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Entrepreneurial ecosystem and well-being in European smart cities: a comparative perspective

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Abstract

Purpose – This study investigates the relationship between the strength of innovative entrepreneurial ecosystems and subjective well-being in 43 European smart cities. Subjective well-being is operationalized by a Quality of Life (QOL) survey that references the level of multidimensional satisfaction or happiness expressed by residents at the city level. The entrepreneurial ecosystem concept depicted here highlights actor interdependence that creates new value in a specific community by undertaking innovative entrepreneurial activities. The research uses objective and subjective variables to analyze the relationships between the entrepreneurial ecosystem and subjective well-being.

Design/methodology/approach – The authors conducted a cluster analysis with a nonaggregative quantitative approach based on the theory of the partially ordered set (poset); the objective was to find significant smart city level relationships between the entrepreneurial ecosystem and subjective well-being.

Findings – The strength of the entrepreneurial ecosystem is positively related to subjective well-being only in large cities. This result confirms a strong interdependency between the creation of innovative entrepreneurial activities and subjective well-being in large cities. The smart cities QOL dimensions showing higher correlations with the entrepreneurial ecosystem include urban welfare, economic well-being and environmental quality, such as information and communications technology (ICT) and mobility.

Practical implications – Despite the main implications being properly referred to large cities, the governments of smart cities should encourage and promote programs to improve citizens' subjective well-being and to create a conducive entrepreneurship environment.

Originality/value – This study is one of the few contributions focused on the relationship between the entrepreneurial smart city ecosystem and subjective well-being in the urban environment.

Keywords Quality of life, Satisfaction, Entrepreneurship, Entrepreneurial ecosystem, European smart cities, Nonaggregative approach

Paper type Research paper

1. Introduction

There has been a revival of academic interest in the role that cities play in national economies and regions (Bosma and Sternberg, 2014; Glaeser *et al.*, 2010; Stam, 2014). Recent studies consider cities as an environment of entrepreneurship. As entrepreneurial ecosystems, cities provide relevant socioeconomic and institutional benefits (Audresch *et al.*, 2015; Audretsch and Belitski, 2017; Ivaldi *et al.*, 2020; Penco *et al.*, 2020); they provide a framework for entrepreneurial ecosystem development.

While the extant literature focuses on the entrepreneurial ecosystem at the regional level (Acs *et al.*, 2014; Szerb *et al.*, 2013), only a few contributions analyze the urban ecosystem level. The urban ecosystem sheds light on the service-dominant logic, a theoretical framework used to explain value creation as the result of multiple actor interactions (Vargo and Lusch, 2016). Assuming that urban ecosystems enhance well-being as part of value cocreation, this research analyzes the relationship between satisfaction about well-being at the city level and the strength of entrepreneurial activities (Audretsch and Belitski, 2015; Ciacci *et al.*, 2021).

Pennings' (1982) seminal work used aggregated indexes, but it emphasized the need for direct accounts of individual perceptions of subjective well-being (Osorio, 2018). Subjective well-being has been defined as a citizen's satisfaction about the quality of life (QOL) (Lepage, 2009; Lee and Sirgy, 2004; Vaez *et al.*, 2004). An accurate expression of subjective well-being depends on the level of life satisfaction; it is defined as a person's subjective cognitive and affective evaluation of QOL (Florida *et al.*, 2013). QOL evaluations should take economic, social and physical factors into account (Andrews, 1974; Helburn, 1982). QOL studies (De Quero Navarro *et al.*, 2020) have often relied on comparative analyses of countries' QOL indices (Peterson, 2006; Peterson and Malhotra, 1997). In order to identify the most suitable strategies, macromarketers have analyzed the influence of marketing systems actors and dynamics on both objectives, that is, material conditions of life and resources as well as subjective definitions and experiences relating to satisfaction (Lee and Sirgy, 2004; Sirgy *et al.*, 2008).

Drawing on entrepreneurial ecosystem literature (Acs *et al.*, 2014; Mason and Brown, 2014; Cavallo *et al.*, 2019), this research aims to identify a relationship between entrepreneurial ecosystem and subjective well-being, operationalized as citizen's QOL satisfaction at the city level. The goal is to study "if and how" subjective well-being is linked to the strength of urban entrepreneurial ecosystems. In this work, the QOL dimensions, through which the authors measure subjective well-being, derive from the concept of the smart city, as smart city policies aim for urban development and the creation of subjective well-being (Cocchia, 2014; Dameri *et al.*, 2019; Kummitha and Crutzen, 2019).

Specifically, in this paper, the authors address the following research questions: First, *is urban subjective well-being associated with a stronger entrepreneurial ecosystem in European smart cities of varying sizes?* Second, *which smart city QOL dimensions show a stronger relationship with the entrepreneurial ecosystem at the European Union (EU) city level?*

The authors investigated subjective well-being using subjective variables connected to the main EU smart city dimensions. To the best of the authors' knowledge, this is the first study to establish a direct relationship between the entrepreneurial ecosystem and smart city subjective well-being. This allows them to examine the efficacy of smart city policies in terms of subjective well-being and their implications for entrepreneurial ecosystems.

The authors decided to research the European urban context. The literature has gaps related to the investigation of the European urban context, concerning both cities' entrepreneurship and well-being (Penco *et al.*, 2020). This research opens future avenues for in-depth study of this relationship, including expanding the field to European smart urban systems that are not necessarily knowledge-based. Europe also presents a paradigmatic case owing to its diversity in terms of local context, harmonization of institutions and rapid urbanization, within a relatively small spatial environment (Ivaldi and Ciacci, 2020; Szerb *et al.*, 2013). Additionally, the harmonization of data collection methods across Europe provided reliable and adequate information for advancing the research (Acs *et al.*, 2014; Capello *et al.*, 2008).

Given these premises, this work discusses the entrepreneurial ecosystem and subjective well-being based on smart city dimensions (Thite, 2011). The findings are relevant to the discussion on entrepreneurship and urban environments: on the one hand, cities and countries can promote investments in "place marketing" focusing on well-being enhancements (Ulaga *et al.*, 2002) to attract new entrepreneurial activities; on the other hand, entrepreneurship is able to contribute positively to the well-being of urbanites.

In addition, conclusions of a wider environmental analysis can orient macromarketing policies toward an effective QOL-based approach for cities. The authors also analyze the urban size, exploring the role of critical mass in large cities. Consequently, this work follows research on entrepreneurship (Acs *et al.*, 2014; Stam *et al.*, 2014; Szerb *et al.*, 2013); QOL and well-being at the city level (Sirgy *et al.*, 2000, 2008); and the smart city literature (Kummitha and Crutzen, 2019), interpreted through the ecosystem approach (Polese *et al.*, 2018; Tan *et al.*, 2020; Palumbo *et al.* 2021).

The authors connect and advance this literature in the following three ways.

First, the ecosystem approach and the service-dominant logic are used for the urban-level analysis of the relationship between the entrepreneurial ecosystem and subjective well-being.

Second, by considering the profiles of new ventures (number of newly registered corporations), the presence of unicorns (start-up companies with a value of over $1 billion), investors (organizations or individuals that give support to start-ups at the initial moments of their life cycle) and accelerated start-ups (early-stage start-up companies supported by organizations and programs through mentorship and often capital and office space), the authors create an innovative entrepreneurship index (ENT) for measuring the city-level entrepreneurial ecosystem. The index computation is performed by applying the poset method. It is a nonaggregative analytical method based on the theory of the partially ordered set and consists of a set of algebraic and combinatoric tools designed to describe and treat order relations (Fattore, 2016). The "posetic" approach is employed to conduct quantitative analysis in the field of applied sciences (Annoni *et al.*, 2017; Carlsen and Bruggemann, 2014; Fattore and Arcagni, 2018). Poset is particularly suitable for the management of multidimensional systems (Fattore, 2016). The application of poset allows the measurement of both ordinal and cardinal variables. The poset method allows assessing hierarchical relationships among cities.

Third, the authors create a multidimensional index focused on subjective factors that explain subjective well-being at the city level, in terms of perceived QOL regarding smart city characteristics. Fourth, in order to identify bottlenecks and derive policy implications, the authors explain the relationship between ENT and each QOL dimension. Specifically, the authors employ cluster analysis to classify the sampled cities into four different clusters, that is, larva, bee, butterfly and flower garden, where larva indicates cities having low satisfaction about QOL and weak entrepreneurial ecosystems; flower garden refers to cities with a high QOL satisfaction and a good entrepreneurial ecosystem; butterfly cities show a relatively poor entrepreneurial ecosystem but good QOL satisfaction; finally, bee cities are characterized by a strong entrepreneurial ecosystem and weak QOL satisfaction.

Significant relationships between the entrepreneurial ecosystem and QOL emerge only from the large cities' group (Acs *et al.*, 2009). Overall, with a focus on the EU context, this work contributes to the debate on the development of urban well-being and entrepreneurship, valuable to both academics and urban policymakers.

The paper is structured as follows. In the next section, the authors review relevant literature that provides insights on entrepreneurial ecosystems, the urban ecosystem and subjective well-being, measured as QOL satisfaction in smart cities. In Section 3, the authors present data, variables and empirical strategy. The results are discussed in Section 4. Section 5 provides policy implications, followed by a brief conclusion.

2. Literature review

2.1 Linking entrepreneurship to the ecosystem approach

Entrepreneurship has stimulated contributions from various disciplines, ranging from economics to psychology since it is considered one of the most dynamic sources of job creation, healthy competition, economic growth, promotion of an "inclusive" society and innovation. According to Bruyat and Julien (2001), two basic perspectives are generally used to analyze entrepreneurship. According to the first perspective, the entrepreneur is the creator and the developer of new businesses of any kind, independently from the business' technological intensity and innovativeness. The second perspective, which the authors adopt in this paper, is consistent with the Schumpeterian concept of the entrepreneur as an "innovator," namely an individual that recognizes opportunities not just to create new ventures but to develop new technological innovations and business models that shape new industries and restructure the economy (Penco *et al.*, 2020).

Several studies emphasized the importance of the relationships between entrepreneurs and their local socioeconomic contexts (Acs *et al.*, 2009; Glaeser *et al.*, 2010, 2014; Stam, 2014). In particular, economic geography and urban economics studies have scrutinized the spatial organization of entrepreneurship and innovation, finding that entrepreneurial activity (especially Schumpeterian entrepreneurship) is more concentrated and clustered than manufacturing (Adler *et al.*, 2019).

Recent literature interprets the interaction among entrepreneurs and other contextual factors/actors in terms of ecosystem (Stam and Spigel, 2016; Mason and Brown, 2014; Brown and Mason, 2017; Acs *et al.*, 2017). The concept of entrepreneurial ecosystem, based on ecological systems thinking, regards the interdependence of actors in a particular community aimed at creating new value. Emphasizing the interdependence between actors and factors, it follows the regional development research and the strategy literature (Acs *et al.*, 2017).

The networks of relationships between entrepreneurs, leadership, finance, talents, knowledge and support services constitute the heart of the entrepreneurial ecosystem (Cavallo *et al.*, 2019; Stam and Spigel, 2016) and form the "micro-entrepreneurial ecosystem." More specifically, the microentrepreneurial ecosystem is constituted by entrepreneurial actors (both potential and existing), entrepreneurial organizations (e.g. firms, venture capitalists), institutions (research centers, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high-growth firms) (Mason and Brown, 2014; Brown and Mason, 2017): start-ups and unicorns explicitly occupy the center of such ecosystems (Stam and Spigel, 2016; Acs *et al.*, 2017).

The entrepreneurial actors exist in a broader ecosystem that provides external conditions and services. According to Mason and Brown (2014), this ecological approach underlines the importance of viewing the wider ecological environment in which the entrepreneurial ecosystem operates. The microentrepreneurial ecosystem is, indeed, connected with an economic and social context that enables or constrains human interaction (Stam and Spigel, 2016); this contest forms "the framework systemic conditions" for the entrepreneurial ecosystem (Cavallo *et al.*, 2019).

2.2 The ecosystem for entrepreneurship: the local-urban environment

Recent entrepreneurship policy trends (UN Habitat, 2016) and related academic research (Audretsch and Belitski, 2017; Penco *et al.*, 2020) focus not only on national and regional perspectives but also on the local-urban perspective. The most important appeal of large metropolitan areas is linked to agglomeration economies (Chatterji *et al.*, 2014) that facilitate a more significant and efficient sharing of complex knowledge along with higher externalities and spillovers (Ghio *et al.*, 2015), economies of scale and incentives to innovation and growth (Ferraris *et al.*, 2020; Szerb *et al.*, 2013).

For these reasons, the urban context offers other drivers for the clustering of entrepreneurial activity and innovation at the city level (Adler *et al.*, 2019). Considering that cities assume even greater importance in today's knowledge-driven innovation economy, with place-based ecosystems critical to economic growth (Florida *et al.*, 2017), in this work cities can be considered the "systemic framework conditions" for the entrepreneurial ecosystem (Mason and Brown, 2014; Brown and Mason, 2017).

Cities will thrive and grow if they provide amenities and infrastructure attractive to their high human-capital residents (Glaeser *et al.*, 2001). Infrastructure enhances connectivity and linkages that facilitate opportunity recognition (Audretsch *et al.*, 2015a, b). Infrastructure, amenities (green spaces, theaters, museums, cinemas, coffee shops and art galleries) and transport links comprise the critical physical conditions that either foster or constrain the interaction between the entrepreneurial ecosystem's agents. Cities provide physical infrastructure and bring together proactive people, local and regional authorities, researchers and scholars, education institutes, nonprofits, public leaders, societal organizations, incubators and investors (Liu *et al.*, 2015; Schmidt and Cohen, 2014). In return, entrepreneurship serves as a conduit for the spillover of creativity to urban economic development (Boschma and Fritsch, 2009; Florida, 2002).

In this vein, the cities are considered an urban ecosystem composed of both natural and artificial components, which are strictly intertwined and integrated into the larger social organism (Tan *et al.*, 2020; Palumbo *et al.*, 2021); cities, providing relationships among actors, can be interpreted as service ecosystems, since they consist of tangible and intangible artifacts oriented to the value cocreation process (Longo and Giaccone, 2017; Polese *et al.*, 2017; Vargo and Lusch, 2018).

In particular, addressing the service-dominant logic that holds that value is always cocreated (Vargo and Lusch, 2016), a service-dominant logic's ecosystem posits that many actors systematically contribute to the value cocreation process and no single agent can individually create value (Holmqvist and Ruiz, 2017).

The value cocreation at the city level is well-being (Tan *et al.*, 2020); it can affect the well-being of both the entire urban ecosystems and of the cocreating actors that operate therein (Baccarani and Cassia, 2017; Ciasullo *et al.*, 2016; Frow *et al.*, 2019; Frow *et al.*, 2016). Well-being in a city depends on a wide range of services (Tan *et al.*, 2020); natural and seminatural ecosystems provide some of these, such as green spaces, public spaces, fresh air and ease of access to natural resources, while others such as amenities, cultural and entertainment service operators, robust urban services (e.g. mobility, education and health) are created by humans and fostered by policies (Musterd and Gritsai, 2012).

The dynamic interactions between the entrepreneurial and urban ecosystems are expected to produce a virtuous circle and something greater than the "sum of their parts": the cocreation of well-being pursued by the urban ecosystem helps to attract and retain businesses, knowledge workers, entrepreneurs and supportive organizations (Florida *et al.*, 2013); the entrepreneurial ecosystem also stimulates the urban ecosystem's well-being, creating wealth and positive conditions for citizens (Porter, 1996).

2.3 The smart cities framework and the service ecosystem reinforcement

Several important cities, such as Amsterdam, Barcelona, Lisbon and Vienna, have smart city policies to foster urban development (Camboim *et al.*, 2019; Cocchia, 2014; Dameri *et al.*, 2019). Successful cities with a core infrastructure – the educational system, amenities (museums, theaters, cinemas and cultural events), a sound transportation system and the entrepreneurship vocation of the area – require a coherent vision of the necessary interventions and public policies to facilitate urban-level well-being. In this vein, public policies can stimulate urban development and promote the benefits of city living (Brown and Campelo, 2014).

A smart city witnesses an extensive deployment of information and communication technology (ICT) in critical infrastructure components and services (Bresciani *et al.*, 2018; Ferraris *et al.*, 2018; Polese *et al.*, 2018). Nam and Pardo (2011) seek to enlarge the scope of the smart city concept by defining a wider range of core factors such as technology, people (creativity, diversity and education) and institutions (governance and policy). Several recent definitions of smart city have a secondary focus – the deployment of ICT for promoting sustainability, economic development and citizens' well-being (De Falco and De Giorgi, 2019). Several researchers have argued that citizens' well-being may not be treated as a separate dimension, since all smart city policies should aim at enhancing citizens' wealth and happiness (Shapiro, 2005). In this vein, Kummitha and Crutzen (2017) propose two approaches for defining a smart city – the technology-driven approach and the human-driven approach. In sum, a smart city is a city that intelligently uses ICT and combines its resources to provide the best economic conditions and superior well-being for citizens (Petrolo *et al.*, 2015). For example, a smart city information system provides citizens with real-time information about the city's services and issues pertaining to the operation and safety of its infrastructure; citizens using ICT-enabled systems enhance the urban information system by spreading useful information via social networks (Shahrour *et al.*, 2017). Recent focus has shifted toward smart communities, emphasizing the importance of social, ethical and environmental variables in urban development (Ciasullo *et al.*, 2018). Different researchers have specified the main dimensions of a smart city (Richter *et al.*, 2015) (Table 1).

Smart city emphasizes the importance of a service-oriented approach (Yu *et al.*, 2019) so that the concept of smart city can be seen in line with some service-dominant logic theory (Vargo and Lusch, 2004; Polese *et al.*, 2018). Polese *et al.* (2018) argued that reconceptualizing the smart city as a service system aids public managers to understand that a smart city should be managed as an urban service system, promoting relationships between people and organizations aimed toward value cocreation. The ecosystem-based view allows the identification of different technologies, resources and value cocreation practices that arise from actors' engagement with the (smart) city space. If adequately harmonized by the government, these variables prove consequential for the development of well-being and sustainable innovation within the smart city space.

2.4 Subjective QOL of ecosystem within the smart city framework

Limited literature explicitly reveals any relationship between the development of the entrepreneurial ecosystem and the citizens' well-being generated by the urban ecosystem, even though well-being is commonly recognized as one of the most important features in urban entrepreneurship development.

In particular, Audretsch and Belitski (2015) associated the subjective well-being created by the urban ecosystem and the entrepreneurial ecosystem. Pennings (1982) suggested the

Smart city dimensions	References
Economy	Petrolo *et al.* (2015), Alawadhi *et al.* (2012), Newman *et al.* (2016), Glaeser (2011), Allam and Newman (2018), Ferraris *et al.* (2018)
Governance	Ciasullo *et al.* (2018), Albino *et al.* (2015), Giffinger *et al.* (2007), Neirotti *et al.* (2014), Dameri (2012), Nam and Pardo (2011), Chourabi *et al.* (2012)
People	Giffinger *et al.* (2007), Nam and Pardo (2011), Chourabi *et al.* (2012), Florida (2002), Petrolo *et al.* (2015)
Welfare	Anttiroiko (2013), Neirotti *et al.* (2014), Kroes (2010), Petrolo *et al.* (2015), Porter (1990)
Culture	Piccialli and Chianese (2018), Allam and Newman (2018), Scott (2004)
Environment	Alawadhi *et al.* (2012), Giffinger *et al.* (2007), Albino and Dangelico (2012)
ICT and mobility	Komninos *et al.* (2011), Willke (2007), Batty (2013), Caragliu *et al.* (2009), Bresciani *et al.* (2018)

Table 1.
Smart city dimensions

use of data sources that provide direct accounts of individual-level perceptions of local well-being (Osorio, 2018). Analyzing the capacity to attract "creative people," Florida *et al.* (2013) stated that the "happiness of cities" should be measured by subjective indicators.

This is consistent with the theorists of well-being that believe well-being can be preferably estimated by subjective measures (Diener and Biswas-Diener, 2002). Subjective measures can be a valid alternative to the gross domestic product as a useful indicator for well-being assessment. The gross domestic product does not quantify several factors that affect well-being (Lepage, 2009). Well-being includes social cohesion, level of trust, administrative efficiency, environmental conditions, progress, security, housing, unemployment (Miringoff and Miringoff, 2000); human and social capital (Lawless and Lucas, 2011; Rentfrow *et al.*, 2009); community life, political freedom and government support (EIU, 2005); ecology, education, community, civic participation measures (Smith *et al.*, 2013); the built environment and infrastructure (Woolley, 2014); as well as health and economic development, domestic diversity, culture, freedom and governance and knowledge (Prescott-Allen, 2001).

Despite researchers being skeptical about using subjective variables as reliable indicators of a phenomenon (e.g. Easterlin, 2001; Kenny, 2005), several studies have found an appropriate measure for the well-being in QOL satisfaction (Prescott-Allen, 2001). In particular, well-being can be measured by the global QOL satisfaction of citizens (Lepage, 2009) at the community level (e.g. Psomas *et al.*, 2020; Sirgy *et al.*, 2000, 2008, 2010; Wagner, 1995; Widgery, 1982, 1992).

In this paper, the authors linked the subjective measures for residents' QOL to the smart city perspective. The choice to adopt the smart city profiles derives from the fact that smart city policies facilitate urban development in terms of the urban ecosystem well-being in itself and of QOL creation for citizens (Cocchia, 2014; Dameri *et al.*, 2019; Kummitha and Crutzen, 2019). This choice allows for the examination of smart city policy efficacy in terms of QOL satisfaction and the implications for the entrepreneurial climate.

To answer to research questions, the research design is depicted in Figure 1.

3. Methodology

3.1 Sample

Consistent with Penco *et al.* (2020) and Bruzzi *et al.* (2019), a sample of 28 EU capital cities was constructed. To foster the entrepreneurship attitude in the national context of each EU 28 country, it was critical to determine the presence of cities in each of these countries. The authors also included noncapital EU cities that are important hubs. The starting point to collect cities is the open-source dataset provided by Bannerjee *et al.* (2016) since it offers complete multidimensional statistics about the innovative and entrepreneurial activities within European cities. Bannerjee *et al.*'s dataset had been already taken as a data reference point for further analyses, that is, Penco *et al.* (2020) and Bruzzi *et al.* (2019).

For well-being, the QOL variables were derived from the Eurostat (2016) survey. In this regard, the dataset employed in this paper is multisource (see Table 2 for the variables' sources indications). Bannerjee *et al.* (2016) and Eurostat (2016) datasets do not fully overlap, as they are the result of different surveys. As such, the authors had to perform a cross-integration of the two source datasets. Thus, the authors identified and excluded all those cities that had been included in only one of the two datasets. The initial number of 59 cities in Bannerjee *et al.*'s dataset was reduced to 43 in this analysis.

To ensure the validity of this study within the smart cities framework, the authors checked that all 43 cities were involved in smart city policies. The validation was positive for all the cities. Table A1 specifies the different smart cities projects in which the cities are involved. For the population of each city, see Table A2.

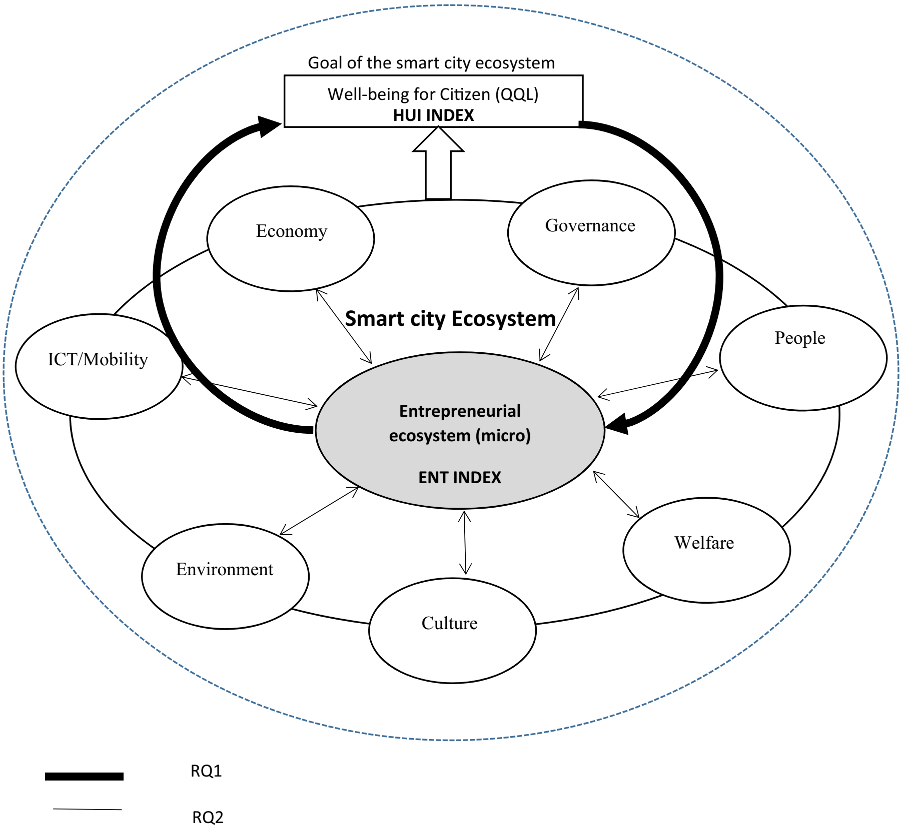


Figure 1.
Research design

During the analysis, the obtained dataset was handled in two separate steps: first, the cities were examined together; second, they were divided into three groups based on population quartiles. The authors applied a partitioning method based on a double rationale: it ensured not losing cities, being the most inclusive. An objective grouping method could lead to excluding certain urban environments (e.g. London, Paris and Düsseldorf, because of their size) or to obtain several groups, producing a statistical unit's dispersion. By applying a relative method of units' partition directly to the sample, the authors preserved the inclusivity not compromising, at the same time, the reliability of the comparison. In this regard, the poset method is suitable because it allows preservation of "specific cases in accordance with their possible incomparability." In other words, the adopted partitioning method consistently aligns inclusivity, maximization of context diversity and adaptability with the quantitative method employed (Glaeser *et al.*, 2010; Iftikhar *et al.*, 2019). Table 3 shows the composition of the three groups.

3.2 Selection of variables

In order to analyze the relationships between the urban entrepreneurial ecosystem and the subjective well-being (operationalized as QOL satisfaction) created by the urban ecosystem (measured in terms of satisfaction for each smart city dimension), the authors collected objective and subjective data. The objective data, which formed the basis for the ENT index

Dimension	Sub-dimension	Variables description	Source	Indexes (COD)
Start-ups	Entrepreneurial vitality	Average monthly increase in the number of start-ups (normalized by the number of inhabitants)	Teleport (2019)*	*ENT*
Investors	Entrepreneurial attractiveness	Number of start-up investors (normalized by the number of inhabitants)	Teleport (2019)*	
Accelerated start-ups	Mentoring and Managerial Assistance	Accelerated start-ups (normalized by the number of inhabitants)	Gust (2016)** Seed DB (2016) **	
Unicorns	Entrepreneurial success	History of highly successful digital companies (unicorns) (normalized by the number of inhabitants)	GP Bullhound (2016)** CB Insights (2016)**	
Economy	Labor market	Ease in finding a job	Eurostat (2016)***	*HUI*
	Financial situation	Satisfaction with the financial situation of your household		
	Taxation	Difficulty paying bills at the end of the month (inverted value)		
Governance	Efficiency	Satisfaction with the efficiency of administrative services of your city		
	Allocation	Satisfaction with the way your city spends its resources		
	Trust	Satisfaction with the public administration		
People	Integration	Satisfaction with the integration of foreigners who live in your city		
	Perception	Satisfaction about the presence of foreigners in your city		
	Trust	Satisfaction with the credibility of individuals		
Welfare	Health	Satisfaction with the healthcare services offered by doctors and hospitals		
	Safety	Satisfaction with the safety of your neighborhood		
	Education	Satisfaction with education and training in your city		
Culture	School	Satisfaction with schools in your city		
	Facilities	Satisfaction with cultural facilities		
Environment	Cinema	Satisfaction with cinemas in your city		
	Green spaces	Satisfaction about the presence of green spaces in your city		
	Air	Satisfaction with the quality of air in your city		
	Cleanliness	Satisfaction with the cleanliness in your city		
ICT and mobility	Public Internet	Satisfaction with the internet access in your city		
	Private Internet	Satisfaction with the internet access at home in your city		
	Mobility	Satisfaction with public transport in your city		

Note(s): *https://teleport.org/(data were collected in November 2019)
**Data have been obtained from Bannerjee *et al.* (2016). It refers to the following sources: (http://gust.com/accelerator_reports/2016/global; /https://www.seed-db.com/accelerators/view?acceleratorid = 3,012; GP Bullhound (2016): www.gpbullhound.com/wp-content/uploads/2016/06/GP-Bullhound-Research-European-Unicorns-2016-Survival-of-the-fittest.pdf; CB Insights2016: www.cbinsights.com/researchunicorncompanies)
***https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/urban/survey2015_en.pdf
Source(s): Our elaboration

Table 2.
Description of objective and subjective variables and indexes

Cities	Group name	Number of cities	Quartile
London. Paris. Madrid. Barcelona. Berlin. Rome. Athens. Warsaw. Manchester. Hamburg. And Budapest	Large cities	11	Population of the metropolitan area exceeding the third quartile of the distribution
Lisbon. Munich. Vienna. Stuttgart Amsterdam. Lille. Frankfurt. Prague. Brussels. Turin. Bucharest. Stockholm. Copenhagen. Dublin. Glasgow. Sofia. Helsinki. Bordeaux. Düsseldorf. Krakow. And Dresden	Medium-sized cities	21	Population of the metropolitan area between the first and third quartiles of the distribution
Malmö. Zagreb. Cardiff. Vilnius. Karlsruhe. Riga. Bratislava. Tallinn. Luxembourg. Ljubljana. And valletta	Small cities	11	Population of the metropolitan area within the first quartile of the distribution

Source(s): Our elaboration

Table 3.
Sample and groups

(Entrepreneurial ecosystem index), were standardized by dividing the value corresponding to each variable by the urban area population. This approach normalized the values and thereby contributed toward avoiding the distortion of the dimensional effect.

Consistently with the literature focused on the entrepreneurial ecosystem, the composite index (ENT) comprises the following measures: new business density (number of newly registered corporations) and the number of investors; accelerated start-ups; and unicorns per 1,000 working-age people. The first measure identifies new entrepreneurship at the city level, while the second and the third underline the attractiveness and vivacity of the entrepreneurial activities. The last measure demonstrates the presence of an "elite" group within the population of start-ups that has been able to scale up, typically operating in a digital and platform business (Acs *et al.*, 2016). The choice of these specific variables is consistent with the literature (Mason and Brown, 2014; Brown and Mason, 2017; Stam and Spigel, 2016; Acs *et al.*, 2017). This index explains Schumpeterian entrepreneurship (Adler *et al.*, 2019).

A multidimensional index for well-being (HUI – Happiness Urban Index) better explains the different dimensions of QOL satisfaction. HUI is based on the subjective indicators deriving from the Public Sector and on the most important QOL dimensions that academics have found in the Smart Cities domain. Specifically, the process of QOL dimensions identification results from a literature review. This approach led the authors to obtain seven different QOL dimensions, that is, Economy, Governance, People, Welfare, Culture, Environment, ICT and Mobility. Even though the breakdown of variables related to QOL is fluid in the smart city literature, and therefore approaches based on a different partition than the one proposed cannot be ruled out, the authors considered the most recurrent dimensions from a careful literature review. Table 1 presents the different dimensions identified and some of the references that legitimize this choice. Table 2 shows the description of the variables associated with each dimension.

The European survey "Quality of Life in European Cities 2015" by Eurostat (2016) includes a scale of five possible answers – "very satisfied," "rather satisfied," "rather unsatisfied," "not all satisfied" and "do not know." For the analysis, the authors considered the percentage of respondents declaring themselves as "very satisfied." Thus, the authors excluded the remaining levels from the analysis because the "very satisfied" level unequivocally solves ambiguities in responses, represented by intermediate options of responses. This choice follows the logic underlying the conceptual framework since the authors conceive subjective well-being as the satisfaction of the urban QOL or happiness (Florida *et al.*, 2013). Therefore, this method of operationalization supports the paper's theoretical framework.

With respect to a full level of satisfaction, the analysis, including positive intermediate responses (i.e. "very satisfied" + "rather satisfied" percentages), does not substantially change the results, in terms of correlation for the various groups of cities. Therefore, this method of operationalization does not fail in a distorted way. In addition, the percentage of "do not know" responses for the different cities represents de minimis percentages. The exclusion of this small percentage does not bias the analysis.

Table A3 provides descriptive statistics to give a more precise idea about the data distribution for each variable.

3.3 From variables to subindexes and indexes

A formative approach provides the methodological basis employed in this study, according to which the latent factor (entrepreneurship and well-being) depends on the indicators that "explain" the factor, and not vice versa (Diamantopoulos *et al.*, 2008). This implies that the variables are not substitutable and that they are functional to the definition of the phenomenon (Maggino, 2017).

This analysis stems from the poset methodology. The idea of the "posetic" approach assumes that compensatory aggregative methods of analysis impede us from capturing the real complex mean of a phenomenon. Considering the peculiar characteristics of different dimensions, very weak interdependence often emerges between the dimensions of a specific phenomenon to be able to proceed with compensation (Fattore, 2017b). The approach based on the poset theory offers valid alternatives to the analysis of a phenomenon by ensuring the preservation of specific cases in accordance with their possible incomparability and makes the evaluation process more real and robust.

The application of the poset theory assumes the knowledge of a specific language, and hence it is useful for providing some methodological definitions.

A poset $\pi = (X, \leq)$ is a set X equipped with a partial order relation $\leq$, that is, with a binary relation satisfying the following properties (Fishburn, 1976):

(1) $x \leq x$ for all $x \in X$ (reflexivity).

(2) If $x \leq y$ and $y \leq x$ then $x = y$; $x, y \in X$ (antisymmetry).

(3) If $x \leq y$ and $y \leq z$, then $x \leq z$; $x, y, z \in X$ (transitivity).

Each element forming an ordered structure is associated with a profile – a sequence of integers within a range to which all the values of the different indicators are traced. A range is a set of integer values, that is, a numerical scale, within which all the values of the different indicators are contained.

If a comparability relationship is found between two elements of a structure, that is, it is possible to make a comparison between them, then the elements are considered comparable. Otherwise, the two units are considered incomparable.

Relationships between the different elements are grafted into a partially ordered structure known as the Hasse diagram, which allows for the representation of the various configurations in comparative terms. These relationships are represented in a way that, if $x \leq y$, an edge is inserted linking node y to node x and then node y is placed above node x.

Given two posets, $\pi = (X, \leq_\pi)$ and $\tau = (X, \leq_\tau)$, on the same set X, τ is an extension of, if $x \leq_\pi y$ in π implies $x \leq_\tau y$ in τ. In other words, τ is an extension of π if it may be obtained from the latter, turning some incomparabilities into comparabilities (Fishburn, 1976). An extension of a complete order is called linear extension (Fattore, 2016). A fundamental property of the poset theory states that two finite partial orders have different sets of linear extensions and that any finite partial order is the intersection of the set of its linear extensions (Fattore, 2016).

Poset evaluation helps to obtain a complete order out of a partial order (Fattore, 2017a). After assigning the evaluation scores to the elements of a poset, the elements can be ordered linearly. The average height procedure allows assigning a score [0, 1] to each element of a poset; the score represents the position of the element in a "low-high" axis (Fattore *et al.*, 2019). The computation of the average height comprises the following steps. First, it is necessary to list all the linear extensions of the poset. For each linear extension, the height of each element must be calculated, defined as 1 plus the number of elements below x in the linear order; finally, for each element of the poset, the average height on its linear extensions is computed, corresponding to the arithmetic mean of the heights of x in all linear extensions (Winkler, 1982).

In addition to the poset analysis, for each group of cities, the authors conduct a cluster analysis to perform a bivariate classification of the cities according to both ENT and HUI. As per Berkhin (2006), clustering is a division of data into groups of similar objects.

This study uses the k-means clustering method. The procedure is based on the classification of a dataset through a number of clusters fixed *a-priori*. The number of clusters is specified in advance and does not change during the iteration (Hartigan and Wong, 1978; MacQueen, 1967).

4. Results and discussions

All procedures were conducted using the *R* software. The partial orders in socioeconomics (PARSEC) package were used for the poset elaboration (Arcagni, 2017).

4.1 Average height and correlation matrix

The application of the average height allowed for obtaining synthetic measures for the performance of different cities in different fields of analysis. The performance by the sizes of cities (large, medium and small) has been also measured. Higher values identify better situations and vice versa.

Table 4 presents the value of the average height for the whole cities (not grouped) sample, for ENT (entrepreneurial ecosystem) and HUI (the well-being created by the urban ecosystem) of the sampled EU cities. The top ten cities' ENT and HUI are in the northern range.

To answer the first research question, the authors constructed a Spearman's correlation matrix. The authors do not intend to detect causal relationships between QOL dimensions and ENT, but to test correlation to extrapolate the bidirectional nature of the value cocreation within entrepreneurial ecosystems based on service-dominant logic. The Spearman's index value of 0.09 reveals that no correlation exists between ENT and HUI for the entire sample (43 cities). Hence, the authors decided to analyze each group of cities based on their size. In this regard, average height has been recalculated on each cities group (Table 5).

In large cities (n = 11 cities), a significant Spearman's correlation between ENT and HUI emerges. For medium-sized (n = 21) and small (n = 11) cities, all the relationships were not significant and were sometimes negative. For large cities, a positive relationship between entrepreneurship and the population (0.7) stands out, while the correlation between HUI and population was not significant (Table 6).

To identify which QOL dimensions are more related to the strength of the entrepreneurial ecosystem (second research question), the authors perform a Spearman's correlation matrix for each group of cities, connecting ENT to the single dimensions of HUI.

For large-sized cities, the correlation between ENT and Welfare dimension was highly significant and positive (0.7). There was a positive correlation between entrepreneurship and Economy (0.5), Environment (0.6) and ICT/Mobility (0.5) QOL dimensions (Table 7).

Table 4.
ENT and HUI average height (city not grouped)

Cities (43)	ENT	Cities (43)	HUI	Range
London	41.6	Munich	40.0	Max 43; min 0
Berlin	41.6	Copenhagen	38.7	
Tallinn	40.1	Glasgow	38.4	
Amsterdam	38.5	Stuttgart	38.4	
Copenhagen	36.2	Düsseldorf	38.0	
Dublin	35.4	Dublin	37.5	
Helsinki	35.3	Frankfurt	37.0	
Munich	35.2	Vienna	36.0	
Stockholm	35.2	Amsterdam	35.3	
Prague	33.8	Stockholm	35.2	
Barcelona	33.5	Dresden	34.1	
Luxembourg	32.1	Helsinki	29.8	
Vilnius	31.0	London	29.8	
Paris	30.4	Bordeaux	29.7	
Madrid	30.4	Cardiff	29.3	
Valletta	30.2	Manchester	29.1	
Vienna	27.1	Hamburg	23.5	
Riga	24.7	Karlsruhe	22.5	
Krakow	24.5	Ljubljana	21.9	
Warsaw	23.1	Luxembourg	21.4	
Hamburg	21.5	Prague	20.9	
Brussels	20.6	Krakow	19.7	
Manchester	20.5	Bucharest	17.5	
Lisbon	20.3	Paris	17.5	
Sofia	19.5	Sofia	17.3	
Ljubljana	19.1	Malmö	17.0	
Athens	15.2	Berlin	16.7	
Zagreb	14.6	Warsaw	16.6	
Budapest	14.3	Valletta	15.4	
Stuttgart	13.6	Lille	15.2	
Lille	13.5	Barcelona	14.2	
Malmö	13.2	Brussels	13.5	
Bratislava	13.2	Madrid	13.2	
Bucharest	10.9	Zagreb	12.6	
Düsseldorf	10.4	Vilnius	12.2	
Frankfurt	9.4	Turin	11.4	
Turin	6.8	Tallinn	10.8	
Karlsruhe	6.5	Budapest	10.2	
Rome	6.3	Riga	9.2	
Cardiff	6.2	Athens	7.6	
Dresden	5.8	Lisbon	6.5	
Bordeaux	2.5	Bratislava	3.0	
Glasgow	2.0	Rome	2.3	

Source(s): Our elaboration

For medium- and small-sized cities, although positive, the Spearman's correlation matrix did not identify any significant relationships (Tables A4 and A5). Considering that ENT represents the Schumpeterian entrepreneurship, literature has demonstrated that high-tech start-up entrepreneurship is considerably more concentrated and clustered on a global scale than is population or economic output (Adler *et al.*, 2019). In this vein, the smaller cities present a lower level of innovative entrepreneurship, expressing a weaker relationship. The case of Glasgow can help to explain why a correlation does not emerge in small and medium-sized cities groups. In fact, Glasgow aimed to attract professional service industry workers

Group	Cities	ENT	Cities	HUI	Range
Large	Berlin	10.5	London	10.1	
	London	10.5	Manchester	9.2	
	Barcelona	7.9	Hamburg	7.5	
	Madrid	7.5	Paris	6.7	
	Manchester	5.7	Berlin	6	
	Paris	5.7	Madrid	6	Max 11; min 0
	Athens	4.9	Warsaw	6	
	Hamburg	4.1	Barcelona	5.5	
	Warsaw	4.1	Budapest	4.5	
	Budapest	4	Athens	2.9	
	Rome	1.3	Rome	1.7	
Medium	Amsterdam	19.4	Munich	18	
	Copenhagen	18	Glasgow	17	
	Dublin	17.9	Copenhagen	15.9	
	Helsinki	17.6	Dublin	15.8	
	Stockholm	17.6	Düsseldorf	14.9	
	Prague	17	Amsterdam	14.7	
	Munich	16.8	Vienna	14.7	
	Vienna	12.5	Stuttgart	14.6	
	Brussels	11.9	Stockholm	14.5	
	Sofia	11.9	Frankfurt	14.1	
	Lisbon	11.2	Helsinki	12.4	
	Krakow	10.6	Dresden	12.1	Max 21; min 0
	Bucharest	7.5	Bordeaux	10.7	
	Lille	7.2	Prague	8	
	Stuttgart	7.1	Krakow	6.9	
	Düsseldorf	6.5	Brussels	5.6	
	Frankfurt	5.5	Sofia	5.5	
	Turin	4.7	Bucharest	5	
	Dresden	4.4	Lille	4.5	
	Bordeaux	3.6	Turin	3.8	
	Glasgow	2	Lisbon	2.6	
Small	Tallinn	10.8	Cardiff	10.2	
	Valletta	9.5	Karlsruhe	8.6	
	Luxembourg	8.6	Luxembourg	7.1	
	Riga	7.8	Malmö	7.1	
	Vilnius	6.6	Ljubljana	6.6	
	Ljubljana	6	Vilnius	6.1	Max 11; min 0
	Zagreb	5.1	Valletta	6	
	Bratislava	4.2	Zagreb	5.1	
	Malmö	4.2	Tallinn	4.1	
	Cardiff	2	Riga	3	
	Karlsruhe	1.4	Bratislava	2.1	

Source(s): Our elaboration

Table 5. ENT and HUI average height of each city group

	HUI-ENT	ENT-city population	HUI-city population
Large-sized cities	0.5*	0.7**	0.2
Medium-sized cities	0.3	0.3	0
Small-sized cities	−0.5*	−0.6**	0.3

Note(s): **$p < 0.01$. *$p < 0.05$ (two-tailed)

Table 6. Spearman's correlations between ENT, HUI and population for each group of cities

(Green *et al.*, 2016; Holcomb, 1993). Cities such as Glasgow are tailored to residents, livable and equipped with amenities designed to make them state-of-the-art environments, even without a clear incentive to give birth to a creative force of innovative entrepreneurship. This argument can clarify why cities such as Glasgow itself, Düsseldorf, Cardiff, Karlsruhe and Malmö reveal high-perceived well-being levels although promoting an innovative entrepreneurial ecosystem is not at the policy forefront.

Another reason for the lack of correlation can be attributed to the cities' organic evolution (Parkerson, 2007, p. 265). Cities grow chaotically depending on the interactions systems between residents and word-of-mouth (Blichfeldt, 2005). This phenomenon leads to unforeseen urban growth effects. In other words, not all is controllable through branding plans.

4.2 The results for each group

Considering that the correlation analysis provides only synthetic results, the research also analyzed the position of each city in relation to others belonging to the same urban-sized group.

Among the large-sized cities, London and Berlin exhibited the best performance in terms of ENT (average height = 10.5). London is also characterized by a positive satisfaction of QOL (HUI = 10.1).

Cities that lack a correspondence between the values of the average height in terms of ENT and HUI are mainly Hamburg (ENT = 4.1, HUI = 7.5) and Manchester (ENT = 5.7, HUI = 9.2). They show a good HUI (second and third, respectively); however, they have a lower ENT (eighth and fifth, respectively).

The medium-sized cities that present the best average height in terms of ENT are Amsterdam (first, average height = 19.4), Copenhagen (second, average height = 18), and Dublin (third, average height = 17.9). Copenhagen (third) and Dublin (fourth) also rank positively in terms of HUI, recording an average height equal to 15.9 and 15.8, respectively. The best small-sized cities are Tallinn (10.8), Valletta (9.5) and Luxembourg (8.6); nevertheless, only Luxembourg presents a good average height in terms of HUI (7.1).

Based on the average height in terms of ENT and HUI, the authors construct a cluster analysis for each urban-sized group (Figure 2a–c). For each urban-sized group, the authors identified four clusters corresponding to four different urban styles and "personification" of cities (Brown and Campelo, 2014). These clusters can help to understand the results of the sharing value cocreation among the multiple levels of the ecosystem (entrepreneurial and urban) in terms of the global ecosystem well-being.

Table 7. Spearman's correlations on average height between different dimensions for big cities

Dimensions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ENT (1)	1*	*0.5**	*0.3**	*0.4**	*0.7***	*0.1*	*0.6**	*0.5**	0.5**	0.7**
Economy (2)	0.5*	*1*	*0.2*	*0.5**	*0.6***	*0.6***	*0.8***	*0.9***	0.9**	0.1
Governance (3)	0.3*	*0.2*	*1*	*0.5***	*0.4**	*0.2*	*0.5**	*0.2*	0.7**	0.3
People (4)	0.4*	*0.5**	*0.5***	*1*	*0.6***	*0*	*0.5**	*0.3*	0.6**	0.1
Welfare (5)	0.7**	*0.6***	*0.4**	*0.6***	*1*	*0.2*	*0.7***	*0.4**	0.6**	0.1
Culture (6)	0.1	*0.6***	*0.2*	*0*	*0.2*	*1*	*0.6***	*0.7***	0.7**	0
Environment (7)	0.6*	*0.8***	*0.5**	*0.5**	*0.7***	*0.6***	*1*	*0.8***	0.9**	0.1
ICT and mobility (8)	0.5*	*0.9***	*0.2*	*0.3*	*0.4**	*0.7***	*0.8***	*1*	0.7**	0.1
HUI (9)	0.5**	*0.9***	*0.7***	*0.6***	*0.6***	*0.7***	*0.9***	*0.7***	1	0.2
City population (10)	0.7**	*0.1*	*0.3*	*0.1*	*0.1*	*0*	*0.1*	*0.1*	0.2	1

Note(s): ***p* < *0.01.* **p* < 0.05 (two-tailed)

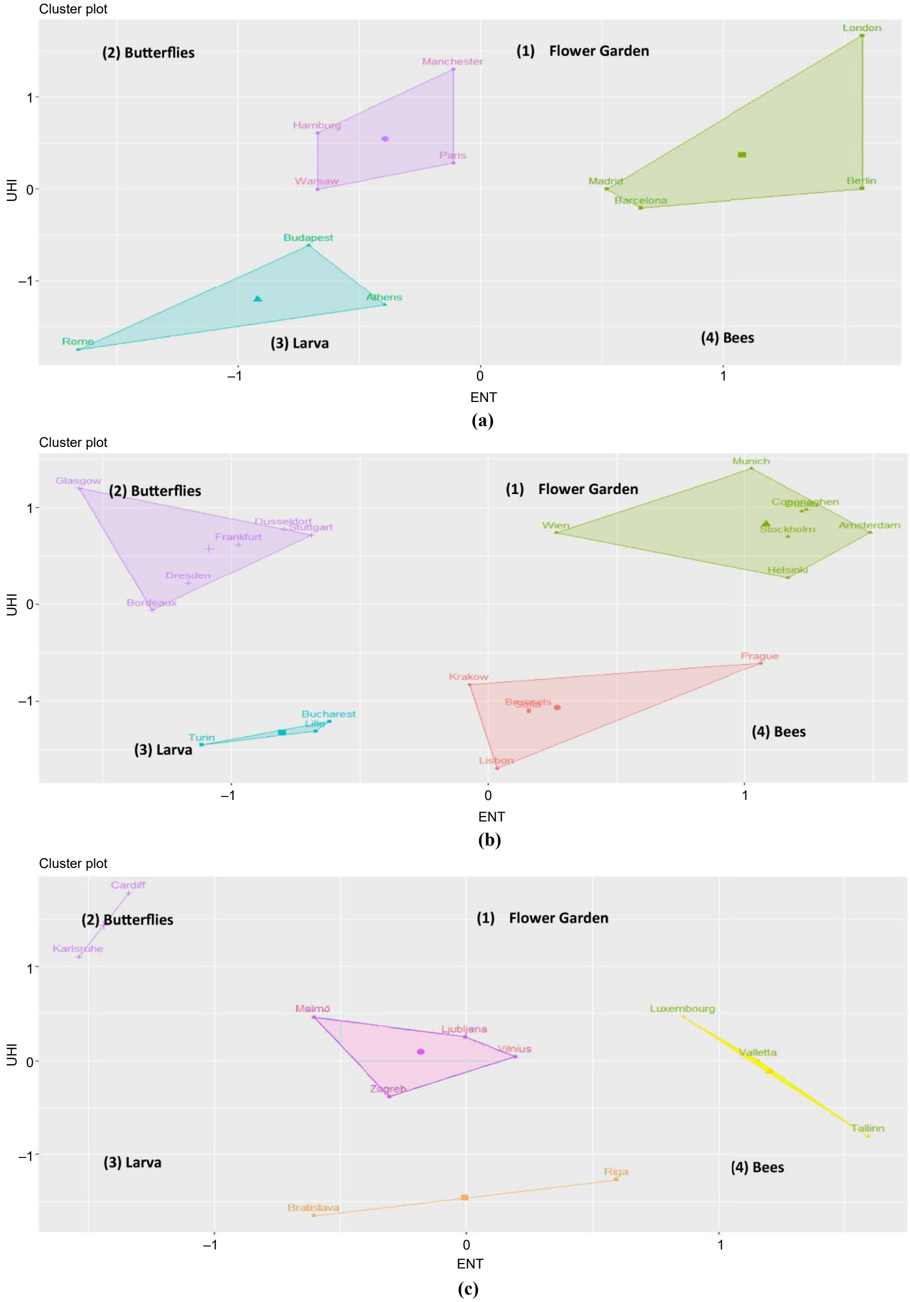


Figure 2.
(a, b and c) Clusters and cities' models: larva, butterfly, bees and flowered garden

The first cluster comprises cities with a high QOL and a good entrepreneurship ecosystem (ENT+; HUI+). The authors name this cluster the "flower garden" because it provides an ideal environment for the creation of the virtual circle of prosperity for entrepreneurial activities (bees) and satisfied citizens (butterflies). In these cities, the high QOL satisfaction (butterflies) contributes toward attracting and retaining entrepreneurship, while entrepreneurship (bees) contributes to enhancing QOL satisfaction by providing wealth and stimulating innovation, new services and amenities.

Named butterfly, the second cluster comprises cities with relatively poor entrepreneurship but with good QOL satisfaction (ENT−; HUI+). These cities must improve business conditions as well as stimulate entrepreneurial attitudes and aspirations to create a good ecosystem for bees. Consistent with Porter (1996), the creation of a positive climate is primarily responsible for attracting and retaining entrepreneurs that stimulate urban wealth.

The third cluster (ENT−; HUI−) is formed by "outsider" cities. Referred to as larva, these cities have low QOL satisfaction and poor entrepreneurship ecosystems. Among the large-sized cities, this cluster includes Rome (ENT = 1.3, HUI = 1.7), Athens (ENT = 4.9, HUI = 2.9) and Budapest (ENT = 4, HUI = 4.5).

The fourth cluster depicts a beehive ecosystem predominantly oriented to entrepreneurial activities. In the medium-long term, entrepreneurial activity can be adversely affected by the negative satisfaction of residents on their life quality and vice versa. In this vein, residents may move to other cities in search of better amenities, thereby constraining the development of entrepreneurial activity in their home city. These cities are "beehives" that nurture entrepreneurs; however, these cities must immediately intervene to create butterfly factors to improve their residents' perception of well-being and activate the flower garden.

4.3 The hierarchy for each group

In order to understand the ENT and HUI better, the Hasse diagram function of the poset methodology has been applied to order cities from higher to lower levels, identifying the position of superiority based on the single variables.

4.3.1 Large-sized cities. Figure 2a represents the results of the cluster analysis for big cities – London (ENT = 10.5, HUI = 10.1), Berlin (ENT = 10.5, HUI = 6), Madrid (ENT = 7.5, HUI = 6) and Barcelona (ENT = 7.9, HUI = 5.5) are considered "flower gardens" because they have good entrepreneurial ecosystems and good QOL satisfaction. The absence of pure "bees" in large cities is not a coincidence; consistent with Florida *et al.* (2013), large cities tend to present high QOL satisfaction. Figure 2 presents the Hasse diagram, that is, the poset hierarchy. Data are available in the Appendices (for ENT, Tables A6–A8; for HUI, Tables A9–A11).

In terms of ENT, London prevails over all cities, except for Berlin (Figure 2a, Table A6). Looking at the single variables, London ranks first only for the variables Start-ups (13.65), Investors (160.23) and Accelerated Start-ups (0.80); Berlin prevails over London only for the variable Unicorns (1.18 vs 1.08), which explains the impossibility of comparing according to the theory of the partially ordered sets – Berlin and London. In this vein, London seems more oriented to support new entrepreneurial activities (start-ups that prevail in London are service-oriented to support start-ups), while Berlin presents an entrepreneurial ecosystem where unicorns are present (Acs *et al.*, 2017).

In the case of the "flower garden" cluster, Madrid (ENT = 7.9) and Barcelona (ENT = 7.5) rank third and fourth as "entrepreneurial" cities. It is not a coincidence that the top ENT cities have recently implemented public policies to promote entrepreneurship. These policies aim to enhance competitiveness at the city and national levels and to attract investors.

Concerning the "butterfly cities," Paris (ENT = 5.7, HUI = 6.7) and Manchester (ENT = 5.7, HUI = 9.2) present good values, respectively, for the variables INV (33.63) and UNI (0.31).

Paris cannot be compared with Barcelona and Madrid as Paris prevails in the case of Investors (33.63 vs 29.64 and 21.46) and Unicorns (0.25 vs 0.18 ad 0.00) variables, demonstrating its ability to attract investors and support highly successful digital companies (Unicorns).

Manchester is ranked lower than Berlin and London, in terms of all the ENT variables. Nevertheless, Manchester holds the third position for Unicorns (0.31), only after London and Berlin. Concerning the other variables, Manchester oscillates between the eighth position (Start-ups 2.46) and 10.5th position (Unicorns 0.00). After the Irish Republican Army (IRA) terroristic attack on the Manchester City Centre and the destruction of its commercial core in June 1996, Manchester promoted the city's entrepreneurial credentials. The city implemented projects that collectively aimed to enhance the QOL and, only partially, the competitiveness of the core entrepreneurial ecosystem (Williams *et al.*, 2000).

Among Larva clusters, despite being placed at the lowest level of the ordered structure in terms of ENT, Athens (ENT = 4.9, HUI = 2.9) holds the third position in terms of Accelerated Start-ups (0.52), but the lowest in terms of Start-ups (0.52). Hence, Athens is located at the bottom of the graph. Rome (ENT = 1.3, HUI = 1.7) is the worst city for ENT; it oscillates between the 10th and 11th positions for all variables.

At the bottom of Figure 2, lower-ranked cities or incomparable cities have been depicted.

Consistent with the classification of the "flower garden," London is ranked as the top city in terms of the HUI (10.1) (Table A9). Concerning the satisfaction about QOL, London ranks first for Environment (average height = 10) and second for subdimensions Governance (9.8), People (8.7), Culture (8.5) and ICT and Mobility (9.3) subdimensions. It is well known that London is oriented toward the implementation of tailor-made public policies aimed at enhancing its role as a multiethnic city and a center of advanced services and tourism/cultural activities; these policies would ensure that London sustains its success as the United Kingdom's only global city (Turok, 2008). The smart city discourse forms an integral part of the overarching narrative of London, which is striving for continuous growth and consolidating its position as a leading international city (Cowley *et al.*, 2017). London is also a top-ranked city in terms of ENT.

Hamburg is a "butterfly city"; it is "dominated by London" (Figure 2b) in all the HUI dimensions, but it is considered a good city and comparable (with the same average height) to London regarding Economy (9.1), People (8.7), Culture (8.5) and Environment (10). Among the German cities, Hamburg is known for its low unemployment rate and remains particularly attractive to young people. Hamburg's QOL is considered very high, as indicated by its economic perspectives, cultural identity and international image, recreational infrastructure and the noticeable presence of green and water areas (Grossmann, 2006). These elements form the premises for the attraction of entrepreneurial activities.

Manchester also ranks best in the ENT index, with high satisfaction scores for Governance (11), Welfare (10.1) and Environment (10), owing to important public policies. Manchester is not dominated by any other city for Governance. After the bomb attack in 1996, authorities collaborated to renovate the city, reconstruct its urban fabric and reactivate the economic and sociocultural systems of the city's core. The aim was not simply to reinstate the bomb-damaged area, but to reinvigorate and revitalize the city center (Williams *et al.*, 2000). Manchester adopted smart city policies characterized by a networked style of governance, which residents appreciated. In fact, the city governed in collaboration with a wide series of allied actors – universities and large hospitals, local engineering and hi-tech firms, transportation for Greater Manchester and grassroots digital organization Future Everything (Cowley and Caprotti, 2018).

Notably, Berlin and Madrid do not bear any resemblance to the other cities. Nevertheless, Berlin holds fifth position; the city is evaluated as satisfactory by its inhabitants for its Environment (9.1) and ICT and Mobility (10.6). These factors are important not only for QOL satisfaction but also for the development of a good entrepreneurial ecosystem.

Concerning Spanish cities' performance in terms of HUI in the flower garden cluster, Madrid holds the top position for satisfaction about People (9.7). Although Barcelona does not hold top values, it ranks high for Welfare (9.6), owing to the smart city policies aimed to make the city more compact and well-lived (Camboim *et al.*, 2019). Considering that Madrid and Barcelona rank high in terms of ENT, this result supports the relevance of informal factors connected to social norms in Spain (Alvarez *et al.*, 2011).

4.3.2 Medium-sized cities. The cluster analysis (Figure 2b) demonstrates that the flower garden cities belong to the northern region, particularly Scandinavia (Vienna, Munich, Copenhagen, Amsterdam, Stockholm, Helsinki and Dublin). Glasgow, Düsseldorf, Stuttgart, Frankfurt, Dresden and Bordeaux are categorized as butterfly; they are typically postindustrial cities that have improved policies aimed at enhancing the QOL (Keil, 2011). Turin, Bucharest and Lille are classified as larva. In recent years, these cities have promoted smart cities policies. For instance, after a transformation, Turin's city government implemented several policies aimed at identifying citizens' needs and promoting innovation (Dezi *et al.*, 2018).

In terms of ENT (Table A7), the top five cities are Amsterdam (19.4), Copenhagen (18), Dublin (17.9), Helsinki (17.6) and Stockholm (17.6). They form part of the flower garden cluster. Figure 3a shows that Amsterdam is positioned above all other cities. Compared to the cities at the level below, Amsterdam dominates Munich and Copenhagen, though it is not comparable with Helsinki and Stockholm. These two Scandinavian cities are not dominated by any city, such as Dublin, which is positioned at a level below the other four cities in the top five. This owes to the incomparability between Dublin and cities at the same level, namely Lisbon, Brussels, Prague and Vienna. Stockholm, however, prevails over Lisbon and Brussels, and hence they cannot be placed at the same height in the ordered structure.

Considering the variables, Stockholm holds the top position for Investors (91.44) and Unicorns (1.82), while Dublin holds the top rank for Accelerated Start-ups (2.71).

Concerning the HUI classification (Table A10) in medium-sized cities, Munich (18) holds the first position for Environment (20.4). It must be noted that Munich holds the first position for HUI, but it does not prevail over all cities. This is because, in other subdimensions, cities that do not have a direct link with Berlin have better values in at least one subdimension (Figure 3b). Munich is followed by Glasgow (17), Copenhagen (15.9), Dublin (15.8) and Düsseldorf (14.9).

It is interesting to note that Glasgow ranks highly for Governance (19.6), People (19.7), Welfare (19.4) and Culture (20.3), but not for Economy (8.5). The city of Glasgow won the Future Cities Demonstrator competition in 2012; several public policies have been implemented in the city to improve the citizen's QOL (Cowley *et al.*, 2017).

4.3.3 Small-sized cities. The results of the cluster analysis are not consistent with the proposed classification of cities. Cities are characterized by mixed models (Figure 2c).

Cardiff (ENT = 2, HUI = 10.2) and Karlsruhe (ENT = 1.4, HUI = 8.6) are pure "butterfly cities," with a lower level of entrepreneurial activities. Cardiff performs best in terms of HUI (Table A11). The other cities present limited levels of HUI. It is impossible to identify a proper "flower garden model" in this group. Luxemburg (ENT = 8.6, HUI = 7.1) is the only city that closely depicts a flower garden; however, it performs modestly in HUI. Since Luxemburg holds the first position for Investors (63.95), it is not dominated by any city. It is incomparable to Tallinn, Valletta and Riga (Figure 4a). Among smaller cities, Tallinn (ENT = 10.8, HUI = 4.1) performs best for ENT (Table A8). Tallinn stands at the highest level of the Hasse diagram and directly dominates Valletta and Vilnius.

Concerning the HUI dimension (Figure 4b), Cardiff dominates all other cities. However, it does not dominate Malmö and Karlsruhe, which are placed at a lower level of the ordered structure. Valletta ranks the lowest because it does not establish any relationship with other cities.

In terms of ENT, although good business conditions have been developed in Tallinn, Valletta (9.5), Riga (7.8), Bratislava (4.2) and Vilnius (6.6), intercultural tensions, political and

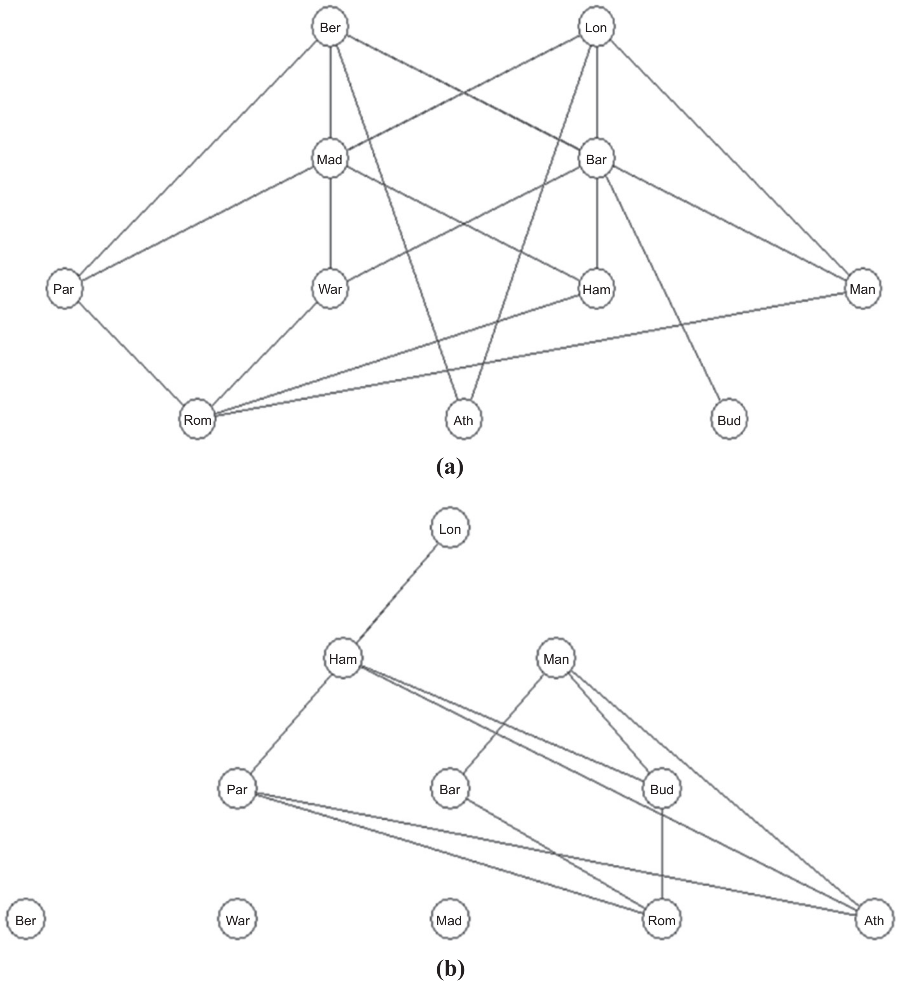


Figure 3. Large-sized cities' Hasse diagram for ENT (a) and HUI (b) dimension

cultural insolvency and other local context factors potentially impede the QOL of an average resident (see Figure 5).

5. Conclusion

This study examines the relationship between the entrepreneurial ecosystem at the urban level and the subjective well-being created by the urban ecosystem. The authors adopted an entrepreneurial ecosystem perspective focusing their attention on Schumpeterian entrepreneurship since the metropolitan areas are assumed to have great relevance to the knowledge-driven innovation economy (Adler *et al.*, 2019).

From this perspective, cities are the critical ecosystems to study economic growth and well-being (Florida *et al.*, 2017). The authors investigated subjective well-being, operationalized as QOL satisfaction, using subjective variables (Eurostat, 2016). The measures of QOL are directly connected to the main smart city dimensions since smart city

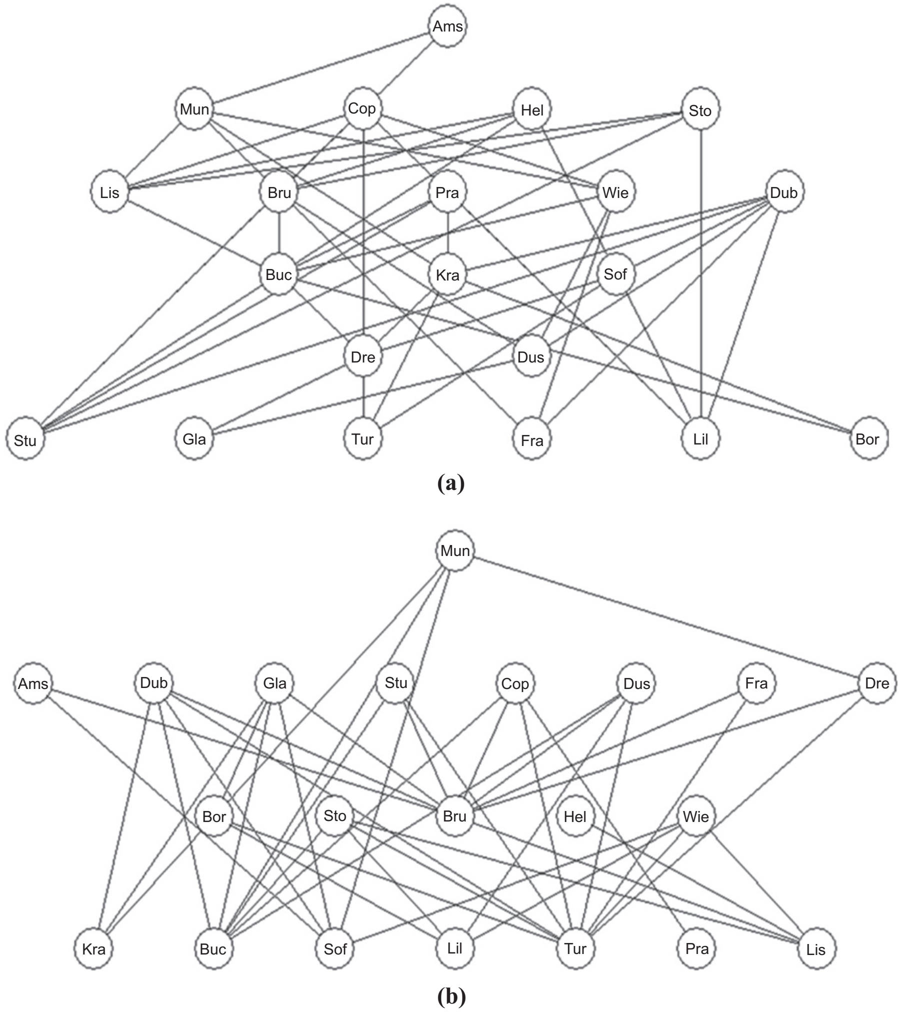
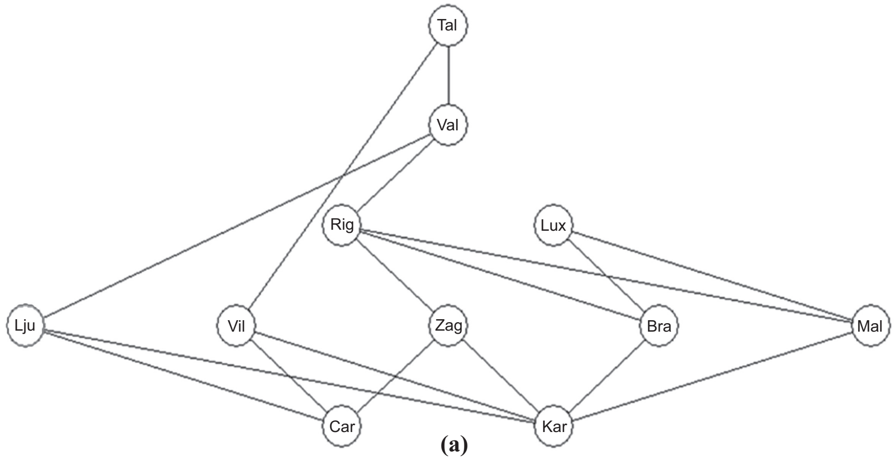


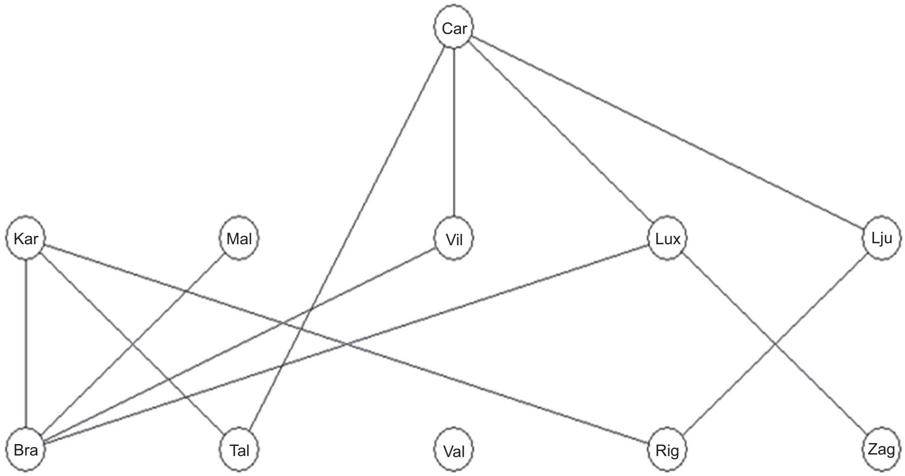
Figure 4.
Medium-sized cities' Hasse diagram for ENT (a) and HUI (b) dimension

policies aim to promote urban development and QOL (Cocchia, 2014; Dameri *et al.*, 2019). Examining the research tradition on entrepreneurial ecosystems and urban well-being, the authors decided on the city as a suitable geographical level of analysis. The analysis included a sample of 43 smart cities, comprising 28 EU capital and 15 noncapital cities. Urban size determined the subgroups of cities.

The correlation analysis shows that the strength of the entrepreneurial ecosystem is positively related to QOL satisfaction only in large cities. This bidirectional finding confirms that a good city climate is linked to entrepreneurial ecosystem strength and vice versa. It could be hypothesized that in large cities, the positive satisfaction about Welfare, Economy, Environment and ICT and Mobility dimensions enhances the entrepreneurial attitude. However, a vital entrepreneurial ecosystem could increase urban QOL satisfaction. Although impossible to state with certainty a causal relationship between the entrepreneurial ecosystem and QOL satisfaction within large European cities, research demonstrated the



(a)



(b)

Figure 5.
Small cities' Hasse diagrams for ENT (a) and HUI (b) dimensions

existence of a strong mutual interdependency. In other words, the evidence provided by this research links the entrepreneurial ecosystem with large cities' QOL, like a sort of virtuous circle. Given this paper's theoretical framework, turning around the service-dominant logic's ecosystem perspective, the authors do not aim to suggest a causal relationship between higher QOL levels and entrepreneurial ecosystems directly. Rather, they looked for correlations between phenomena, highlighting the bidirectional nature of the value cocreation within urban ecosystems based on service-dominant logic.

The cluster analysis shows that the flower garden represents the ideal environment for the creation of the virtual circle of prosperity for bees (entrepreneurial activities) and butterflies (satisfied citizens). In these cities, the high QOL satisfaction (butterfly) contributes toward attracting and retaining entrepreneurship, while entrepreneurship (bees) enhances the QOL satisfaction as well as wealth provision and stimulating innovation, new services and amenities. The cities defined as flower gardens have implemented explicit policies to enhance their national business competitiveness and achieve harmonious development with neighboring regions. With proper business-related and smart city policies, the cities in the larva cluster can be transformed into butterflies or bees and/or, subsequently, to a flower garden. For butterfly cities, crucial priorities are improving business conditions and stimulating entrepreneurial attitudes and aspirations to create a nurturing ecosystem for bees. However, the cities' entrepreneurial ecosystem in the bee cluster can be adversely affected by residents' negative QOL satisfaction. These cities require immediate intervention to create butterfly factors to improve their residents' perception of well-being and cultivate the flower garden. Flower gardens have shown the importance of the implementation of urban strategies aimed at creating a nurturing environment and stimulating entrepreneurship.

This study contributes to the debate on urban well-being and entrepreneurial ecosystems by providing useful insights to academics and urban policymakers. In terms of theoretical implications, this research contributes to entrepreneurial ecosystem literature (Cavallo *et al.*, 2019) by evaluating the existence of relationships between the entrepreneurial ecosystem at the city level and the urban environment via QOL multidimensional satisfaction measurements. This study also advances the knowledge of the entrepreneurship literature by bringing together the entrepreneurial ecosystem (Brown and Mason, 2014), urban well-being (Audretsch and Belitski, 2015; Florida *et al.*, 2013; Sirgy *et al.*, 2000, 2008) and smart city profiles (Kummitha and Crutzen, 2019; Nam and Pardo, 2011). In this vein, it stimulates the debate on smart cities' role in promoting entrepreneurship, which currently is an underinvestigated topic, especially at the European level.

Interpreting these topics and their relationships based on the service ecosystem approach (Polese *et al.*, 2018), this research contributes to enhancing the service ecosystem literature. Specifically, the study applies the S-D logic to cities and smart cities and recognizes some typical features of the service ecosystem. Moreover, this work conceptualizes the relationship between the entrepreneurial ecosystem and the well-being created by an urban ecosystem (Frow *et al.*, 2016). In other words, well-being and entrepreneurial ecosystems influence each other by addressing the value co-creation process typical of the service-dominant logic.

The identification of the four clusters creates an original taxonomy with applicability to different contexts in which two ecosystems interact; it contributes also to macromarketing policy for the personification of cities. From a methodological point of view, this work develops original and synthetic indexes aimed at measuring the strength of the entrepreneurial ecosystem and city-level well-being/QOL satisfaction.

Considering that the results demonstrate the existence of a strong and positive relationship between the entrepreneurial ecosystem and the well-being only for large cities, the practical implications are mainly referred to large cities but they can be extended to medium-sized and smaller cities. The findings suggest that public policies should increase the strength of their entrepreneurial ecosystem, managing the levers that can improve citizens' well-being. Entrepreneurs are generally attracted by the high quality of life. In this vein, the definition of urban policies aimed at creating well-being can serve as "economic leverage," as seen empirically in the positive association between the new urban entrepreneurship and the satisfaction of welfare requirements, economic well-being, environmental quality and transport/digital infrastructure. These policies should also ensure higher returns on investment in real estate, infrastructure and events. Additionally, they should promote coherent urban development by bringing together physical, social, economic and cultural factors. Such policies will help inhabitants, businesses and institutions experience a new sense of purpose and direction and thereby contribute toward enhancing the city's reputation for attracting entrepreneurs. In addition, authenticity and sustainability provide support for regional, economic and cultural development and enhance residents' well-being (Doyduk and Okan, 2017). A stronger entrepreneurial ecosystem can also enhance the perception of well-being in the city, by offering more and new opportunities to residents; improving creativity and community initiatives; strengthening the urban social fabric; and giving value to the city's image. City administrators must realize that the growth of entrepreneurial aspirations (bees) and business investors relates to citizens' QOL satisfaction (butterflies). They should also take into account that the capacity to nurture an entrepreneurial ecosystem substantiates an increase in QOL dimensions. Proper policies can transform larva cities into butterflies or bees and/or, subsequently, into a flower garden.

These findings suggest the importance of public policies to stimulate the growth of entrepreneurial ecosystems and well-being since they are bounded by an intricate set of reciprocally influenced drivers. This path indicates the importance of city decision-makers as planners along the double line of entrepreneurial ecosystem-urban well-being to reinforce the urban ecosystem as a whole.

Moreover, the study of QOL satisfaction at the city level can be used for the implementation of internal and external macromarketing policies (Sirgy *et al.*, 2000), aimed to address the needs and wants of the local entrepreneurs and to attract external entrepreneurs looking to expand or invest. Providing a cluster analysis, it suggests possible personification for the city (Brown and Campelo, 2014) that can promote the urban ecosystem's entrepreneurship and well-being. For entrepreneurial activities, local enterprises and entrepreneurs should base their strategies on the authentic advantages deriving from the city's image and brand (Cassia *et al.*, 2018; Doyduk and Okan, 2017). Aspects such as environment, culture, lifestyle, resources, history and local values are an integral part of any ambitious entrepreneurial ecosystem growth strategy.

Beyond the adoption of city branding measures, the importance of tradition cannot be overlooked (Green *et al.*, 2016). This means that cities can develop independently of conscious attempts to affect that meaning (Braun, 2011; Freire, 2005). A set of influencing and uncontrollable factors can pre-exist to launch a city's branding strategy (Govers and Go, 2009, p. 14; Parkerson, 2007). These appear in some cities' histories (Braun, 2011); educative traditions, cultural roots found in literature and arts heritage (Hankinson, 2004); and media communication (Papadopoulos and Heslop, 2002). The research shows the existence of historical *inertia* in the city's evolutionary frame.

Regarding medium-sized cities, the average height constructed for this group allows to cluster them and to identify four clusters. Despite it being not possible to find a strong correlation between HUI and ENT, several cities present high average scores in both the profiles, and they can be defined as flower gardens. The flower garden trend is not widespread across the entire medium-sized cities sample. Cities such as Vienna, Munich, Copenhagen, Amsterdam, Stockholm, Helsinki and Dublin show high levels of both entrepreneurship and QOL. In contrast, a more tenuous alignment on these components emerges for the other cities. This is not enough to obtain a strong correlation at a sample level.

Given the qualitative–quantitative composition of the sample, further study is needed to determine whether adding medium-sized cities changes the correlation value. As it stands, it appears that some cities are better equipped than others and that such cases are not the rule for medium-sized cities, but rather cases of higher entrepreneurial quality and wealth. In such cases, as opposed to others, the urban ecosystem has undergone an alignment of factors such that it is a flower garden.

From a statistical point of view, there is no correlation between the dimensions of entrepreneurship and well-being in the sample of small cities. In other words, the characteristics of small cities appear to be the result of a trade-off or asymmetrical development of the two components. For smaller cities, the results of the cluster analysis are not consistent with the proposed classification of cities, and only Luxemburg is similar to the flower garden model. If smaller cities implement policies aimed at the QOL, they can construct also a different model of the flower garden, focusing on an entrepreneurial ecosystem based on service activities and knowledge-based workers (Florida, 2002; Ivaldi *et al.*, 2020). Based on these results, small cities seem far from achieving adequate alignment between entrepreneurship and QOL. In its absence, the urban fabric is less willing to converge toward a knowledge-based economy based on a more intense logic of servitization.

This study has some inherent limitations to be addressed by future research. First, one of the main limitations is the low number of cities included in the large and small cities groups. Given the limited number of cities used in the two samples, a marginal increment in numbers for each group could result in a correlation variation. Therefore, it is important that further research consider these limitations and test the robustness of the obtained results by including more European cities. In addition, the investigation was performed on EU cities alone; further studies are required to enlarge the sample, including extra-EU areas, enabling a comparison with other relevant countries (e.g. emerging/advanced economies). Second, based on cross-sectional data, this explorative analysis does not attempt to capture any causality between the entrepreneurial ecosystem's strength and subjective well-being; future research can address this issue by performing longitudinal analyses. Defining an appropriate experimental design could aid in this effort. Third, the number of variables and attributes that refer to each dimension could be expanded, embodying additional dimensions or theoretical perspectives that might reasonably contribute to a better understanding of the research concepts. In addition, this study addresses a pre-COVID-19 situation, since this might encourage an exodus to gentrified affluent suburbs and small towns near superstar cities (Florida *et al.*, 2021). Since new challenges and requirements characterize smart cities after the pandemic, future works should address this situation by embracing new paradigms of well-being, QOL, entrepreneurship and redefining smart cities' priorities.

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Appendix

The Appendix file is available online for this article.

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