the spatial development domain. It seems that the superior performance of Helsinki is due to its greater size. For example, a large city-region commonly hosts a big university producing high quality research outputs and thus performing better in the university rankings. Similarly, in a big city-region there are many NGOs providing services for a variety of special interest groups. Thus, it seems that some of the indicator results achieved by Helsinki are strongly size-related, which has been evidenced also in the recent literature (Burger et al. 2014; Parkinson et al. 2014; Van Oort et al. 2014). On the other hand, some of the negative aspects—higher cost of living, lower personal safety—seem to be directly linked to the size issue. This is an important observation in regards to the value of the multidimensional and balanced KBUD approach, as focusing on economic development would only give a partial view of the reality. The notion of Oulu city-region falling behind can perhaps be explained by the tyranny of distance—Oulu being located further north than Helsinki, Tampere and Turku that are relatively close to each other. This proximity provides an inter-regional or inter-metropolitan spill over effect for Helsinki, Tampere and Turku supporting the development of a supra-region among them. This finding is in line with the empirical verification by Camagni et al. (2014); SOCRs are able to overcome diseconomies of scale either through innovating in the functions that they perform, or in the organisation of activities with other city-regions through networking. Thus, SOCRs can ‘borrow size’ from the neighbouring primate city-region, consequently gaining access to the functions and networks hosted there, without incurring high locational disadvantages.

Figure 4 displays the area specific scores of city-regions. Helsinki is clearly ahead in most areas and Tampere is the runner-up. Tampere is a fairly balanced performer in KBUD areas, but it particularly excels in the area of high quality of life and place, and takes the first position in spatial development domain—slightly in front of Helsinki. This finding is also backed up with recent research (Morais et al. 2013) measuring the quality of life across European cities—ranking Tampere higher than Helsinki. Turku shows strength in the societal domain—coming second behind Helsinki. Being the former capital of Finland, Turku accommodates vibrant societal, cultural and political scenes. The advanced shipbuilding industry also has positive reflections on society. Oulu takes the second position in the institutional domain—behind Helsinki—as a result of the attention and investment given to become a well planned and managed city-region.

[INSERT FIG.4]

Fig. 4: Area Specific Performances of City-Regions.

Size of the city-region is considered as a key cause for the high performance of Helsinki. The size question is important from two perspectives. Firstly, there is a current debate in Finland about the optimal size for cities and regions for both providing high quality public services as well as funding their development. This analysis provides a perspective for that discussion, ‘bigger seems to be better from many KBUD perspectives’. However, as the case of Helsinki presented, being bigger may result in facing spatial development and environmental protection challenges. Secondly, it is intriguing to consider the size issue on a more philosophical or theoretical level. Is it possible to achieve KBUD without a large size? Considering the negative environmental and quality of life issues of large city-



regions, is there some kind of an optimal size? In other words, does size matter? These questions represent areas for further research.

In a recent study (Yigitcanlar, Lönnqvist, 2013), Helsinki was compared to Boston, San Francisco, Birmingham, Manchester, Melbourne, Sydney, Toronto, and Vancouver by using KBUD-AM. The results put Helsinki's overall performance in the middle of the eight city-regions—ranked fifth with San Francisco being at the top and Birmingham at the bottom. Although these two studies are not fully comparable, the international study provides a point of reference to the results at hand. The comparison of the two studies suggests that Tampere, Turku and Oulu are still quite far behind from the world's leading city-regions. On the other hand, Yigitcanlar and Lönnqvist (2013) find that Helsinki performed the best in spatial development domain, where it did not showcase a top performance in the study at hand. Thus, perhaps due to size and local spatial development policies, it can be claimed that the three SOCRs studied here have remarkable performances in this domain. However, their overall performances are yet to be put to test in the global arena.

In addition to the KBUD-AM findings, cluster analysis results reveal the formation of two distinctive clusters of Finnish city-regions. In this analysis Helsinki stands out as a distinct cluster—Cluster B—considering its high performance indicators, whereas Tampere, Turku and Oulu are closely bundled together—Cluster A (Figure 5). This is the basic indication of Helsinki's primacy in KBUD formation and performance being at the global scale. Earlier literature backs up this finding (Inkinen, Vaattovaara 2007; Van Winden et al. 2007; Vanolo 2008). For the SOCRs, their common KBUD characteristics represent a regional competition to bridge the gap between the Nordic country region's global KBUD icons—i.e., Helsinki, Stockholm, Copenhagen. However, this study once again reminds us that the pursuit of development comes with a price. It is self-evident that SOCRs are reluctant to pursue development with major social and environmental costs.

[INSERT FIG.5]

Fig. 5: Cluster Analysis Dendrogram.

In the light of the literature and analysis findings, we speculate that the following strengths of Finnish SOCRs make them form their unique KBUD style. Tampere has built its KBUD profile as a place of transformation—from industry to knowledge—and pristine natural environment (Carrillo et al. 2014; Lönnqvist et al. 2014). Turku has built its profile as a place of social and human capitals and culture scenes, and Oulu as a place of planned and engineered KBUD and rare example of successful development orchestration. All SOCRs have managed to bring together innovation and sustainability in their KBUD endeavours as suggested by Mieg (2012). This is to say that Finnish KBUD investigation showcases a unique competition example. Rather than SOCRs competing with each other by copying their success, each pursues KBUD by building on their unique areas of endogenous assets. These unique assets already exist in Finnish SOCRs—Turku being a former capital city, Tampere being a former industrial city-region, and Oulu having a history of successful KBUD orchestration.

The studies by Parkinson et al. (2012), Lönnqvist et al. (2014) and Evans (2015) support our findings by revealing Tampere as the most successful SOCR with an impressive history of economic renewal. Evans (2015) suggests that the general characteristics of effective policymaking apply to Tampere—i.e., continuity, compositional balance, comprehensive packages of measures, stakeholder participation in design, and delivery to reflect their particularities. Lönnqvist et al. (2014) highlight the success factors of Tampere as having: rich knowledge assets; open and good relations between key regional actors; strong domestic knowledge network connectivity; triple- and quadruple-helix partnerships; transparent democracy open to grassroots and community involvement in policymaking, and; urban atmosphere desirable for Finns to live and study. Parkinson et al. (2012, p. 51) predict that Tampere will face tough challenges in the near future, and stated, “it will need continuous renewal supported by flexible governance structures and public-private partnerships. The relatively small scale of Tampere region is an advantage—it can create agile procedures and governance structures”.

Turku has been deemed for its traditional shipbuilding and new biotechnology industries. Höyssä et al. (2004) propose the recognition of historical configurations and social capital in the analysis of regional development in the context of high-tech industries in the Turku Bio-cluster. Their findings correspond with our results. Both studies indicate the importance of social dimension and issues of trust in KBUD. For example, the local self-organised networks in Turku that aided collaboration between universities, companies and government organisations, in the spirit of the triple-helix model, were seen as fruitful means to enhance regional development in the context of biotechnology. However, Turku faces challenges related to spatial pull from Helsinki concerning particularly the outmigration of highly educated young workforce.

Oulu is an exemplar case of successfully diminishing regional disparities. It is developed as a technology and knowledge hub under the guidance of local government and university, and proved that path dependence is not necessarily a critical requirement for KBUD. Initiatives dating back to the early 1980s—i.e., branding the city first as ‘City of Technology’ and then as ‘Ubiquitous Smart City’, founding the Oulu Technopolis, and receiving financial support from the Centre of Expertise Program—played an essential role in its progress (Sotarauta, Linnamaa 1998; Häyrynen-Alestalo et al. 2006; Pasquinelli, Teräs 2013). While until recently Oulu has been able to stand out as a success story, nowadays it faces numerous challenges. As a result of the recent global financial crisis and Nokia’s fall (shutdown of the ex-Nokia R&D facilities by Microsoft), Oulu struggles with an increasing skilled workforce unemployment rate. Furthermore, not being able to diversify its economy (dependency on ICT sector) and the tyranny of distance are further problems that Oulu needs to resolve. Salo (2014) discusses these challenges in greater detail.

The methodological choices done in this study have implications on the results and their validity and reliability. A well-known problem in studies such as this one is the lack of comparable data, particularly on the intangible aspects of KBUD. The choice of indicators was made based on best available and suitable data. As far as individual indicators are concerned, sometimes the best available can be problematic. Thus, the challenging nature of the discourse of regional competitiveness and KBUD—so as their measurement—and the performance analysis based on limited and biased indicators, as Bristow (2005) indicates, may make any city-region a winner or a loser. However, as there are 32 indicators altogether it can be assumed that as a whole the indicator set provides a valid broad perspective of KBUD despite the potential problems in some individual measures.

The paper presents a rather static cross-sectional view on development. To discuss the long-term KBUD patterns of Finnish SOCRs, one would need a wider timeframe for datasets. Having said that, data availability plays a large role in this caveat, since time-series data for many of the KBUD dimensions are largely unavailable. The results hint to the existence of spatial pull and push factors caused by Helsinki—experienced by Tampere and Turku—as well as to the problems faced by Oulu due to its distance to other notable population centres. Additionally, for Helsinki, Turku and Tampere, it is justifiable to use the functional delineations employed to encompass the core city together with its surroundings (daily travel to work areas). The applied geographical scale might not do justice to Oulu with its significant sparsely populated hinterland.

These notions are duly noted in the interpretation of the results, and the analysis does not take into account the possible bias caused by spatial autocorrelation and the geographical scale. Accordingly, the limited number of SOCRs in Finland and the confinement into a single country restrict the possibilities for sophisticated statistical analyses and countrywide comparisons. Thus, it remains a task for further studies to repeat the analysis conducted here in other national settings and with refined statistical methods (and with time-series data). This will help to clarify whether the KBUD patterns identified here add up when examined in countries with different socio-spatial and politico-institutional backgrounds (and an evolutionary process in time). This paper provides invaluable insights for further studies to take advantage of, as this is the very first empirical attempt to measure KBUD at the SOCR context.

## 5 Concluding Remarks

Literature findings reveal that Finnish primate city-region and SOCRs represent a fine example of KBUD performance. However, contemporary literature highlights the necessity of a multidimensional and balance-seeking development approach encompassing all development domains in order to achieve a sustained KBUD. In other words, city-regions must not only adjust their local economies (business climate), but also invest in their society (people climate), environment (spatial climate) and institutions (governance climate) to become competitive in the global and regional arenas. This requires a wider perspective than mostly targeting knowledge-based economic accomplishments. In such environment, there is a need to better understand the key variables and mechanisms of urban and regional development. Furthermore, there is a need for analytical tools, which help scrutinise the performance of city-regions in a way that captures relevant variables. Thus, the approach introduced in this paper is a novel way for addressing these needs.

Results of the empirical analysis conducted in this study suggest that Helsinki represents the leading overall KBUD performance in Finland. As expected the benchmark city-region dominates all SOCRs in economic, societal and institutional development areas. However, a SOCR (Tampere) outperforms our benchmark case in the spatial development area—perhaps due to the smaller-size urban settlement nature. This is a strong argument for the balanced KBUD approach, which captures different aspects of the complex and multidimensional phenomenon. However, an international KBUD comparison of Helsinki against the global KBUD giants (Yigitcanlar, Lönnqvist 2013) reveals that Helsinki in the global stage is a best practice case in urban development and environmental protection. This brings us to the conclusion of Helsinki not performing poorly, but Tampere due to its unique environmental and urban nature performing exceptionally well.

Findings reveal Tampere as the photofinishing SOCR. The city-region has fairly balanced and good performance, but it is overshadowed by the economic scale, global connections and population size of Helsinki. However, Tampere has continuously been selected the most liveable region by Finnish people during the last couple of years, and is the most populous inland city in any of the Nordic countries. This is another indication of the city-region's success despite its rather small-scale. The other SOCRs are fairly balanced KBUD performers as well. Their performance levels are just slightly lower than Tampere. However, small differences can be observed in the domain results. In fact, the results paint a different kind of KBUD profile portrait for each case. Tampere is a balanced and strong performer, Turku is strong in the societal domain, while being a bit weaker in the other areas, and Oulu performs well in spatial and institutional developments, while having some problems in economic and societal domains due to the tyranny of distance. These findings point out clearly the areas for improvement as well as those strengths that SOCRs should aim at preserving and further building on. Furthermore, the unique KBUD style of Finnish SOCRs in building their future based on their strengths and endogenous assets could form a good example for others to take lessons from.

The empirical analysis undertaken proved to be a useful approach in capturing the multidimensional KBUD phenomenon in the context of SOCRs. The overall KBUD scores provide an overview of performance and the more detailed domain-specific results offer explanations for the overall performance as well as identify concrete issues for improvement. The comparison of the cases makes it possible to interpret and provide meaning for the results of individual indicators. This would be difficult without a point of reference. The value of the analysis conducted in this study is two-fold. Firstly, a careful analysis of KBUD of SOCRs helps scholars to understand their peculiarities and predict their potential sustainability. This can serve the development of new theories or designing of better measurement instruments. Secondly, the issue is highly relevant for practical policymaking as it sheds light on the fundamental issues related to the competitiveness and sustainability of SOCRs.

To conclude and highlight the contribution of this paper, we summarise the key findings regarding our research objectives. First, this study revisited the assessment framework (Yigitcanlar, Lönnqvist 2013; Carrillo et al. 2014; Yigitcanlar 2014a) to employ it in the SOCR context. The framework was shown to be applicable and it clearly produces new understanding of the KBUD performance of SOCRs. Second, empirical findings reveal the KBUD ranking and specific KBUD profiles of the Finnish SOCRs. Furthermore, the comparison between the Finnish city-regions raised fundamental

questions about the values based on which SOCRs prioritise their development goals, and whether the size matters. Bigger is in many cases better, but it also comes with a price in terms of size-related issues as discussed by Parkinson et al. (2014). Finally, as suggested by Markusen and Schrock (2006), more theory, empirical testing and evaluation of practices in the case of SOCRs are needed to guide them through a multidimensional approach to search for their unique distinctiveness.

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## Appendix

[INSERT APP.A]

App. A: Indicator Raw Values.

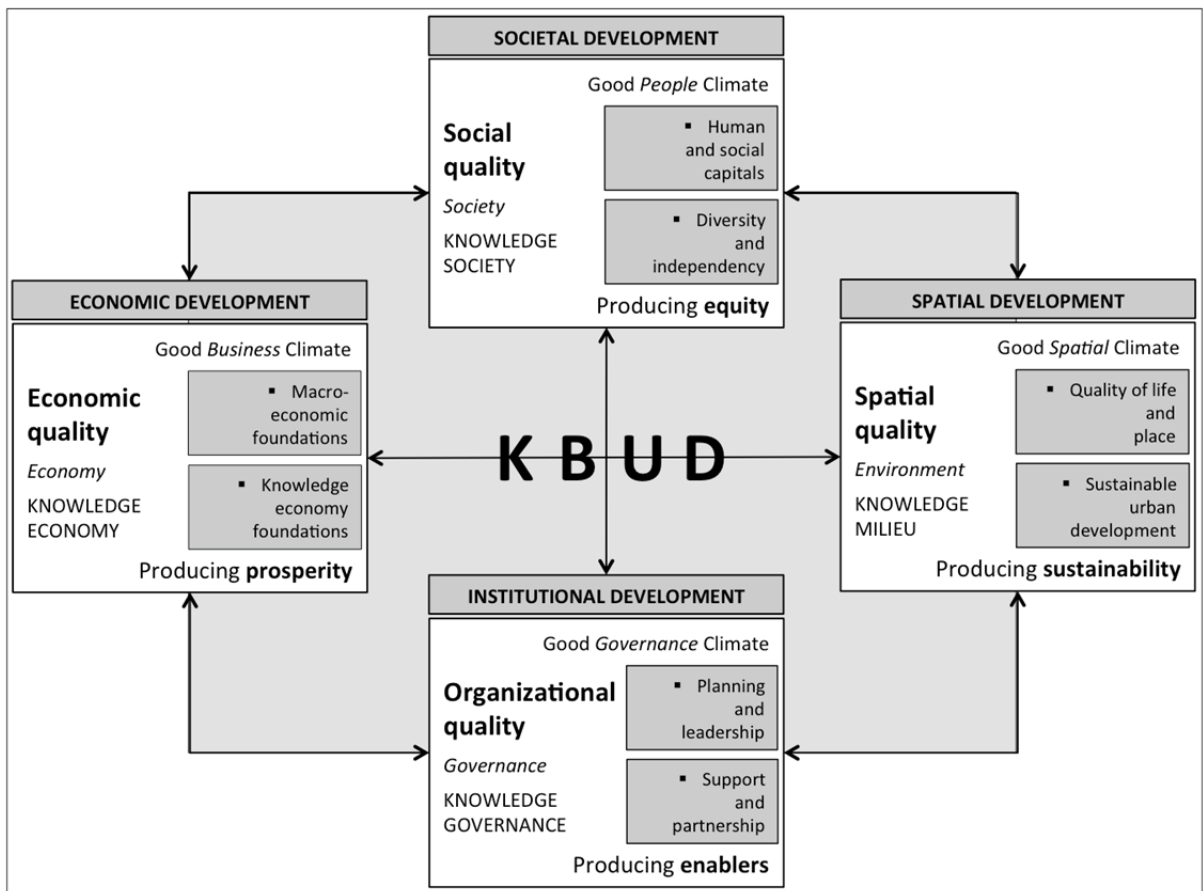
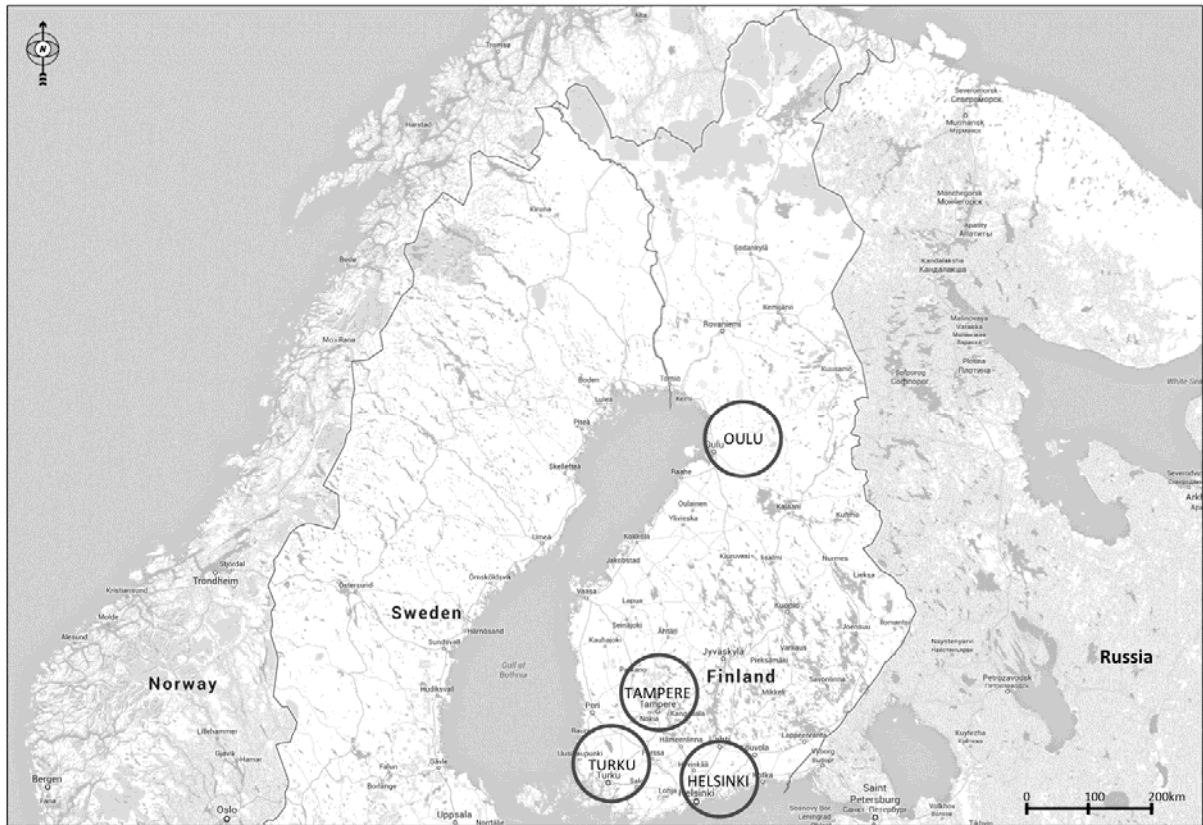
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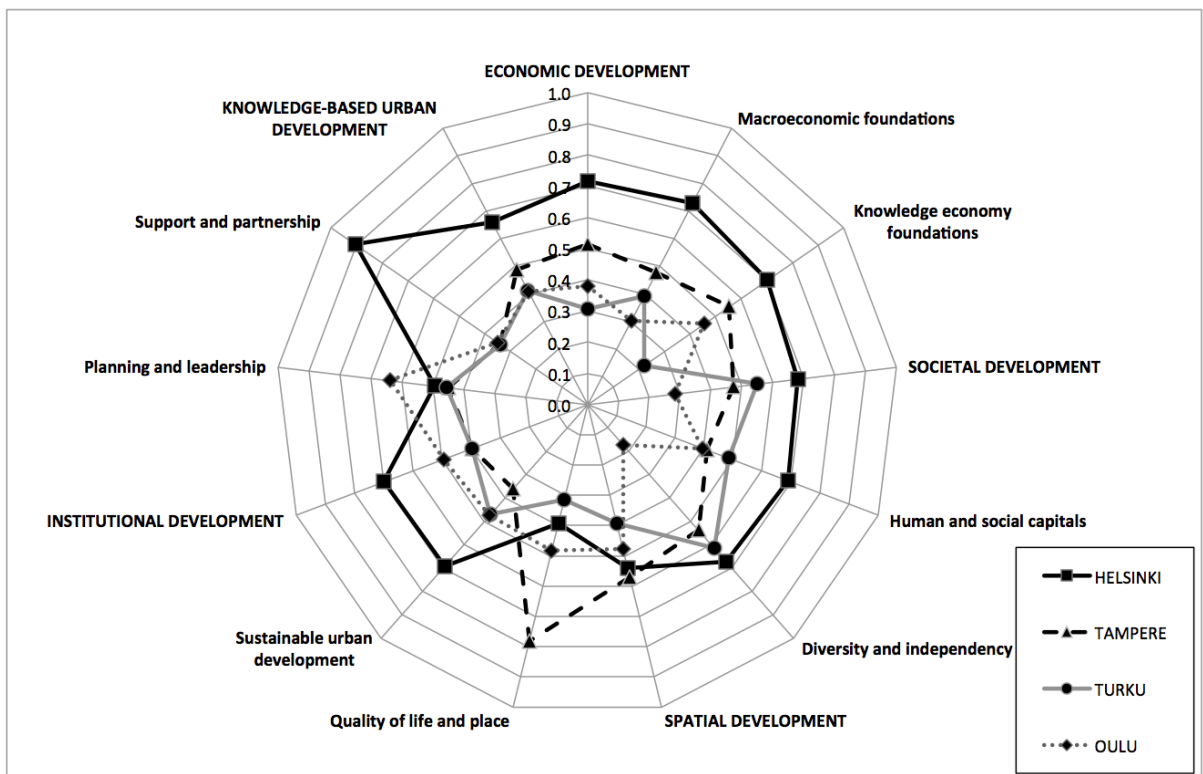
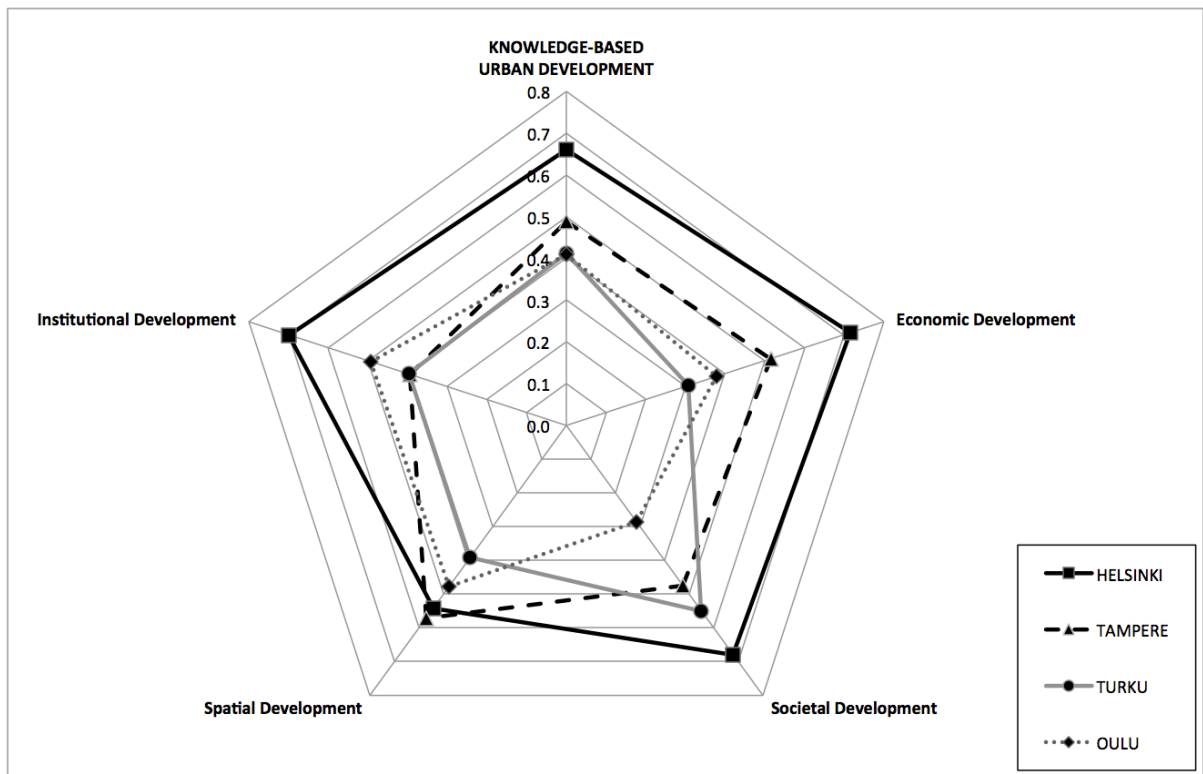
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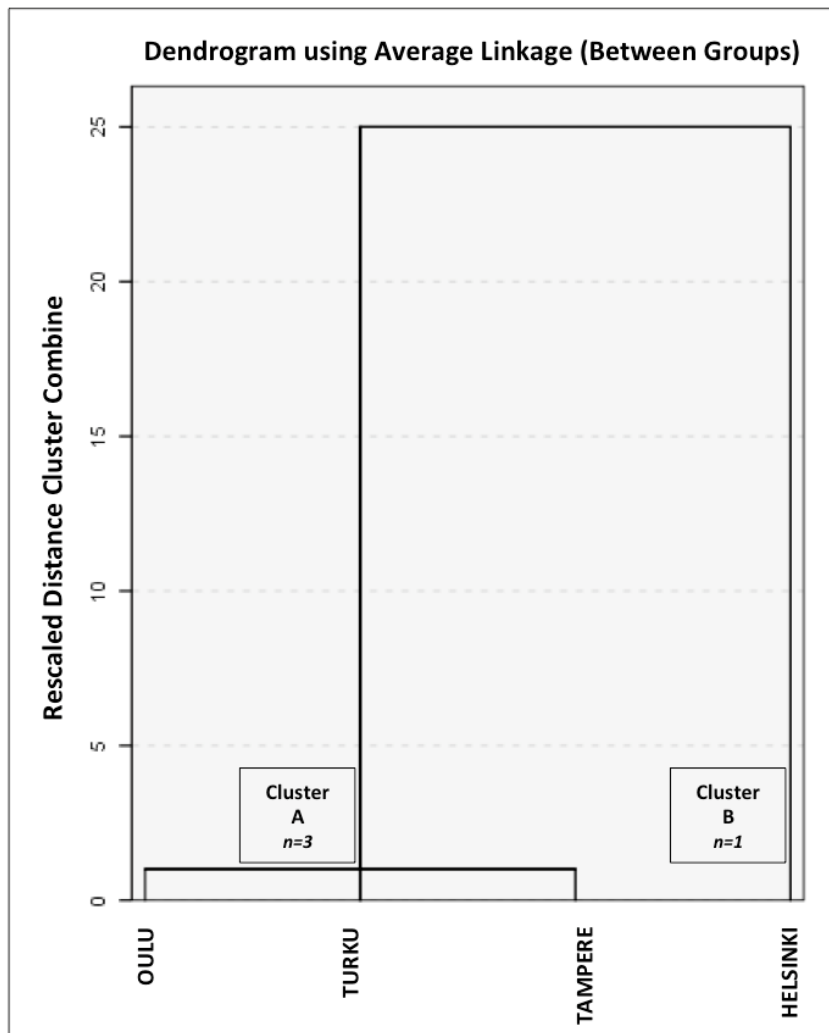
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Tab. 1: Salient Characteristics of Finnish City-Regions.

	POPULATION (people)	AREA (km <sup>2</sup> )	DENSITY (people/km <sup>2</sup> )	MEDIAN AGE (age)	INCOME (€per capita)
Helsinki City-Region (Uusimaa)	1,532,309	9,097	168	38	44,521
Tampere City-Region (Pirkanmaa)	487,923	12,446	39	41	30,140
Turku City-Region (Varsinais-Suomi)	465,183	10,662	44	42	30,022
Oulu City-Region (Pohjois-Pohjanmaa)	394,965	35,504	11	37	26,721
Finland (Suomi)	5,375,276	303,892	18	42	28,171

Tab. 2: Second-Order City-Region Analysis Framework.

COMPOSITE INDICATOR	INDICATOR CATEGORIES	INDICATOR SETS	INDICATORS	DESCRIPTIONS	UNITS	SOURCES	NOTES
KNOWLEDGE-BASED URBAN DEVELOPMENT	ECONOMIC DEVELOPMENT	Macroeconomic foundations	Gross domestic product	Gross domestic product (GDP) per capita in € of the city-region	Count	Statistics Finland	Higher values are desired
			Enterprise headquarters	National top 500 company headquarters located in the city-region	Count	Kauppalehti (Business Newspaper Database)	Higher values are desired
			Disposable income	Household disposable income—final consumption expenditure and savings—growth rate over the last 10 years in the city-region	Ratio	Statistics Finland	Higher values are desired
			Long-term unemployment	Long-term unemployment rate of people with continuous periods of unemployment extending for a year or longer in the city-region	Ratio	Statistics Finland	Lower values are desired
		Knowledge economy foundations	Research and development expenditure	Ratio of research and development (R&D) expenditure in GDP of the city-region	Ratio	Statistics Finland	Higher values are desired
			Patents granted	Patents granted per million inhabitants in the city-region	Count	Statistics Finland	Higher values are desired
			Knowledge workers	Ratio of knowledge workers to all employed—full and part-time	Ratio	Statistics Finland	Higher values are desired
			Knowledge-intensive businesses	Ratio of knowledge-intensive service, business and industry firms to all service, business and industry firms of the city-region	Ratio	Statistics Finland	Higher values are desired
	SOCIETAL DEVELOPMENT	Human and social capitals	Education investment	Public educational institutes per 1,000 inhabitants in the city-region	Ratio	Statistics Finland	Higher values are desired
			Professional skill base	Ratio of residents over 18 years of age with a tertiary degree or studying at a tertiary education institute in the city-region	Ratio	Statistics Finland	Higher values are desired

SPATIAL DEVELOPMENT		University prestige	Main university ranking of the city-region in the top 500 world universities	Count	QS Top Universities	Higher values are desired
		Wireless broadband coverage	Wireless @450 broadband network availability and coverage in the city-region in the scale of 1-7	Scale	Finnish Ministry of Transport and Communications	Higher values are desired
	Diversity and independency	Cultural diversity	Ratio of foreign country born inhabitants to all inhabitants of the city-region	Ratio	Statistics Finland	Higher values are desired
		Inbound migration	Ratio of crude international and domestic net migration to all population of the city-region	Ratio	Statistics Finland	Higher values are desired
		Socio-economic dependency	Ratio of the elderly population to the working age population of the city-region	Ratio	Statistics Finland	Lower values are desired
		Income inequality	Gini coefficient of the city-region in the scale of 0-1	Scale	Statistics Finland	Lower values are desired
	Quality of life and place	Quality of life	National city ranking as a desired place of residence of the city-region in the scale of 4-10	Scale	Taloustutkimus Oy (Market Research Company)	Higher values are desired
		Personal safety	Crimes against life and health and sex offences per 1,000 inhabitants in the city-region	Ratio	Statistics Finland	Lower values are desired
		Housing affordability	Ratio of GDP per capita to owner-occupied medium-size dwelling price in the city-region in €/m <sup>2</sup>	Ratio	Statistics Finland	Lower values are desired
		Cost of living	Average gas (95E10) prices in €/l and rental price of dwellings in the city-region in €/m <sup>2</sup> /month	Count	Polttoaine.net (Online Fuel Prices); Statistics Finland	Lower values are desired
	Sustainable urban development	Urban form and density	Population density of the city-region in persons per km <sup>2</sup>	Density	Statistics Finland	Higher values are desired
		Sustainable transport use	Ratio of sustainable mode use (walking, cycling, public transport) for commuting to all commuters of the city-region	Ratio	Finnish National Travel Survey; WSP Finland Oy (Engineering Consulting Company)	Higher values are desired
		Greenhouse gas emissions	Carbon dioxide emissions of	Count	CO <sub>2</sub> Raportti	Lower values are

			the city-region in kilotons		(Greenhouse Gas Emission Reporting Agency)	desired
		Climate change mitigation	Municipal subvention for increasing household energy efficiency of the city-region in €/per capita	Count	Statistics Finland	Higher values are desired
INSTITUTIONAL DEVELOPMENT	Planning and leadership	Strategic planning	Strategic planning vision of the city-region referring to knowledge-based urban development in the scale of 0-3	Scale	Local and Regional Council Websites	Higher values are desired
		City branding and marketing	National ranking in city image of the city-region in the scale of 4-10	Scale	Taloustutkimus Oy (Market Research Company)	Higher values are desired
		Political leadership and stability	Consequent election victory of the political party currently in the office in the city-region in the scale of 1-3	Count	Statistics Finland	Higher values are desired
		Community organizations	Registered non-governmental, non-profit and grassroots organizations (NGOs, NPOs) of the city-region	Count	Statistics Finland	Higher values are desired
	Support and partnership	Government grants and incentives	Ratio of public grants and incentives for R&D in GDP received in the city-region	Ratio	Statistics Finland	Higher values are desired
		Innovation recognition and support	Ratio of national innovation prize and awards received in the city-region	Ratio	INNOFINLAND (Finland Innovation Awards)	Higher values are desired
		Government-industry-academia partnerships	Ratio of university funds raised via partnership schemes in the city-region	Ratio	University of Vaasa Databases	Higher values are desired
		Global network connectedness	International sister city, twin town and intercity co-operation agreements of the city-region	Count	Local and Regional Council Websites and Documents	Higher values are desired

Tab. 3: Performance Area Scores.

	HELSINKI	TAMPERE	TURKU	OULU
Economic development	0.7153	0.5149	0.3073	0.3787
Macroeconomic foundations	0.7277	0.4767	0.3922	0.3025
Knowledge economy foundations	0.7030	0.5530	0.2225	0.4548
Societal development	0.6805	0.4740	0.5502	0.2850
Human and social capitals	0.6893	0.4101	0.4850	0.3959
Diversity and independency	0.6718	0.5379	0.6154	0.1740
Spatial development	0.5417	0.5713	0.3921	0.4779
Quality of life and place	0.3918	0.7821	0.3157	0.4824
Sustainable urban development	0.6916	0.3605	0.4685	0.4734
Institutional development	0.6996	0.3948	0.3977	0.4941
Planning and leadership	0.4953	0.4486	0.4559	0.6381
Support and partnership	0.9038	0.3410	0.3395	0.3500
Knowledge-based urban development	0.6593	0.4887	0.4118	0.4089

App. A: Indicator Raw Values.

	HELSINKI	TAMPERE	TURKU	OULU
Gross domestic product	44521	30140	30022	26721
Enterprise headquarters	268	30	25	23
Disposable income	0.0505	0.0285	0.0315	0.0248
Long-term unemployment	0.9832	0.9691	0.9767	0.9768
Research and development expenditure	0.0439	0.0748	0.0486	0.1007
Patents granted	178.1	189.71	67.61	109.94
Knowledge workers	0.5937	0.3986	0.364	0.4075
Knowledge-intensive businesses	0.1557	0.0929	0.0794	0.0698
Education investment	0.4603	0.5779	0.6571	0.7766
Professional skill base	0.2409	0.1806	0.1658	0.1677
University prestige	89	390	224	304
Wireless broadband coverage	6.98	6.9	6.77	6.48
Cultural diversity	0.0613	0.0251	0.0333	0.0151
Inbound migration	0.0482	0.0491	0.0379	0.001
Socio-economic dependency	0.787	0.7242	0.7046	0.7638
Income inequality	0.6944	0.7269	0.7179	0.7407
Quality of life	6.67	7.84	6.88	6.61
Personal safety	9.96	7.33	8.35	8.91
Housing affordability	0.9393	0.9409	0.9476	0.9441
Cost of living	0,311-7,2	0,303-9,15	0,318-9,77	0,292-9,97
Urban form and density	168.45	39.2	43.63	11.12
Sustainable transport use	0.3167	0.2914	0.286	0.3029
Greenhouse gas emissions	169	65	69	59
Climate change mitigation	2.8864	0.4328	2.164	1.2569
Strategic planning	1	2	2	2
City branding and marketing	7.28	7.52	7.17	7.59
Political leadership and stability	3	1	3	3
Community organizations	297	22	27	33
Government grants and incentives	0.0064	0.0034	0.0015	0.0046
Innovation recognition and support	0.2759	0.0517	0.0517	0.0862
Government-industry-academia partnerships	0.7064	0.1394	0.0572	0.0295
Global network connectedness	65	24	48	8