

Louvain School of Management

What parameters are European cities driven by in their transition towards Food Smart Cities?

Authors : Marie Rouvroy and Philippine Rouvroy
Supervisor : Carlos Desmet
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Foreword

First, we would like to sincerely thank our supervisor Carlos Desmet for his all-time availability, insightful recommendations and genuine interest in the topic we proposed.

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Executive summary

Never have we been faced as much as nowadays with the realization that our food systems, which we thought to be fair, reliable and secure, turned out to have major shortcomings. Our current food consumption pattern has proven to disregard the scarcity of resources, overlook local actors, increase socio-economic inequalities, while leading to overconsumption. However, these issues are an opportunity to deconstruct, rethink and redesign food systems beneficial to both the environment and human beings. In that light, the concept of *Food Smart City* emerges as a cutting-edge concept aiming at implementing resilient urban food systems. To palliate to the scarce amount of literature on the subject, this paper analyzes the parameters that push cities towards implementing food smart practices based on a sample of twenty European cities.

Our research concludes that the food smartness of a city mainly depends on environmental, socio-demographic, educational and health parameters, while very few come from the political, economic and socio-economic inequities dimensions. Digging deeper in the sub-categories of food smartness, we search for the parameters that will incite cities to rather tend to adopt specific food smart pillars introduced by the Milan Urban Food Policy Pact; Food Waste, Food Production, Food Supply and Distribution, Sustainable Diets and Nutrition, Social and Economic Equity or Food Governance. On Food Waste, practices are influenced by political, health, educational and environmental parameters. Both the pillars Food Governance and Social and Economic Equity are influenced by a broader range of dimensions; health, education, economic, environmental, political, socio-economic inequity and socio-demographic. The category Sustainable Diets and Nutrition is mainly depending on parameters related to inhabitants; educational, socio-demographic and environmental parameters. Turnover of the food industry is the main significant parameter for Food Production, next to environmental, political and health parameters. Eventually, Food Supply and Distribution parameters mainly derive from economic, political, socio-demographic, socio-economic inequities and educational dimensions, while few parameters come from environmental and health dimensions.

Knowing what drives cities to develop specific food smart practices is crucial to better apprehend the concept of a food smart city and to implement it according to a city's needs and challenges. In that light, rethinking our current approach to urban food systems is an exciting challenge that leaves room for innovation and creativity with as ultimate purpose to make cities better places to live.

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List of abbreviations

Athens	ATH
Barcelona	BCN
Bilbao	BI
Bratislava	BA
Bruges	BG
Ghent	GH
Lisbon	LX
Ljubljana	LJ
Luxembourg	LUX
Marseille	MA
Milan	MI
Munich	MUN
Prague	PRA
Riga	RG
Stockholm	SK
Tallinn	TLL
Turin	TOR
Utrecht	UT
Vienna	VIE
Warsaw	WS
Community-supported agriculture	CSA
European Union	EU
Food and Agriculture Organization of the United Nations	IEEP FAO
Food Smart Cities for Development	FSC4D
Institute European Environmental Policy	IEEP
Milan Urban Food Policy Pact	MUFPP
Organisation for Economic Co-operation and Development	OECD
Sustainable Development Goals	SDGs

1 General Introduction

1.1 Current context and challenges

Food, as a primary need, plays a unique role in sustaining human life and is related to a broad range of municipal and regional policy areas. Food addresses justice and health issues and vehiculates the integration of economic, social and environmental aspects of sustainability (Moragues-Faus et al., 2013).

Yet, never have our urban food systems been confronted with challenges such as those they face today. Surveys have shown that 70% of the world population is expected to live in cities by 2050. Hence, urban areas represent a serious danger for the environment as they consume 75% of the total world's resources and are responsible for 80% of greenhouse gases worldwide (Mohanty, Choppali, & Kougianos, 2016). In that light, European cities nowadays face critical issues of overconsumption, increasing social inequities, pollution and a critical scarcity of resources (European Cluster Observatory, 2017). This goes along with a looming climate change that threatens our food system and increases hunger worldwide (Maye, 2019). As a matter of fact, our current consumption pattern has lost sight of the availability of resources, causing serious damage to the environment and disregarding small and local actors (International Panel of Experts on Sustainable Food Systems [IPES FOOD], 2019).

The IPES FOOD (2019) provides alarming numbers on the food sector and its implication on the life of European citizens. 800 Million European citizens suffer from hunger and 9.1% of them are unable to have access to one quality meal a day. The study also points out that despite the demographic boom in Europe and consequently the increasing demand for food, one out four farms have disappeared from Europe between 2003 and 2013, moving to international sourcing and land being transformed for industrial development (IPES FOOD, 2019). This goes along with security and health problems associated to current food systems as well as excessive air pollution. Yet, those issues are an opportunity to rethink our current approach to consumption and leave room for new innovations to make cities better places to live (European Cluster Observatory, 2017).

European Commission surveys within the 28 member states of the European Union show interesting consumption trends; in 2012, 71% of Europeans pretend to find the origins of their

food important, while 65% emphasize the quality of the food as being very important (European Commission, 2012). In 2017, 77% of European citizen attested that local traditions and know-how significantly influence their purchasing decisions (European Commission, 2017). In the same line, Born & Purcell (2006) have claimed food being local to have an important positive connotation among people (Born & Purcell (2006) as cited in Kenis & Mathijs (2014, p.8))¹, while Morgan (2010) confirms that local food faces growing consumer preferences. This is due to the fact that ‘local food’ is often related to as retaining more nutrients, therefore increasing health, fostering social capital and increasing local interactions.

Rethinking our consumption model questions the role of different levels of power in their design and implementation. In 2017, 51% of European respondents considered the European level as the most suitable level to deal with food issues, compared to 34% that appointed the national level (cfr. Figure 1) (European Commission, 2017). This supranational responsibility for creating healthy, high quality and safe food did not appear yet in 2012 and is a main change in EU citizens’ opinions. Still, differences remain among member states; the importance of the European responsibility in agriculture is particularly highlighted in the Netherlands, Spain and Belgium, while France and Italy recognize slightly more the importance of managing the quality of agricultural products at regional level (cfr. figure 1).

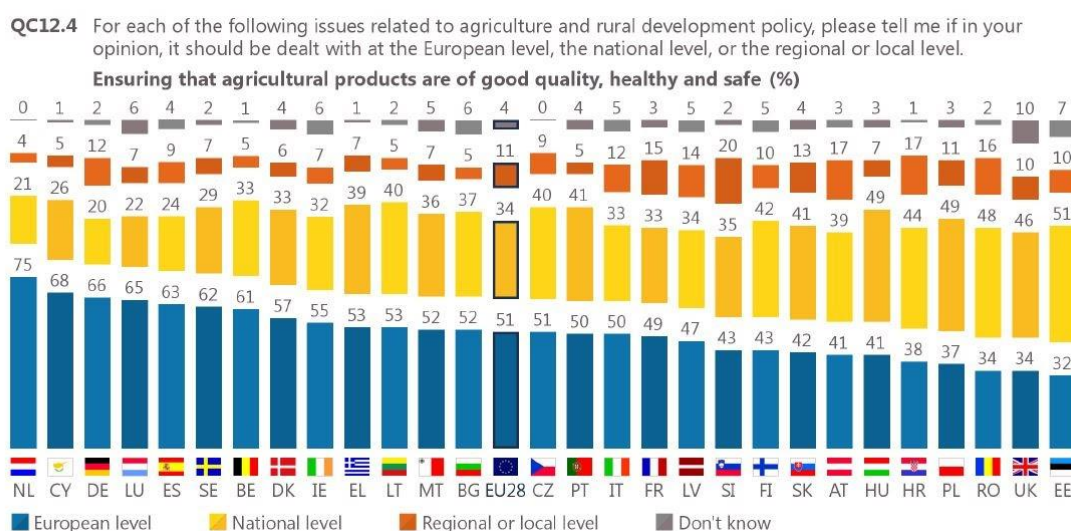


Figure 1: Eurobarometer 473 (European Commission, 2017)

For Italy and France, this goes along with a rising general trend of local and regional identification (Haller & Ressler, 2006)

¹ Born, B. & Purcell, M. (2006). Avoiding the Local Trap: Scale and Food Systems in Planning Research. *Journal of Planning Education and Research*, 26, pp.195-207.

In that context, food smart cities arise as innovative patterns to rethink and redesign urban food systems to be sustainable, accessible, of high quality and safe. Food smart cities offer the opportunity to make local actors the protagonists of a healthy and secure food system while preserving the earth's resources. A lot of cities have started their journey towards sustainable urban food systems. This paper will analyze the incentives for cities to start their transition towards becoming food smart and to invest in food smart practices.

1.2 Motivation of this thesis

In the light of current worrying trends related to the food industry, consumers increasingly seek to question their food consumption pattern and take an active participation into being informed about what they eat. While challenges in the food industry are high, food has the potential to solve a wide range of socio-economic issues cities face and are therefore both a challenging and exciting opportunity. The rising interest of individuals in buying local and sustainable combined with environmental, economic, cultural and social issues has led us to reconsider our food system and its sustainability.

As many individuals born in the end of the 90's, we have been raised with growing concerns on food sustainability, the quality and origin of our food and its composition. We have grown with the belief that citizens can act on society and have their vote to cast on the change they want to see in the world. Therefore, we believe in participative models that would take various stakeholders into account to create urban food systems that would be tailored to each citizen. Different players from various organizations have the potential to transform our current food system into sustainable food systems, that would benefit to all and improve different aspects of citizens' lives. In that light, the emerging concept of food smart cities seems to be a cutting-edge subject that has drawn our attention on how to respond to challenges the food industry faces. While the notion of food smart city is still hardly known among people and research remains scarce, it fostered our will to deepen ourselves in this current trend of transformation of cities on their path to sustainable food systems.

1.3 Research question

This analysis will focus on finding the key parameters that push European cities in their transition to food smart cities and implement specific categories of food smart practices. Concretely, our research question is the following ;

What parameters are European cities driven by in their transition towards Food Smart Cities ?

2 Literature Review

2.1 Shifting governance and regional inputs in our food systems

When asked to customers, the vast majority tends to define ‘local food’ as either national or produced within a limited area, mostly at city level (Morgan, 2010). The European Commission defines local food systems as food systems where food production, processing, trade and consumption take place in a delimited geographical area, from 20 to 100 km radius at most (Gava, Galli, Bartolini, & Brunori, 2014). In comparison, the ‘regional’ scale has a European Commission legally recognized framework that leaves no doubt on its boundaries (European Cluster Observatory, 2017). However, the local and regional level are often confounded and used interchangeably as they are highly related. This strong interrelatedness between ‘local’ and ‘regional’ is particularly true in the context of food systems. As a matter of fact, the trend of regionalization of our food systems happens mainly in high-income countries and both at regional and local level, with as aim to mitigate drawbacks of globalized chains (Donald, Gertler, Gray, & Lobao, 2010). Throughout this report, the notions of ‘local’ and ‘regional’ will be used interchangeably in a common understanding of ‘localization’ processes.

Starting after the Second World War, a growing number of supranational organizations have been gathering health, social and economic data not only about countries, but also about regions. This is the case of the World Health Organization (WHO), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Development Program (UNDP) (Kitchin, Lauriault, & McArdle, 2015). Different cities from a same country have very different resources, opportunities and threats that should not at all costs be considered at country level to be seized adequately. Territories are embedded in systems of knowledge-sharing that raise thanks to proximity, place-based systems such as systems of innovation, smart specialization strategies, clusters and public policies that heavily rely on regional or local territories. Through time, an increasing number of competences and policies have been brought at regional level (Wilson, 2019).

Aside from those shifting territorial competencies, there is a need for new ways of managing cities with new forms of beyond-the-state governance, challenging our traditional forms of decision-making, far from state-based top-down policies (Moragues-Faus & Morgan, 2015; Swyngedouw, 2005). This shift of governance happens at the same time upwards and downwards as outwards, moving decision-making to non-governmental actors (Wilson, 2019). Indeed, aside from a governance becoming multilayered (Moragues-Faus & Morgan, 2015), we experience a trend towards co-governance, including NGOs in decision-making (Morgan, 2015). Lemke (2002) points out that it is not about a diminishment of state sovereignty, but a “displacement from formal to informal techniques of government and the appearance of new actors on the scene of government” (Lemke (2002) as cited in Swyngedouw (2005, p.8))². Those actors should come from the different parts of the quadruple helix; public administration, civil society, business and research (European Commission, 2016; Maye, 2019; Baccarne et al., 2014).

Recent engagement of cities in food and agriculture have exploded, through the increasing involvement of city councils, urban movements or local authorities in drawing urban food strategies (Maye, 2019; Brand, 2015). Localization of food systems is opposed to the large-scale economic and political influence vehiculated by globalization and neo-liberalization, often associated to the decrease of local farms and practices as well as food insecurity, the use of genetically modified organisms, food inequalities, poor nutrition, concentration in ownership and labor exploitation (Allen, 2010; Wilkinson, 2015). The International Panel of Experts on Sustainable Food Systems (2019) recognizes cities and regions as playing increasing roles in food innovation, creating new cooperations between civil society, public actors and local entrepreneurs (IPES FOOD, 2019; Moragues-Faus & Morgan, 2015). The European Union is an enabler for going towards the reterritorialization of our food systems, by backing agri-food clusters, while most of the EU smart specialization strategies currently concern the domain of food (European Cluster Observatory, 2017; Brand, 2015). It has the potential to create its Common Food Policy, that could complete- or even replace the current Common Agricultural Policy (CAP) and be a policy setting for the entire European food system towards sustainability (Candel & Pereira, 2017, IPES FOOD, 2019). In that aim, the European Union can rely on its advisory body, the European Economic and Social Committee (EESC), to foster civic

² Lemke, T. (2002). Foucault, governmentality, and critique. *Rethinking Marxism*, 14(3), pp. 49–64

discussions and implement a participative democracy linking local and supranational authorities (IPES FOOD, 2019; European Economic and Social Committee, n.d.).

However, the regionalization of food systems goes along with some reflections. Firstly, it is a mistake to associate all types of regional food chains to performing better on sustainability than global chains, as many producers act on a small scale responding to consumer preferences rather than genuinely caring about environmental matters (Dedeurwaerdere et al., 2017). Secondly, it is essential to notice that this local trend does not naturally exclude the global one. ‘Local’ approaches to food systems emerge from Morgan (2010) and Donald et al. (2010) as a necessary mix of global and local production factors, illustrated for example in the coexistence of both fair-trade and locally produced food (Morgan, 2010). It defies a strict categorization of being entirely ‘local’, ‘global’ or ‘green’ versus ‘fairtrade’ (Donald, Gertler, Gray, & Lobao, 2010). To illustrate the paradox of local and global trends arising simultaneously within food systems, while our retail has largely become globalized around few international players and food safety standards managed at European level, approaches to local food sourcing have raised parallelly (Bartolini, Brunori, Galli, & Gava, 2018; Polsa & Xiucheng, 2011).

2.2 The future of food supply chains and retailers

The shortening of food value chains and the transformation of our food system appear as alternatives towards reaching sustainable food systems. The European Commission defines short food supply chains as food that can be identified by, and traceable to a farmer with a minimal amount of intermediaries (Gava et al., 2014). However, different types of short supply chains exist. The proximity sales category are local farming systems where locally farmed products are offered to local consumers. Schemes such as Community-Supported Agriculture (CSA) rely on partnerships between producers and consumers for production decisions. Lots of short supply chains exist where consumers have to get to the production place to buy a farmer’s product in a farm shop, roadside sales, etc. Farmers can also sell their products in food festivals, restaurants, farm-based deliveries, cooperative shops or supermarkets with none or few intermediaries. Eventually, farmers can reach directly to public institutions such as schools, companies and hospital canteens (Gava et al., 2014). In those models, the shortening of supply chains often implies overlooking retailers.

The Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI) (2019) predicts a trend towards local food circles and circular value chains that completely redefines roles in food chains. Food circles are new ways of designing and organizing our food system based on the interconnectedness of various actors of the food production to reach a sustainable and local agriculture. In this model, the role of various actors for growing, distributing and consuming food is reconsidered and competes against traditional roles of retailers. Small farmers will increasingly be integrated by retailers to respond to the demand for locally produced food and reduced wastage. Further, retailers will increasingly be confronted to the ‘do-it-yourself’ tendency, where consumers start producing their own food. Borders between producers and consumers become blurred and retailers will be hit by this, as food bought in supermarkets will increasingly be preserved for stocks or produced directly by consumers. To emphasize this, pilot projects on innovative cultivation techniques are tested and would bring resources back to their origins in models such as urban gardening (Fraunhofer ISI, 2019). Those trends will impact retailers by putting pressure on the supply of local products.

But the establishment of more local supply chain does not necessarily have to be at the expense of existing large retailing companies. Despite trends towards small-scale local food systems, the Fraunhofer ISI (2019) predicts an increasing market power for large retailers. Studies have proven that both retailers and farmers see opportunities for large grocers to source local products. With the increasing popularity of corporate social responsibility, big retailers such as Delhaize and Ahold have begun to disclose information on local food procurement and made local food practices and spending part of performance indicators. Through their position of retail, they can significantly influence prices, distribution conditions, quality, production conditions and preferences. Ongoing trends from large retailers towards local practices is a scenario for their future thriving (Martinez et al., 2010). However, more sustainable food systems require more transparency of large food retailers, at the risk of triggering consumer losses. The large German retailer Lidl has started to give the possibility to trace products and find additional origin information. Launched in 2018, its transparency initiative aims at adding QR codes on products, redirecting customers to the fTRACE platform (fTRCE, n.d.). Aside from responding to customer expectations, retailers are expected to face tougher regulations and legal frameworks on labelling, waste, nutrition and packaging (Fraunhofer ISI, 2019).

2.3 Smart City

2.3.1 Introduction to the concept of ‘Smart City’

Thanks to the latest development of information and communication technologies (ICTs), the concept of ‘Smart City’ emerges as a solution to global societal challenges of urban areas (Datta & Odendaal, 2019). A smart city is defined by the European Union as an interactive and responsive place where services and networks are made efficient by using telecommunication technologies and digitalism (European Commission, n.d.). More concretely, a smart city can be identified as an ecosystem that involves multiple stakeholders mobilizing the use of innovative technologies for implementing sustainable strategies. While they identify stakeholders to be governments, universities, businesses, international organizations or citizen associations, technologies can be hybrid or engineering technologies (Caragliu et al. (2009); Nam and Pardo (2011); Haque (2012); Schaffers et al. (2011); Chourabi et al. (2012) as cited in Smart City Institute, (2014, p.1))³⁴⁵⁶⁷. The necessity of developing smart cities lies in the ability of predicting and adapting outcomes of possible urban policies on the environment thanks to extensive gathering of data (Maye, 2019). Smart cities are a great opportunity to reduce energy- and water consumption, carbon emissions, transportation and waste (Mohanty, Choppali, & Kougianos, 2016). The importance of social sustainability is not to be neglected either, defined as policies improving individual skills, tightening social inequalities or increasing one’s wellbeing (Trivellato, 2017). Highlighting this multifaceted sustainability, Mohanty, Choppali, et Kougianos (2016) define a smart city as:

‘A smart sustainable city is an innovative city that uses information and communication technologies (ICT) and other means to improve quality of life, efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects’ (Mohanty et al., 2016, p.1).

³ Caragliu, A., Del Bo, C., & Nijkamp, P. (2009). *Smart cities in Europe*, in *Proc. of the 3rd Central European Conference in Regional Science (CERS)*, pp. 45-59

⁴Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo, T., & Scholl, H. J. (2012). Understanding Smart Cities: An Integrative Framework, in *Proc. of the 45th Hawaii International Conference on System Science (HICSS)*, pp. 2289–2297

⁵ Haque, U. (2012). What Is a City that It Would Be ‘Smart’? *City in a box*, 34, pp.140-142

⁶ Nam, T. & Pardo, T. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. *ACM International Conference Proceeding Series*, pp.282-291

⁷ Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., & Oliveira, A. (2011). Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation. *Future Internet Lect. Notes Comput. Sci.* 6656, pp. 431-446

To do so, smart cities are “driven by digital technology” (Datta & Odendaal, 2019, p.2) and make use of a permanent flow of data and technology to optimize the management of their city thanks to the Internet of Things (Dieuzeide & Coulée, 2018). This concept is defined as devices that connect together thanks to the use of Internet to share data (Cambridge Dictionary, n.d.). Concretely, a city is made smart through nine components linked through the Internet of Things; smart- infrastructure, citizen, building, transportation, energy, healthcare, technology, education and governance. However, a smart city does not necessarily need all components (Mohanty et al., 2016).

2.3.2 Measurements of a Smart City

Widely used standards for tracking the performance of cities are firstly the ISO 37120 framework entailing the ISO 37122 indicator reference for smart cities. They aim at three purposes; measuring performance management and quality of life of a city, providing learning by comparing outcomes with other cities and backing policy development. Concretely, the ISO framework builds up measurable indicators around 24 themes such as economy, education, environment, finance, governance, health, housing, population, safety, solid waste, etc. (International Organization for Standardization, 2018). Drawbacks are that those standards do not provide any threshold value. Cities can only compare themselves to others, neglecting singularities. Moreover, cities do not necessarily have authority on all factors influencing indicators in their described powers. As an example, the city’s authority in Bulgaria does not have competencies to act on education, that is controlled by the central government, leaving few municipal decision making (European Committee of the regions, n.d.).

Another measurement is the CITYkeys indicator framework for smart city projects and smart cities supported by the European Commission. Those indicators, 99 for smart projects and 76 for smart cities, are similar to key performance indicators and aim at tracking the advancement of cities towards their objectives. They target decision-makers of a city, smart projects organizers in towns and national and European actors to track the functioning of cities. The framework is built around five themes: people, planet, prosperity, propagation and governance, each containing sub-themes and policy goals (CITYkeys, 2017). Examples of indicators are the percentage of electric vehicles, the coverage of parking guidance systems, the share of intelligent buildings, the increase of computer literacy among the elderly (CITYkeys, 2017).

Another framework is the Global City Indicators Facility (GCIF) of the World Bank and the OECD, providing ways of measuring factors related to cities, composed of 20 topics around cities and quality of life of citizens (Kitchin et al., 2015).

Some cities have already shared the ambition to use real-time data to track the performance of their city on socio-economic factors. To do so, the implementation of ‘city dashboards’ allows citizens to visualize online data on their city. Dublin has already kick-started the implementation of its own prototype, even if few cities are following suit (cfr. figure 2) (Kitchin et al., 2015).

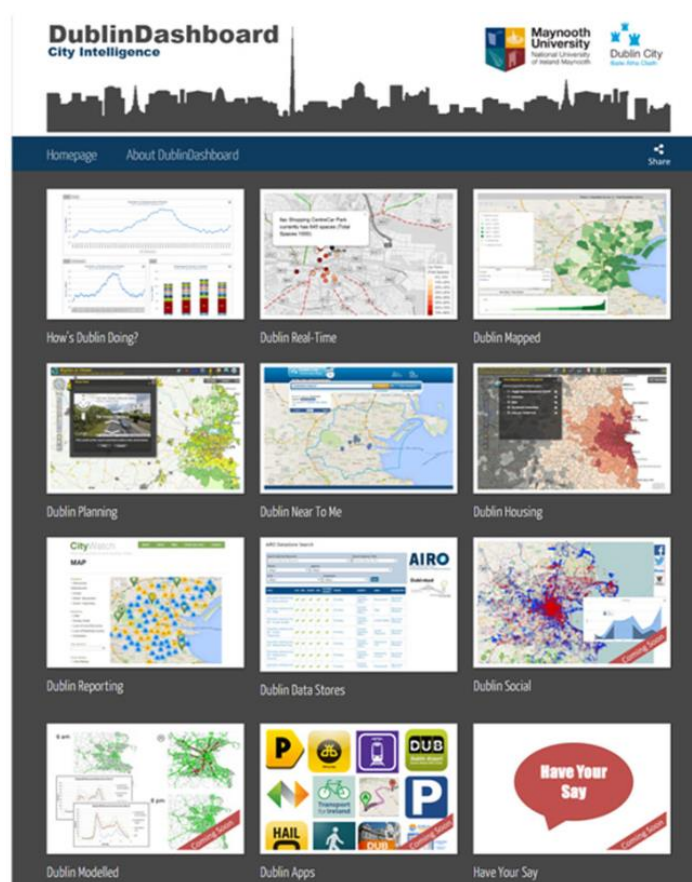


Figure 2: Dublin City Dashboard (Kitchin, Lauriault, & McArdle, 2015)

2.3.3 An insight on Smart Cities in Belgium

The Smart City Institute (2017) highlights the current state of advancement towards smart cities. Research in 589 Belgian municipalities shows interesting trends on how the country approaches smart cities. Overall, smart cities tend to be associated first to a technological challenge, before being seen as an opportunity and lastly as the future landscape of cities. The different regions of Brussels appoint different importances to smart cities; 88% for Brussels, 78% in Flanders,

while only 45% in Wallonia. Depending on rural or urban respondents, significant differences emerged on their necessity, 34% in rural areas while 77% in urban cities. Only 17 municipalities have appointed a responsible for smart city development and 17% plan on elaborating a strategic plan towards developing a smart city (Smart City Institute, 2017). Overall, transformation towards smart cities in Belgium remains minimal.

2.3.4 COVID-19 emergency as stress-test for Smart Cities

The recent outbreak of the COVID-19 has been a stress test for smart cities and has been the way forward to deal with sanitary crisis such as the one we face currently. At the epicenter of the crisis, China has relied extensively on its smart city technologies to deal with COVID-19. President Xi Jinping has recruited several tech companies and announced the creation of 500 Chinese smart cities designed to gather traffic, pollution and public health data. However, the establishment of the link between smart cities and health is not new, as in 2014 the government already announced its Promoting Health Smart City Development Policy, backing on artificial intelligence and big data to manage health (e-Zigurat, 2020). Worldwide, the technologies smart cities offer through extensive sensors use and data sharing have been able to track the efficiency of social distancing measures to slow the spread of the disease. From flows of vehicles to pedestrians, energy consumption, air quality or parking occupancy, our movements have been monitored to address the pandemic as accurately as possible (World Economic Forum, 2020). Smart cities in that sense offer solutions to monitor and mitigate the crisis impact but could in turn threaten civil liberties and privacy. Crucial question therefore remains; can the surveillance services smart cities offer to deal with crisis outweigh current privacy and civil liberties concerns?

2.4 Food Smart Cities

2.4.1 The emergence of the notion of ‘Food Smart Cities’

The duty of cities to guarantee a stable food supply to their population is not new and has been existing for centuries. However, what is new is the understanding of the number of challenges related to urban food systems, their magnitude and complexity. Current food issues cut across the food system and its value chain, which make issues more complex than ever (IPES FOOD, 2019). In that context, the term *Food Smart City* has emerged and still lacks an official European

Union definition, the idea being a new approach towards food sustainability in cities (Maye, 2019; Rikolto, 2019).

Its precursor emerged in the early 90's, when several cities started developing food strategies and food policy councils (De Cunto, Tegoni, Michel, & Lajili-Djala, 2017). A food policy council can be defined as “a network of stakeholders who wants to change the food system of the city” (Moragues-Faus et al., 2013, p.13). Food policy councils and partnerships may take the form of non-profit organizations that can apply for public and private organization's funds (Moragues-Faus et al., 2013). Recent food policy councils in Europe are proof of change in the governance of food systems in cities, although they have started slightly earlier in North America (Morgan, 2015). An example of such governance shift is the city of Toronto with its Toronto Food Policy Council that started in 1991, involving stakeholders of different sectors (De Cunto et al., 2017). By contrast, in the United Kingdom, it is only in 2010 that the first Food City Council was launched in Bristol (Morgan, 2015). In 2001, the Food and Agriculture Organization of the United Nations (FAO) launched the ‘Food for the cities’ initiative, aiming at designing sustainable food systems. In 2014, the FAO launched a three-year project on City Regions Food Systems in seven countries. One year later, with its Food Smart Cities for Development Project, the initiative Milan Urban Food Policy Pact (MUFPP) massively started using the concept of ‘food smart city’ and highlighted the role of cities in designing sustainable food systems. Finally, an exploding number of EU-funded projects related to the food sector in cities in recent years further shows growing interest (De Cunto et al., 2017).

2.4.2 Introduction to the concept of a Food Smart City

The concept of ‘Food Smart City’ stands at the heart of the concept of a ‘Smart City’. Rikolto's Food Smart Cities Cluster (2019) defines food smart cities as “the central concept for cities that are working towards new urban food systems” (The Food Smart Cities Cluster, para. 1). According to Maye (2019), urban food systems can be defined as “the different ways food in cities is produced, processed, distributed and retailed” (Maye, 2019, p.20). Urban food systems refer equally to food produced and packaged miles away from cities they are intended to be sent to, as well as produced in cities themselves. Therefore, the food provisioning system is often referred to as hybrid, influenced by a range of local, regional, national and international factors (Maye, 2019). However, urban food systems are also related to a wide range of factors such as community cohesion, social and mental wellbeing, the use of resources, the reuse of

waste water, the saving of energy, food growing practices, ecological pressures, etc. Urban food research is very much oriented towards the transformative potential of urban food strategies to create synergies between food producers and consumers as well as between cities and outskirts (Maye, 2019). At the light of those considerations, a food smart city can be considered as a city starting its journey towards designing sustainable and innovative urban food systems that address current challenges (Maye, 2019; Rikolto, 2019).

Maye (2019) identifies several crucial elements of a food smart city. The first is ‘city regionalism’, highlighting the necessity of working on a city-region scale, to adapt urban food systems to the context of each city and recognize the role of cities in food policies. Besides this, a food smart city focuses on ‘connectivities’, defining at which level to set the governance of food systems and enabling synergies within same locations. A third element is the creation of a ‘circular metabolism’, going from linear to circular food systems (Maye, 2019). Eventually, a fourth element is to recognize the importance of social practices at local level as sources of innovation and knowledge building (Maye, 2019).

As smart cities do, food smart cities also rely on ICT tools. As an illustration, some applications were launched recently to bring customers closer to producers through electronic information-sharing, such as the EU-funded mobile application FoodSMART for Android devices (Hartwell et al., 2019). Concretely, this easy-to-use application enables the consumer to access nutritional compositions of dishes, as well as allergenic information and value for money (Hartwell et al., 2019; European Commission, n.d.) Aside from applications, the use of agricultural robotics, smart LED lightning for vertical farming or data metrics to monitor energy use or waste optimally are other ways of using ICT in cities (Maye, 2019).

2.4.3 Urban food strategies as a way of implementing Food Smart Cities

An urban food strategy is defined as “a process consisting of how a city envisions change in its food system, and how it strives towards this change” (Moragues-Faus et al., 2013, p.6). It provides a way of implementing sustainable food systems in food smart cities.

Until recently, food issues, strategies and policies were handled at European, international and national level through separate silos on sectoral basis. However, this segmentation of food issues could lead to the vulnerability and disruption of food systems. To palliate to this, many

urban food policies share system-thinking, a concept that relies on the complexity of food systems and interrelatedness of its different actors (Sonnino, 2019; Brand, 2015; Brand et al., 2019). The aim of urban food strategies became to link different stakeholders by creating synergies between them (Davies, 2019; Moragues-Faus & Morgan, 2015).

Urban food systems reconsider the role of food in urban areas (Brand, 2015) by involving both horizontal and vertical dimensions (cfr. figure 3) (Moragues-Faus et al., 2013; Brand et al., 2019). The horizontal dimension of the food system fosters different policy areas such as health, environment, social and cultural aspects, wellbeing, education and community development. Alongside the horizontal dimension, the vertical dimension includes different stages of the food system such as food production, processing, retail, transport, consumption and wastage. The development of urban food strategies involves different stakeholders, both to gather and take responsibility for cities' food systems. Integrated urban food policies have as purpose to address various issues related to food systems and often imply complex governance layers, embedding local, national, international and European levels. The majority of urban food policies are targeted actions that have concrete objectives, such as addressing environmental or health-related concerns (IPES FOOD, 2019). Urban food systems are built up based on key features of cities; the strength of the local economy, the involvement of its civil society, its governance structure, political and societal characteristics, natural resources, ... (De Cunto et al., 2017).

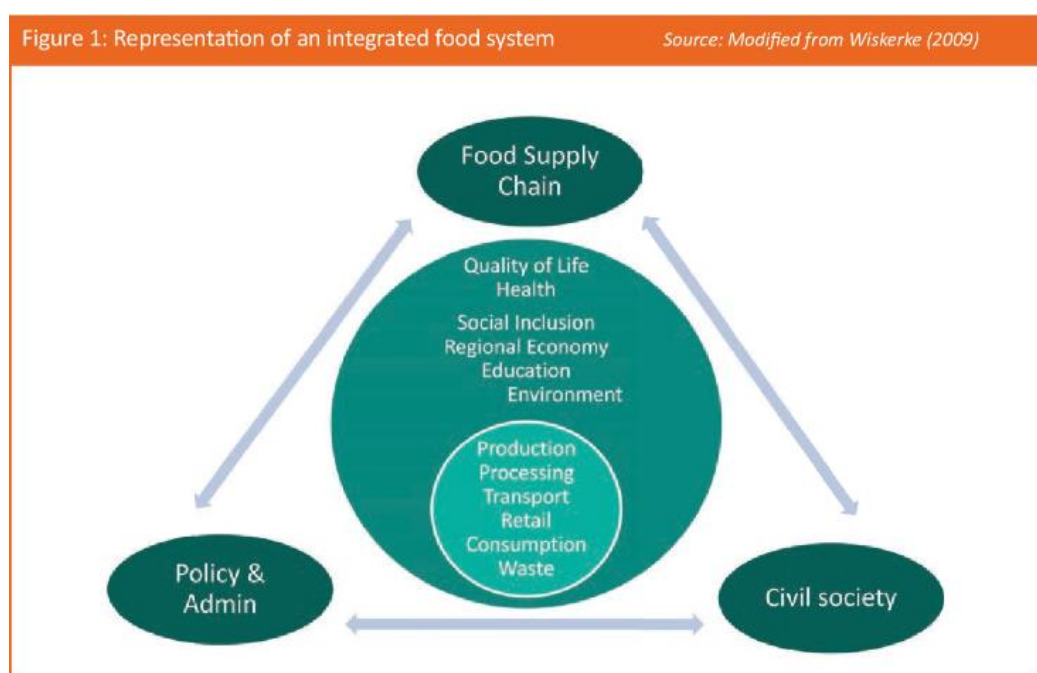


Figure 3: Integrated food system (Moragues-Faus et al., 2013)

The different stakeholders involved tend to have access to diverse resources and have different powers, public bodies tending to deal with regulatory and financial instruments while civil society has a tendency to rather adopt concrete actions. City administrations use as main instruments public procurement, spatial and territorial planning and communal infrastructure. Public procurement can be used to influence how an urban food system works by for example inciting the offer for healthy and organic food, as well as inciting for local food. Territorial and spatial planning can be useful to design land for urban agriculture and support short food supply chains. Eventually, communal infrastructure can help creating facilities that support short food supply chains such as storage, processing facilities, etc. Creating bonds between stakeholders is therefore a way to benefit from the different resources and knowledge (Moragues-Faus et al., 2013).

Brand et al. (2019) provide three different urban food policy implementation approaches, that can be used separately or combined. A first approach to implement urban food policies is to analyze the levers available for local urban governments. Analysis, instead of being based on objectives, starts from the potential of available levers to solve food-related issues. Levers are used to achieve goals that they were not intended to reach from the beginning on. An example is the role of school cafeterias to put forward organic food. A second approach that can be used to implement urban food policies is to first start from the issues local urban governments face in their cities and how to solve those. An illustration of this would be to start from the issue of food security and then find levers that would help solve this, such as lower cafeteria prices, food aid, etc. Eventually, a third approach is to first focus on a policy proposal, consisting in actions that would solve food issues. To do so, an action framework should be developed and link problems with levers (Brand et al., 2019).

2.4.4 Measurements of a Food Smart City

The previously addressed ISO 37120 standard that serves as a useful framework for measuring the performance of smart cities can be used to measure certain aspects of food smart cities. The ISO 37120 measures the advancement of a city towards some Sustainable Development Goals (SDGs) that are considered as priority areas for food smart cities, but however remains incomplete. Besides, some factors measured in the CITYkeys reference framework for smart cities could be applied to measure whether cities are food smart. For example, indicators on smart projects such as the increased access to green space, the efficiency of resource

consumption, the reduction of water consumption, increase of reused water, the food- and water self-sufficiency, climate resilience measures, the increase of use of local workforce or local job creation, local food production, climate resilience strategy, the presence of smart city policy, multilevel governance, ... (CITYkeys, 2017). A more complete framework of indicators for food smart cities is proposed by the Milan Urban Food Policy Pact (MUFPP), an international initiative taking the lead in food smart cities (cfr. Section 2.5). This framework, finished in 2018, is composed of outcome areas, recommended actions and 44 smart indicators divided amongst the six key pillars identified by the MUFPP; Food Waste, Sustainable Diets and Nutrition, Social and Economic Equity, Food Supply and Distribution, Food Production and Food Governance (Magarini & Porreca, 2019). Every indicator of those MUFPP categories is itself linked to sub-goals of the UN Sustainable Development Goals. The framework does not provide detailed guidelines on how to approach measurements but proposes methods to do so and proposes cities to measure only the areas where they focus their development policies on. It does not aim at providing any ranking of cities or serve as a basis of comparison between them (MUFPP, 2019).

2.4.5 Challenges of Smart- and Food Smart Cities

However, these ways of organizing cities go along with important challenges. A first is the cost associated to this transition. This cost can be subdivided into operation and design cost (Mohanty et al., 2016). While design cost is paid at once, operation cost aims at maintaining the smart city through time. Moreover cities should be able to cope with new demographic and environmental trends such as exploding populations or low carbon economies. They should also be resilient to natural catastrophes, power failures or technological problems. Besides, as a city relies heavily on digital tools, it should know how to cope with downturns and ensure reliable communication at all times. Ensuring security, public safety and privacy are also main challenges (Mohanty et al., 2016). Indeed, by using extensively technology, cities can be reproached to track behaviors of citizens and compromise privacy. Moreover, policies and implemented programs should not lose track of citizens' wellbeing and quality of life (Trivelatto, 2017). Furthermore, the new beyond-the-state forms of governance it incorporates leaves questions about division of power, accountability, political rights of citizens and their empowerment (Datta & Odendaal, 2019; Swyngedouw, 2005). It should support transparency, entitlement and representation with regards to democratic values (Moragues-Faus & Morgan, 2015).

2.4.6 An insight on Belgian and European Food Smart Cities

Even if rankings similar to those for smart cities do not exist yet for food smart cities, different cities in Belgium have shown to undertake transformations towards becoming food smart, particularly in Flanders. The region of Flanders, located in the north of Belgium, strives for a more sustainable and fair food industry while enhancing the socio-economic development of the region (Flanders Food, 2019). The movement ‘Transition Towns’ has as main focus food and entails 80 initiatives aiming at ruralizing towns, developing roof gardens, local food chains, compost toilets or farmer markets (Kenis & Mathijs, 2014). Another example of a Flemish initiative is the inclusive platform and cluster named Flanders’ Food that facilitates innovation in the agri-food sector through collaboration. It was created in 2005 and has as mission to promote healthy lifestyles as well as tasty food for the next generations, with as aim to become a European top region in the agri-food sector. This platform targets a large range of actors such as companies, suppliers, distributors and consumers both in Flanders and cross-borders (Flanders’ Food, 2019; European Cluster Observatory, 2017). Besides this, while the cities of Leuven and Ghent are part of the international Rikolto initiative, aiming at creating more effective and smaller food chains in their city (Rikolto, n.d.), Bruges and Ghent are both part of the Milan Urban Food Policy Pact, an international initiative striving for cities to become food smart (De Cunto et al., 2017). Brussels is also a signatory city of the MUFPP. Besides, the region has its own Good Food Strategy, developed by the current Minister of Environment, Quality of Life and Energy Céline Fremault, aiming at developing sustainable food systems, promote local food production, better the quality of life of its citizens, ensure the continuity of natural resources and fight food waste as well as raise awareness among future generations (Ronsmans, n.d.). In the region of Wallonia, the digital agency called Digital Wallonia, promotes smart farming by showing the business opportunities it can create, by raising awareness and enhancing collaboration of various actors in the agricultural sector through digitalization (Joinup, 2017). Liège has signed the Milan Urban Food Policy Pact and is involved in several initiatives towards providing its citizens with local food (MUFPP, n.d.).

At European level, in 2015, the European Commission decided to launch its own Research and Innovation (R&I) framework for the transformation of food systems, called the Food 2030 Agenda. Its focus area is fourfold; nutrition for sustainable and healthy diets, designing sustainable and climate resilient food systems, ensuring the circularity of food systems and innovation and empowering communities. Collaboration has become crucial to reach the 17

Sustainable Development Goals and their 169 targets (European Commission, 2018). Governments, businesses and communities are called upon to safeguard human rights, strive towards eradicating poverty and environmental protection as well as enabling individuals and communities to reach their full capabilities (Sonnino, 2019; Melo, 2018). In that context, several initiatives of the European Union have emerged, such as FOODMETRES, URBACT and UTURN, further described in appendix 1. The Milan Urban Food Policy Pact is an example of an international initiative put in place to strive towards food smart cities on a global scale.

2.5 Milan Urban Food Policy Pact (MUFPP)

At international level, an exposition dedicated to ‘Feeding the planet, Energy for Life’ took place in 2015 in the city of Milan. This was the trigger for the mayor of Milan to create an international framework that had as aim to combat food-related issues at an urban dimension. The purpose of this initiative was to get as many world cities involved in the project to strive for resilient urban food systems. In that light, the Milan Urban Food Policy Pact was launched in 2014 and was to be signed during the Exposition 2015 in Milan. The content of the Pact was discussed with over forty cities from every continent in September of that same year (BCN, MUFPP, 2018). The MUFPP was developed under the guidance of an advisory group composed of leading international organizations that strive for a sustainable and equitable future. Eventually, the Milan Urban Food Policy Pact was signed by more than 100 cities in October 2015 and amounts to 209 signatory cities from all around the world (MUFPP, 2019). By signing the MUFPP, signatory cities recognize the crucial role they play in implementing and promoting sustainable food systems with regard to current challenges (MUFPP, 2019; Forster, Egal, Renting, Dubbeling, & Getz Escudero, 2015). The Milan Urban Food Policy Pact has given birth to the EUROCITIES working group on food, gathering the 51 European cities of the MUFPP agreement. This has enabled the involvement of the European Commission in food-related activities through its Directorate-Generals DEVCO, REGIO or SANTE (Magarini, De Cunto, & Porreca, 2018).

By signing, cities promise to work on developing sustainable and resilient food systems that offer healthy and affordable food. Moreover, they should conserve biodiversity and minimize waste created, while governments should favor cross-sectoral and interdepartmental collaboration. Then, cities commit towards striving for coherence amongst municipal, regional, subnational, national and international level on food-related policies. Further, local

governments will engage all food system's sectors in the development and implementation of food-related policies. Eventually, the Pact also commits governments to amend existing urban policies to encourage sustainable and resilient food systems, address their development with the Framework for Action drawn up by the MUFPP and encourage other cities to join MUFPP's food policy actions (Forster et al., 2015).

This Urban Food Policy Framework for Action is a voluntary framework that recommends food-related actions to local governments in six main areas, namely Governance, Sustainable Diets and Nutrition, Social and Economic Equity, Food Production, Food Supply and Distribution and Food Waste. Moreover, as mentioned before, the MUFPP implemented a monitoring framework to measure and monitor progress of cities towards reaching sustainable food systems (MUFPP, 2019). 44 Indicators are mobilized to act on the six categories of the Urban Food Policy framework, each being related to the achievement of sub-goals of the Sustainable Development Goals (Barilla Center for Food & Nutrition Foundation [BCFN], 2018).

2.5.1 MUFPP categorization of food smart practices

Food Waste

The category *Food Waste* includes raising awareness among the local population on food wastage, management and collection of this waste and saving food to avoid being turned into waste (De Cunto et al., 2017). In low-income countries, the reason for wasting food are linked to financial and technical limitations in agricultural techniques, infrastructure, storage and cooling facilities, as well as climate conditions. However, in medium to high-income countries, reason are often linked to consumer behaviors, quality norms, legislation and bad coordination among actors of the supply chain, leading to overproduction, malfunctions or oversupply. Concerning the food service area, reason for food waste can be attributed to large portions sizes, undesired accompaniments, inflexible supply chains and pressure to guarantee enough food to propose large menu choices (Leal Filho & Kovaleva, 2015).

The MUFPP links this 'Food Waste' category with the achievement of the sub-goals of SDG 12 'Responsible Consumption and Production' and SDG 4 'Quality Education' (Barilla Center for Food and Nutrition, MUFPP, 2018; FAO, 2019).



Food Production

By *Food Production*, we aim at all practices meant at the urban-and peri-urban production of food, protecting and enabling access to land and management of wastewater. All initiatives meant to involve the local population in the production of food and those of shortening the supply chain for food production are part of this section. The concept of community gardens for example is part of innovating methods of producing food in urban areas. It can be defined as commonly shared pieces of lands where people grow products in shared plots, often in urban or peri-urban areas (Senes et al., 2016). Okvat and Zautra (2011) characterize them by bottom-up and collective approaches (Okvat and Zautra (2011) as cited in Senes et al., (2016, p.83))⁸. In Europe, aside from community involving initiatives, have rapidly grown in the past years citizens self-initiated projects such as urban bee hives or guerrilla gardening as new urban agriculture methods (Morgan, 2015).

‘Food Production’ recommends 7 actions to reach sub-goals of SDG 2, 11, 12 and 15, namely ‘Zero Hunger’, ‘Sustainable Cities and Communities’, ‘Responsible Consumption and Production’ and ‘Life on Land’ (BCFN, MUFPP, 2018; FAO, 2019).



Food Governance

This section is about the elaboration of food policies and regulations, at regional, national or European level. System thinking as important aspect of urban food policies, leads to the integration of different sectors and the establishment of closer cooperation between various actors, leading to an inclusive form of governance. Various cities have been suggesting the creation of regional food policy councils, with an emphasis on promoting participation in their implementation (Sonnino, 2019; Maheshwari, Singh, & Thoradeniya, 2016). According to Borrelli, Deakin, et Diamantini (2018), future-internet based technologies enable new forms of

⁸ Okvat, H., Zautra, A.J. (2011). Community gardening: a parsimonious path to individual, community, and environmental resilience. *Am. J. Commun. Psychol.* 47, pp.374-87

participative governance to support smart, inclusive and sustainable food systems governance. Food Governance therefore includes the development of risk reduction strategies and involves contribution from the research-, third-and public sector (Maheshwari et al., 2016). An illustration of such governance models are local collaborative networks called Food Buying Groups, gathering citizens of communities around farmers in regular interactions. They are a form of social innovation containing various characteristics, such as a central role of the farmer in the social network, the dissemination of information with other buying groups, solidarity for the farmer as a central value and a variety of tools favoring participation in decision-making. In France, more than 1500 such initiatives have seen the light, linking producers and consumers in a closer partnership (Dedeurwaerdere et al., 2017).

‘Governance’ works towards achieving SDG 16, namely ‘Peace, Justice and Strong Institutions’ (BCFN, MUFPP, 2018; FAO, 2019).



Food Supply and Distribution

The *Food Supply and Distribution* category contains the whole logistics behind the management of flows of food between different actors and processes. It includes food storage, warehousing, transport, food procurement, etc. (De Cunto et al., 2017). Examples are the shortening of food chains, the localization of food activities or food market initiatives. Besides, food security is also an integral part of this category. It is about ensuring the availability and accessibility of food through practices and policies. Food availability is measured through the net trade, the amount of food production and stock levels while food access is mainly influenced by income, the capacity of households to access social aid, the price of food and adequate facilities and infrastructures (FAO, 2019). Compared to its all-time use in America, this concept is still very new in Europe. Since the application of austerity measures after the crisis of 2008, the term food security has been used not only to refer to low-income economies anymore, but also to high-income economies, faced with unprecedented levels of hunger. Wars, natural catastrophes and economic recessions have compromised the availability and access to food in countries recently (FAO, 2019).

‘Food Supply and Distribution’ strives towards reaching SDGs 2, 11, 12 and 13, respectively being ‘No hunger’, ‘Sustainable Cities and Communities’, ‘Responsible Consumption and Production’ and ‘Climate Action’ (BCFN, MUFPP, 2018; FAO, 2019).



The category of Food Supply and Distribution also includes food safety concerns. Food safety is about having an acceptable quality of food and ensuring sustainable and healthy food for everyone that does not put health at danger. Consumers rely on governments to ensure food products are safe and are effectively composed from what they are claimed to. Food safety, instead of only focusing on nutrition, should consider expanding the transparency of components, regulation of unhealthy food, surveillance of products and prevention of foodborne illnesses, such as bacteria, viruses, etc. (Fung, Wang, & Menon, 2018).

It remains questionable whether local food systems are likely to impact food safety. The United States Department of Agriculture points out that producing and selling local food can trigger important food safety risks; e.g. diseases, exposure to weather conditions and fluctuating prices. Local farmers often lack the right post-harvesting practices, agricultural certifications, packaging, recordkeeping, cooling methods and the conformity to local and state regulations (United States Department of Agriculture, 2010). In several places in the United States, the rise of local food systems have led to the outbreak of foodborne illnesses and contamination incidences, due to a lack of food safety checks on local fresh fruit and vegetables (Chapman & Gunter, 2018). Urban farming can also be associated to hygiene risks, risks of impaired food transportation or distribution in cities, food poisoning and food spoilage (Knorr, Khoo, & Augustin, 2017). Regulation on food can be complicated as “voluntary” requirements of the Federal Government can be seen as mandatory at state level, leading regional and local farmers to apply different safety standards due to lack of clear regulation. To not downgrade our food safety standards with current food localization, the FAO aims at providing small farmers with knowledge to comply with global requirements. This can be ensured through training and leadership of local farmers (United States Department of Agriculture, 2010).

Food safety is a major constraint for urban food systems that is tackled in the Food Supply and Distribution pillar and mostly managed at national level. We link this category to the SDG 3, ‘Good Health and Wellbeing’, SDG 6 ‘Clean Water and Sanitation’ and SDG 12 ‘Responsible Consumption and Production’.



Sustainable Diets and Nutrition

This section contains diet-related practices such as the promotion of sustainable eating habits, the fight against non-communicable diseases, the accessibility of drinking water and the collaboration between the sectors of food and health. This involves local authorities, that play a key role in public health. An example is the ongoing school-food reform in the world, raising awareness about hunger and obesity and aiming at promoting sustainable food systems (Morgan, 2010).

‘Sustainable Diets and Nutrition’ strives towards SDG 1 ‘No Poverty’, ‘Zero Hunger’; SDG 2, ‘Good Health and Wellbeing’; SDG 3 and ‘Responsible Consumption and Production’, SDG 12 (BCFN, MUFPP, 2018; FAO, 2019).



Social and Economic Equity

Lang et al. (2009) claim food to be related to the comprehension of socio-economic, cultural and political processes in the current worldwide landscape (Lang et al. (2009) as cited in Moragues-Faus & Morgan (2015, p. 1558))⁹. Initiatives in this category are encouraging employment in the food sector, enforcing social inclusion and enhancing research, training and education among local population. As an example, initiatives such as ‘Transition Town’ mentioned previously have shown to increase social interaction, strengthen communities and social justice (Kenis & Mathijs, 2014).

⁹ Lang, T., Barling, D., & Caraher, M. (2009). *Food Policy: Integrating Health, Environment and Society*. Oxford University Press, Oxford

‘Social and Economic Equity’ embeds a series of different SDGs. It encloses SDG 1 ‘No Poverty’, SDG 2 ‘Zero Hunger’, SDG 4 ‘Quality Education’, SDG 6 ‘Clean Water and Sanitation’, SDG 8 ‘Decent Work and Economic Growth’ and SDG 12 ‘Responsible Consumption and Production’ (BCFN, MUFPP, 2018; FAO, 2019).



General remarks

The evolution of the relative weights of undertakings in each of those six MUFPP categories in the past years is outlined in the radar charts below (cfr. figure 4).

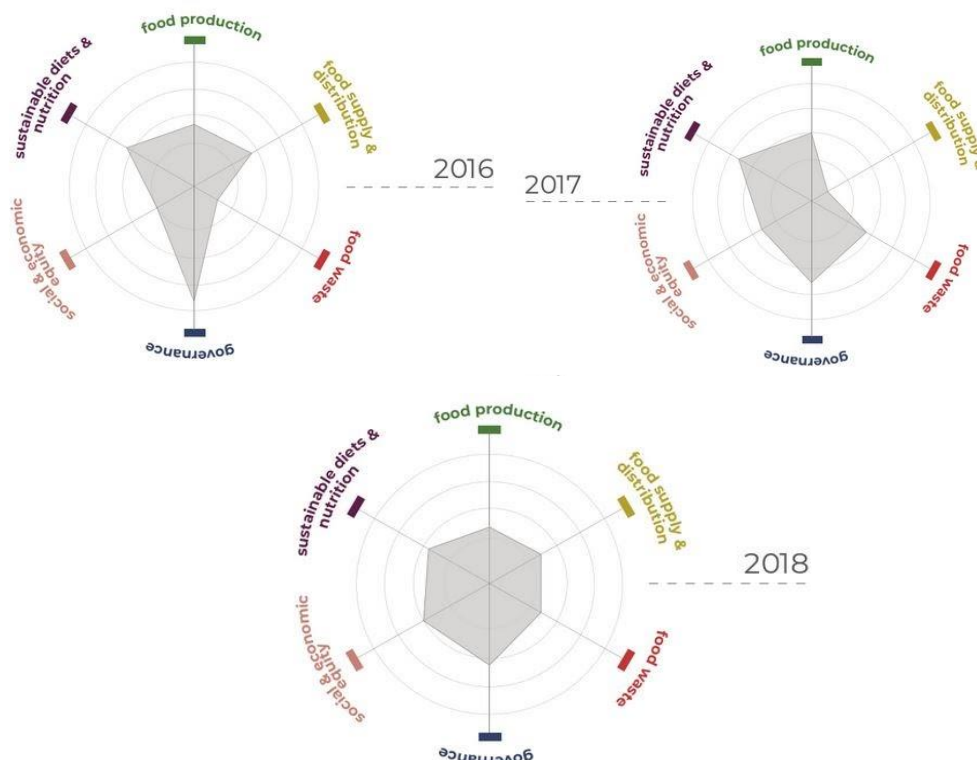


Figure 4: Relative weight MUFPP categories for submitted practices (BCFN, MUFPP, 2018)

The relative weights of those six categories from submitted practices for the Milan Pact Awards have been changing through time going from mainly governance initiatives to more various pillars, increasing Social and Economic Equity practices (BCFN, MUFPP, 2018).

Throughout our analysis, we will therefore combine the SDGs mentioned in this section, namely SDGs 1,2,3,4,6,8,11,12,13,15 and 16, to analyze their link to food smartness and the particular food smart pillars they relate to. Names of the relevant SDGs can be seen in table 1.

Acronym	SDG name
SDG 1	No Poverty
SDG 2	Zero Hunger
SDG 3	Good Health and Wellbeing
SDG 4	Quality Education
SDG 6	Clean Water and Sanitation
SDG 8	Decent Work and Economic Growth
SDG 11	Sustainable Cities and Communities
SDG 12	Responsible Consumption and Production
SDG 13	Climate Action
SDG 15	Life on Land
SDG 16	Peace, Justice and Strong Institutions

Table 1: names of the SDGs of interest

2.5.2 Food Smart Cities for Development (FSC4D)

Within the framework of the MUFPP, the Food Smart Cities for Development (FSC4D) is a project led in 2015 that aimed at emphasizing the role of cities in creating sustainable urban food production and consumption models. The project was funded by the European Union through its Commission's Directorate-General for International Cooperation and Development (DG DEVCO) from 2015-2016 (De Cunto et al., 2017). A total of €2.700.000 was granted for the project (Eurocities, 2017). The project had as aim to demonstrate the potential European decentralized cooperation can have in combating poverty and hunger. Three main objectives were given to the project; raise public awareness on the impact of decentralized European collaboration policies on sustainable food systems and development, enforce the role of European cities as promoters and implementers of global food security strategies, to make signatory cities and civil society debate about future agenda points on food. In Europe, the project involved the cities of Turin, Barcelona, Bilbao, Gent, Marseille, Bruges, Utrecht and civil society organizations. A common framework of action was drawn, called the Food Guidelines. Those guidelines had as purpose to help urban areas and civil society concretely implement food strategies. By doing this, signatory cities were pushed to take on those sustainable food policies by exchanging good practices. Three essential pillars ground the guidelines agreed upon by the organization; improving global food governance and its boundaries with society, enhancing responsibility and aware consumption with fair trade,

making use of decentralized cooperation to collaborate on global issues at local level (MUFPP, 2019).

2.5.3 FSC4D partners and MUFPP food categories

This section analyzes for the eight European signatory cities of the Food Smart Cities for Development 2015 the advancement on the six pillars drawn by the Milan Urban Food Policy Pact. As every MUFPP category relates to a set of SDGs, its conclusion are drawn from analyzing the score of every city and its country on SDGs relevant to food smart cities, combined with an in-depth research on the panel of initiatives undertaken by the city on becoming food smart. For concision purpose, only conclusions are outlined here. Complete analysis and references are to be found in appendix 2.

The city of Barcelona is mainly acting on Food Supply and Distribution, Food Waste and Food Governance pillars. As its country, the city performs well on Food Waste. While it was stated that Spain scores poorly on sustainable agriculture or ‘Zero Hunger’, an OECD analysis (2020) states that Barcelona has reached its targets for 2030 on this SDG. However, Barcelona does not show major undertakings neither on Social and Economic Equity or Food Production. The city does not have major undertakings either on Sustainable Diets and Nutrition, while its country still has main issues with obesity. However, Barcelona scores particularly good on Responsible Consumption and Production, which is linked to a mix of different categories for which the city scores very differently. However, on Clean Water and Sanitation, Barcelona obtains particularly bad results, in line with its poor results on Social and Economic Equity. Concerning Climate Action and Sustainable Cities and Communities, Barcelona scores average according to the OECD (2020).

An analysis of Bilbao and its food pillars leads to completely different results than in Barcelona. In opposition to Barcelona, Bilbao invests a lot in Social and Economic Equity through its projects, probably leading to the good results of the city on Zero Hunger, having reached its 2030 goal (OECD, 2020). However, even if better than Spain, the city scores low on Decent Work and Economic Growth. The city’s major undertakings regarding public health respond to the importance obesity rates Spain faces. In contrast with Barcelona, it has some undertakings in the Food Production category to better its country’s poor results on sustainable agriculture. Bilbao’s SDGs linked to Food Production however are weak; the city has a widely negative gap

both on Life on Land and Sustainable Cities and Communities compared to Spain's higher average. Initiatives on Food Governance and Food Supply and Distribution are somewhat lacking in Bilbao, even if undertakings on food security are important. However, as Barcelona, the city invests a lot in food waste.

From our analysis, Bruges seems mostly acting on the MUFPP pillars Food Governance, Food Production, Sustainable Diets and Nutrition, Social and Economic Equity and Food Waste. While Belgium scores low on Food Waste, Bruges has adopted major actions to palliate to this in its city. In contrast food security initiatives have less mentioned actions despite the main challenge on the SDG 'Zero Hunger' in Belgium. Despite the city's will to design shorter food chains, Food Supply and Distribution actions seem still minor or tackled indirectly. Our contact person, Climate Coordinator at the City of Bruges Karine De Batselier, drew a top-three of food categories most worked on by the municipality, namely Food Governance, Food Waste and Food Production (K. De Batselier, email, March 27, 2020).

The city of Ghent implemented major actions in the majority of categories; Food Production, Social and Economic Equity, Food Waste, Food Governance and Sustainable Diets and Nutrition. Moreover, the OECD analysis (2020) shows overall particularly good results on the SDGs. The same goes for supply and distribution of food, probably in line with weaker results on related SDGs Responsible Consumption and Production, Sustainable Cities and Communities and Life on Land. Ghent reaches the maximum score on Zero Hunger and Peace, Justice and Strong Institutions (OECD, 2020).

Laure Gaillard, Chief of Sustainable Food, Agricultural Economy and Innovation of Aix-Marseille-Provence points out first Food Production, than Food Governance and lastly Social and Economic Equity as main focus areas of Marseille. Besides, Marseille has important initiatives on Sustainable Diets and Nutrition, Food Waste and Food Supply and Distribution, reflecting the categories where France scores best in food sustainability. Moreover, it has major undertakings on food safety due to its water safety policy, which translates in very good scores on water-related indicators of the OECD analysis, the Clean Water and Sanitation SDG as well as Life under Water. However, Marseille scores poorly on the SDG Good Health and Wellbeing. While France has significant challenges on education, it is an important part of Marseille's strategy, scoring slightly above average on the SDG Quality Education. The city obtains excellent results on SDGs Peace, Justice and Strong Institutions and Zero Hunger.

Besides, it has a good score on Sustainable Cities and Communities. Surprisingly, there is a wide gap to be noticed between the strong French average on Climate Action and that of Marseille. Responsible Consumption and Production in Marseille seems to be low too.

Milan's initiatives mainly address Food Waste, Food Production, Sustainable Diets and Nutrition and Food Governance. Awareness raising among citizens on health and diets is of major importance in Milan, probably responding to the country's main struggle of Responsible Consumption and Production. Food Supply and Distribution and Social and Economic Equity also are topics impacted by its food strategy (FAO, 2018). As part of the Food Supply and Distribution category, food security remains an important part of Milan's strategy. Comparing initiatives to the OECD (2020), it is clear that Milan puts its focus where it scores badly at SDGs, such as its focus on Food Production and Sustainable Diets and Nutrition to better the SDG Responsible Consumption and Production and Life on Land. While the city has good scores on Zero Hunger, Decent Work and Economic Growth remain poor (OECD, 2020).

Turin is involved in various activities related to Food Production, food security in the supply chain, Sustainable Diets and Nutrition, which is in line with the nutritional challenges of the country, Social and Economic Equity, Food Waste and Food Governance. The city of Turin scores poorly on Responsible Consumption and Production. In that light, its undertakings on Social and Economic Equity are a way of bettering this poor Responsible Consumption and Production, combined with low results on Decent Work and Economic Growth (OECD, 2020).

Finally, Utrecht addresses mostly Food Production, food security in the Food Supply and Distribution category, Food Waste, Food Governance and Social and Economic Equity. Logistics in the Supply and Distribution and Sustainable Diets and Nutrition are fields that are tackled in combination with Food Waste initiatives (FAO, 2018). Concerning its supply chain and distribution undertakings, the city has already outstanding results on related SDGs Climate Action, Zero Hunger and Sustainable Cities and Communities. While 'Zero Hunger' remains a significant challenge in the Netherlands, it is surprising to see that 2030 level is achieved on this SDG in Utrecht (OECD, 2020). Our discussions lead with Anne-Marie Gout, from the Public Health Department of the Municipality of Utrecht, allowed us to specify our analysis, detailing healthy diets and nutrition as the most targeted category, followed by Social and Economic Equity (A.-M. Gout, email, April 15, 2020).

2.5.4 Remarks on FSC4D cities food smart practices

Food strategies implemented by different cities most of the time enclose quite similar policies and actions. Besides, for most cities, interventions and targets are made deliberately broad, in contrast with for example Ghent's strategy. Food strategies in themselves largely vary in their details; few cities have implemented detailed, specific goals and timed objectives. Populations structures, obesity or poverty rates however seem to shape the ambition of cities in the design of food strategies (De Cunto et al., 2017). Moreover, the extent to which the community or government explicitly takes initiative is also widely different. The nature of goals and instruments also tends to show similarities across regions, while forms of local governance tend to vary on food strategies (Candel & Pereira, 2017).

Through our analysis, it quickly appears that categories such as Food Waste or Food Governance are the most addressed categories by the cities we evaluate. Initiatives around Food Production are also numerous, however insufficiently though to become large-scale initiatives. The cities in our analysis almost all undertake initiatives to raise awareness amongst population on sustainable diets and healthy eating. Social and Economic Equity is often addressed as seen previously from figure 4. For Food Supply and Distribution, most projects concern food security, but few effectively address flows, transport or storage.

Literature confirms our analysis; food strategies most of the time included four of the MUFPP categories of actions; Food Waste, Sustainable Diets and Nutrition, Social and Economic Equity and Food Production (Candel et al., 2017). Magarini & Porreca (2019) specify Food Waste, Sustainable Diets and Nutrition and Food Governance to be the most targeted categories. Moreover, while circular economy initiatives strictly relates to Food Waste, Sustainable Diets and Nutrition most of the time relate to diets (Magarini & Porreca 2019). It is possible that missing data on food flows leads the category Food Supply and Distribution to remain insufficiently addressed in the cities we observe (Candel et al., 2017). Overall, few cities appear to be involved yet in food smart initiatives and the scope of initiatives is still very fragmented. Indeed, challenges to implementing food strategies remain various. While they can possibly not be identified as a political priority, they can lack support from key players within the food sector, face a lack of jurisdiction at the required level or deal with missing linkages between research and real-life application (De Cunto et al., 2017).

To verify these remarks, our analysis will focus on computing the precise food smartness score of European cities. We will enclose in our sample the eight cities initially involved in the FSC4D; Barcelona, Bilbao, Bruges, Ghent, Marseille, Milan, Turin and Utrecht. We do not pretend those cities to be food smart, but have proof of significant action and early commitment those cities have undertaken to start their journey towards becoming food smart since the launch of the Milan Urban Food Policy Pact in 2015. We make the choice to add to these cities twelve other cities to enlarge our sample of cities. The choice of these cities reflects a personal interest and the will to take cities that are geographically, historically and culturally divergent in the European Union; signatory of the MUFPP or not. To the eight initial cities were added Riga, Ljubljana, Bratislava, Greece, Vienna, Munich, Luxembourg, Warsaw, Prague, Tallinn, Stockholm and Lisbon (cfr. figure 5).

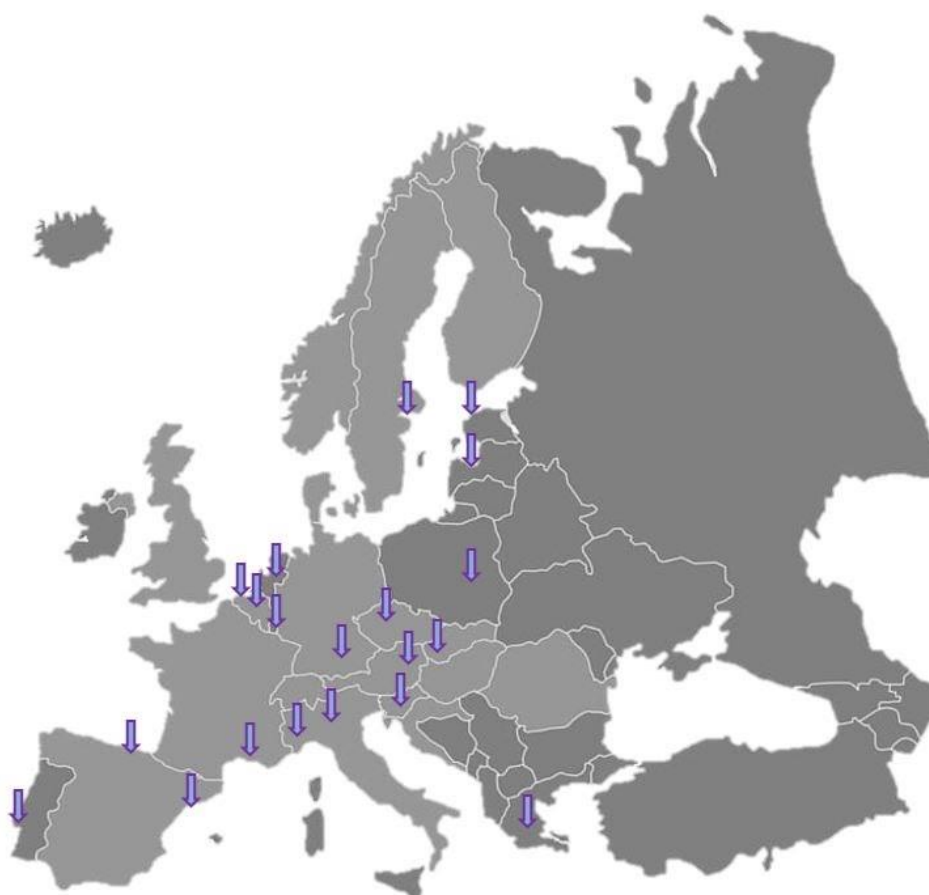


Figure 5: Selected cities for our analysis (PNGEKG, n.d.)

2.6 An analysis of our sample of cities

To have a first insight on the food smartness of our twenty cities, we conduct an analysis based on smartness, SDG scores and Food sustainability Index. Thanks to our quantitative analysis, we will be able to verify food smartness and its link to early engagement in FSC4D, to being a MUFPP signatory city, to SDG performance and to the interrelation between smartness and food smartness.

2.6.1 Smartness

This section has as aim to quantify the smartness of our eight FSC4D cities to be able to analyze the link between smartness and food smartness afterwards. The Vienna University of Technology with its European Smart City ranking 2014 ranks 70 European medium-sized cities on food smartness (Centre of Regional Science [SRF], 2014). The city of Luxembourg has the first place in this ranking, Ljubljana is 15th. Then appears the city of Ghent, at the 20th position out of 70, followed by Bruges in the 37th position. The latter two cities score particularly good in the smart environment and smart people pillar. The research took three criteria into account to take European cities as candidates; having a number of inhabitants in a range of 100,000 to 500,000, being listed in the Urban Audit Database and having at least 80% of data availability for its indicators. Utrecht, Bilbao, Tallinn and Bratislava who respect the two first criteria are not being part of the sustainability ranking. It is interesting to note that the large majority of smart cities ranked have less than 300,000 inhabitants (SRF, 2014).

In the International Sustainable Cities Index 2016 of Arcadis, 100 global cities are ranked on three pillars; People, Planet and Profit sustainability. Stockholm appears as third city, followed directly by Vienna. Prague is in the 9th position followed by Munich. Then, Barcelona ranks in the 24th position on European smart cities and Milan 42nd. Warsaw obtains the 37th position, Lisbon 46th and Athens is positioned 66th out of 100, as last European city of the ranking. Smaller cities do not appear in this ranking, which explains the difference with previous index of the Vienna University of Technology (Arcadis, 2016). The last Arcadis Sustainable City Index 2018 shows quite the same trends as in 2016. Stockholm gains one place and ranks as second most smart city out of 100 global cities, followed by Vienna 5th, Munich 7th, Prague 23rd. Barcelona has lost 4 places in the ranking with a 28th position and Milan keeps the exact same place (Arcadis, 2018). A few cities significantly drop in the ranking; Warsaw from 37th to a 54th position, Lisbon 62nd compared to 46th in 2016, while Athens is now positioned 75th, falling 9 positions behind previous ranking. Once more, Athens is the last European city

in the ranking. This time, rankings embed cities from all sizes and either small as large cities obtain bottom and top positions. However, no cities of less than 500,000 inhabitants appear, which might explain the missing cities of Bilbao, Utrecht, Ghent, Bruges, Ljubljana, Tallinn and Bratislava.

The more recent IMD Smart City Index 2019, first of its edition, ranks 102 cities worldwide. The survey analyzes five key areas, namely health and safety, mobility, opportunities, activities and governance. In this ranking, Bilbao obtains an outstanding 9th position worldwide and 6th position in Europe. Vienna obtains the 17th European position, followed closely by Prague 19th, Milan positions itself in the 22nd position worldwide and 14th in Europe. Stockholm is 25th, Barcelona is ranked 48th worldwide and is the 23rd European city. Warsaw is 61st, Lisbon 76th and Bratislava 84th. Again, Athens is ranked ultimate European smart city by the IMD Smart City Index 2019 with a 95th position (IMD, 2019).

Besides, in the Lisbon ranking for European Smart Sustainable Cities (2019), the same capital cities fit the highest and lowest positions in the rankings. Stockholm has an excellent second position among European capital cities, while Prague and Vienna have an upper-medium score, followed by Tallinn, Lisbon, Luxembourg with a medium ranking. Athens ends up 26th, Ljubljana 24th and Bratislava 22nd on 28. Riga has a position of 17th in this ranking (Akande, Cabral, Gomes, & Casteleyn, 2019).

Divergences between those four indexes can be explained by city size criteria, changing time frame, different criteria of analysis, data availability and diverging methodologies (cfr. appendix 3). Joining different indexes therefore enables us to have a complete and complementary vision on current situation.

To conclude this section, while most of our cities appear in European and even global smart city rankings, Utrecht, Marseille and Turin did not appear in any ranking. Generally speaking, the city of Stockholm tends to be the smartest among our cities, while Athens, Bratislava, Lisbon and Warsaw tend to appear at the bottom.

2.6.2 SDG comparison

The Institute European Environmental Policy (IEEP) released an in-depth 2019 analysis of European Union member states on the 17 Sustainable Development Goals. Sweden scores the highest of our countries, followed closely by Austria and Germany. France is 6th in the ranking, followed by the Netherlands in a 7th position and Czech Republic. Just after that, Slovenia appears, followed by Estonia and Belgium as 11th. Spain obtains the 14th positions, followed by Portugal, Poland and Italy, just before Slovakia and Latvia. Greece is positioned as 25th out of 28, as last of our selected countries. SDG scores per country of the European Union can be seen on figure 6 (IEEP, 2019).

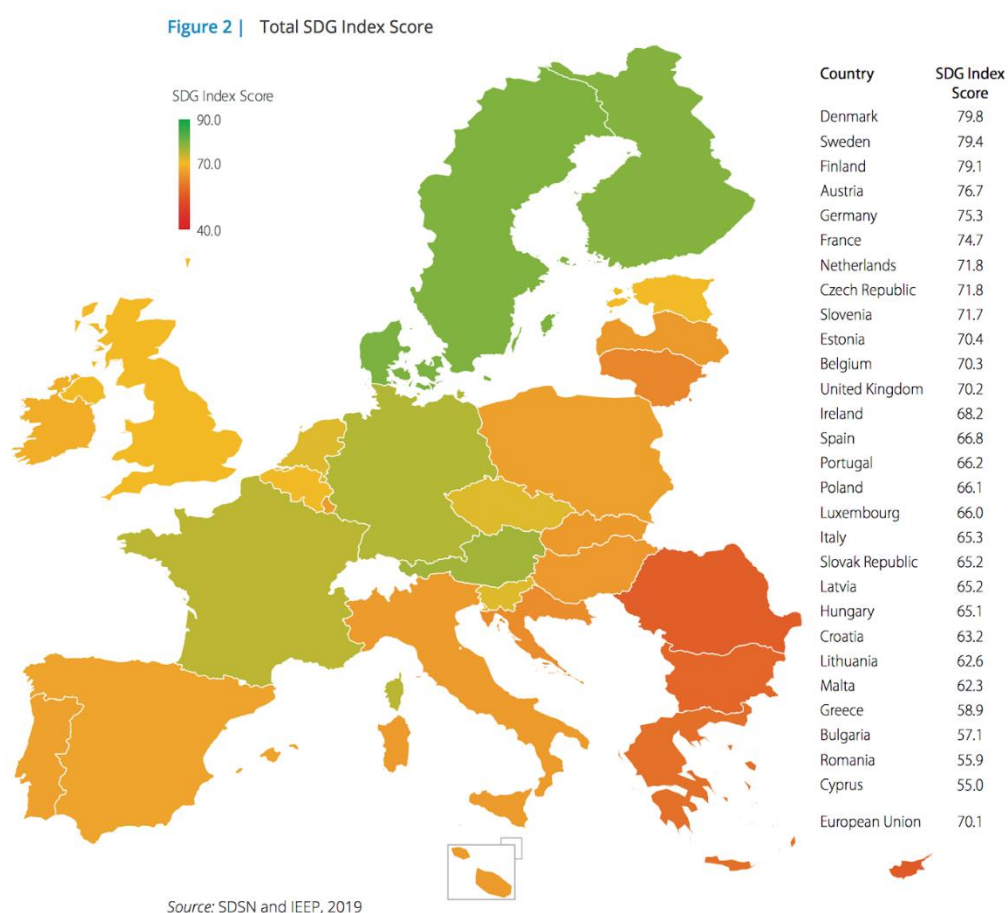


Figure 6: SDG index score of European Countries (IEEP, 2019)

Global SDGs scores for our twenty cities are given by the Sustainable Development Solutions Network that gives Marseille the highest score, followed by Stockholm, Utrecht, Ljubljana, Bruges and Ghent. Lisbon and Athens are the last from our twenty cities ranking. Even if trends remain more or less the same, this city SDG ranking diverges a bit from the country level ranking mentioned above (SDG, 2019).

To be more accurate in our analysis, an OECD tool allows us to compare cities on their advancement towards specific SDGs, based on a set of related indicators. This tool has two main drawbacks; limited data availability for some SDGs and the city of Bruges missing. However, it already offers an interesting insight to compare cities on different SDGs. Cities hereunder are represented with dots. The twenty cities we selected appear in green with Marseille being dark blue. The more right-sided cities are on this image, the more they are advanced on the mentioned SDG. We analyze our cities on the most relevant SDGs to food smartness and add SDGs from relevant regions when necessary, e.g. for Bruges.

On SDG 1 No Poverty, few data is available at city-level. Marseille is represented with the dark blue dot, as last of our selected cities represented in green (cfr. figure 7). It is located around France's average, represented with the light grey dots. From left to right, the green dots represent respectively Turin, Milan, Lisbon, Vienna. In the top 20% appear the cities of Ghent and Stockholm with a 100 value reached. For the cities of Munich and Bruges, for which SDG scores are missing, OECD scores from their regions give the high value of 98,6. The region of Tallinn obtains the lowest score with a 45,38, with Riga scoring only slightly better (OECD, 2020).

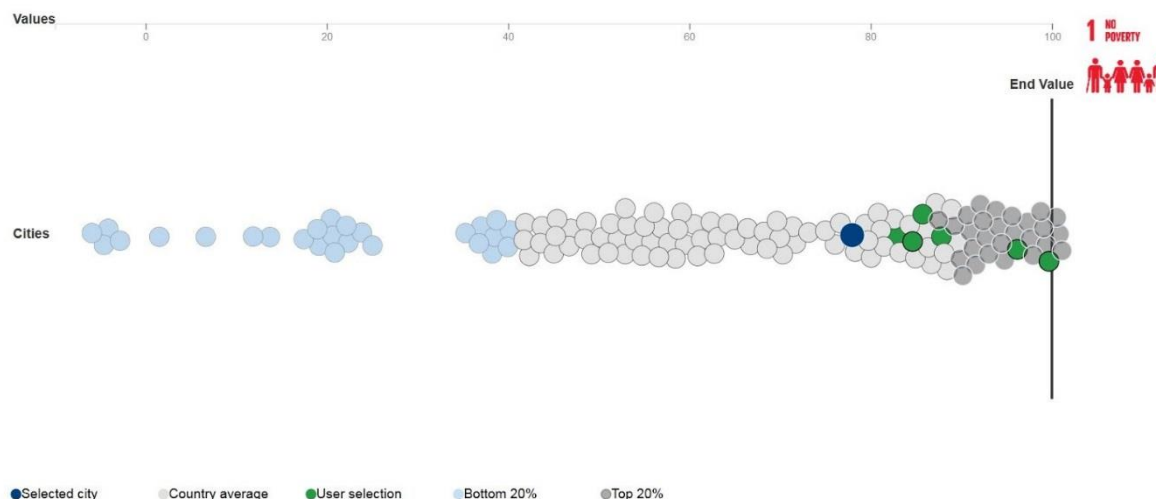


Figure 7: Visualizing cities on SDG 1 (OECD, 2020)

For SDG 2, Zero Hunger, most European cities already reached their 2030 ambitious value as can be seen from figure 8. From right to left, Riga, Tallinn, Prague, Luxembourg, Ljubljana and Bratislava did not (OECD, 2020).

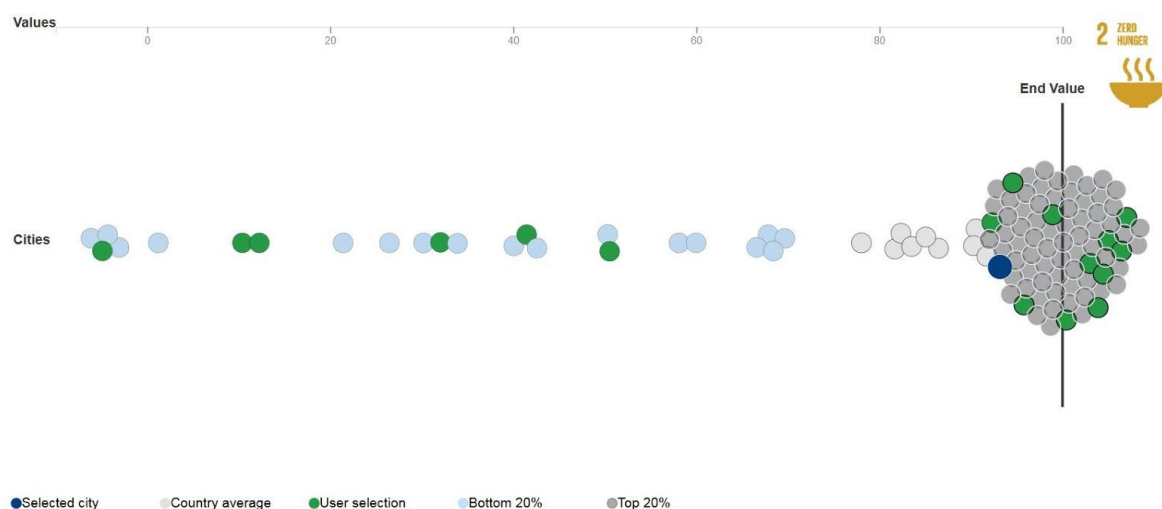


Figure 8: Visualizing cities on SDG 2 (OECD, 2020)

Figure 9 shows how on SDG 3, Good Health and Wellbeing, Stockholm, Tallinn, Munich, Bratislava and Prague score best. Warsaw scores at the bottom part of the figure. Marseille, Riga and Ghent score in the lower average part. An overview of this SDG on the regions shows that Bilbao has a 100 value and confirms that among our cities Warsaw has the lowest score on this SDG (OECD, 2020).

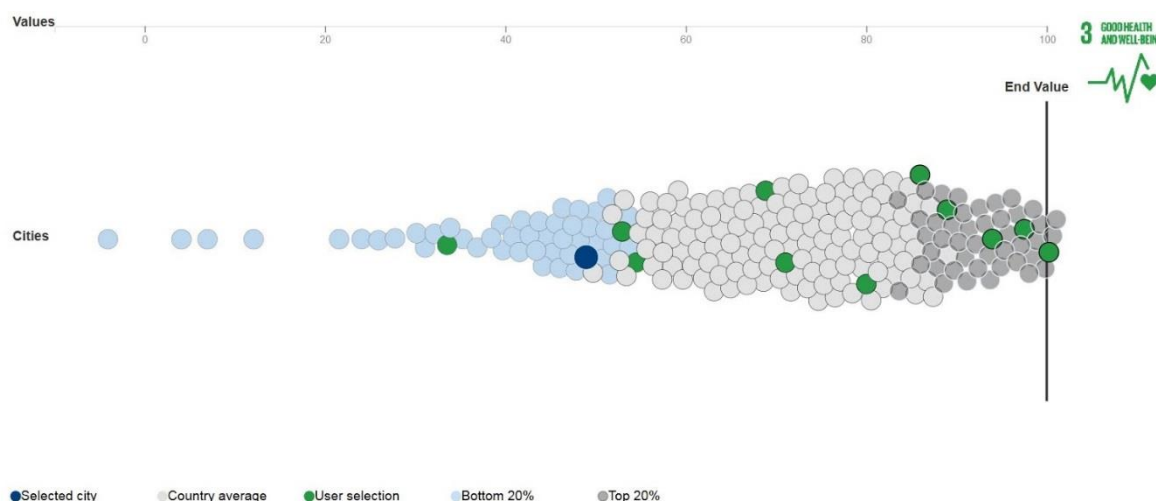


Figure 9: Visualizing cities on SDG 3 (OECD, 2020)

For SDG 4 on Quality Education, only four cities have an available score, as can be seen on figure 10. Tallinn has a 95 value, Marseille is situated in the average of France with a 81 value, Riga scores 59 and Ljubljana 28. OECD region scores give Prague, Utrecht and Bilbao the highest scores among all our cities with a 100 value for their respective regions. Ljubljana

obtains the lowest score, followed by Turin and Barcelona (OECD, 2020).

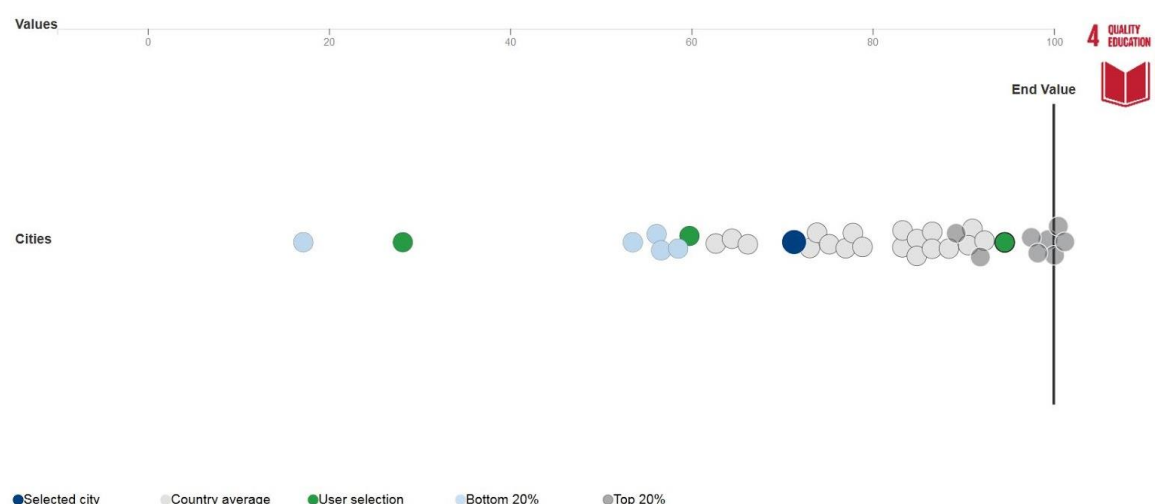


Figure 10: Visualizing cities on SDG 4 (OECD, 2020)

Results for SDG 6 Clean Water and Sanitation are mitigated, as the reader can observe from figure 11. Warsaw, Milan, Ljubljana, Turin and Vienna score in the top 20%. In the lower 20%, results are still mixed, from Ghent with a 66 score, to Bilbao with 62, Tallinn 28, Barcelona 14 and Lisbon 7. Stockholm obtains a zero value, probably due to missing data. From its regional score, Riga obtains a 100 value on this SDG (OECD, 2020).

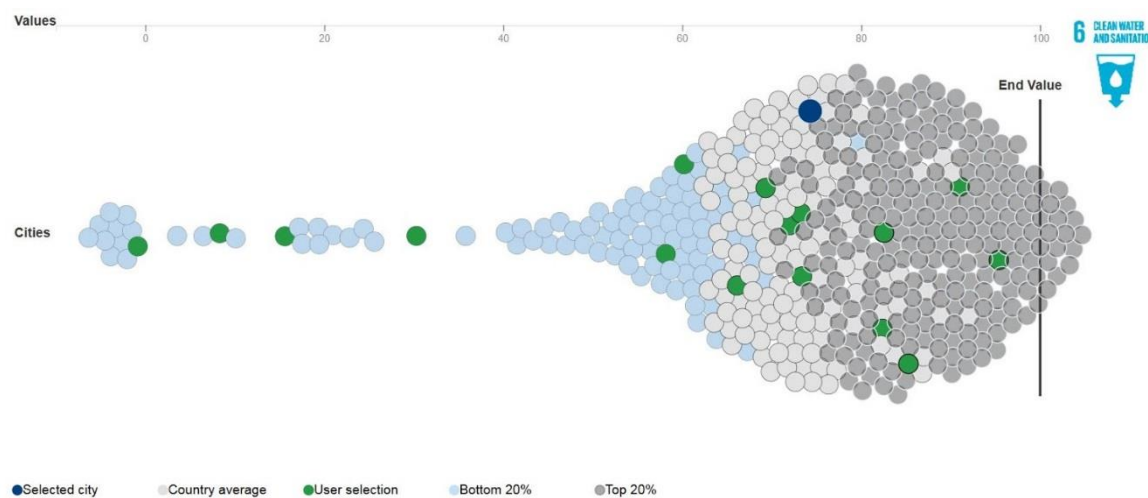


Figure 11: Visualizing cities on SDG 6 (OECD, 2020)

On SDG 8 Decent Work and Economic Growth, Warsaw and Bratislava have reached end value. Ghent still has an outstanding score followed by Stockholm, Prague and Tallinn. Bilbao, Vienna, Barcelona and Milan score in the lowest part with Riga and Turin lagging the most behind (cfr. figure 12) (OECD, 2020).

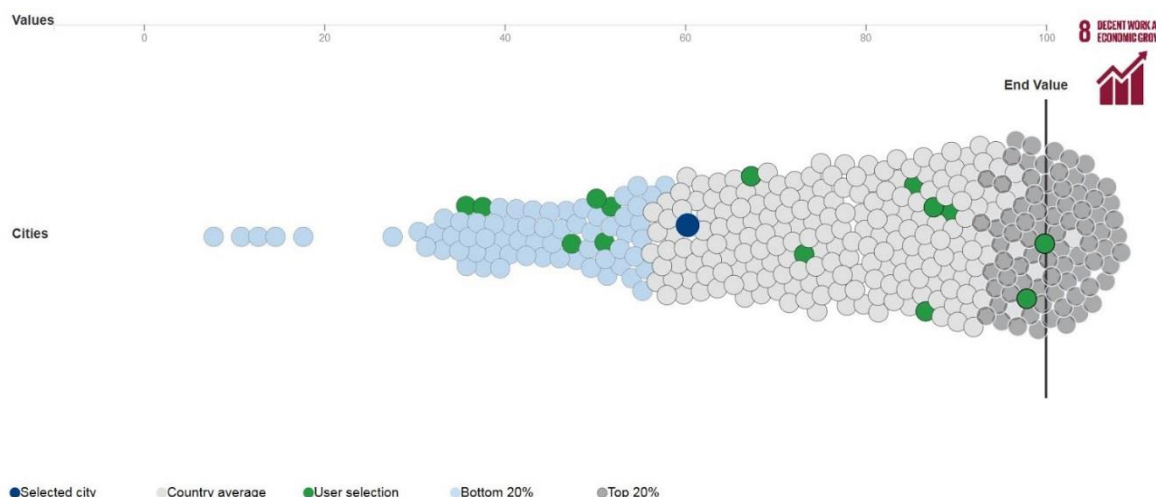


Figure 12: Visualizing cities on SDG 8 (OECD, 2020)

On SDG 11, Sustainable Cities and Communities, Stockholm, Munich and Luxembourg score in the top 20%, while Milan, Turin, Bratislava, Riga and Warsaw score the lowest (cfr. figure 13). Marseille is still represented by the blue dot and has a medium score (OECD, 2020).

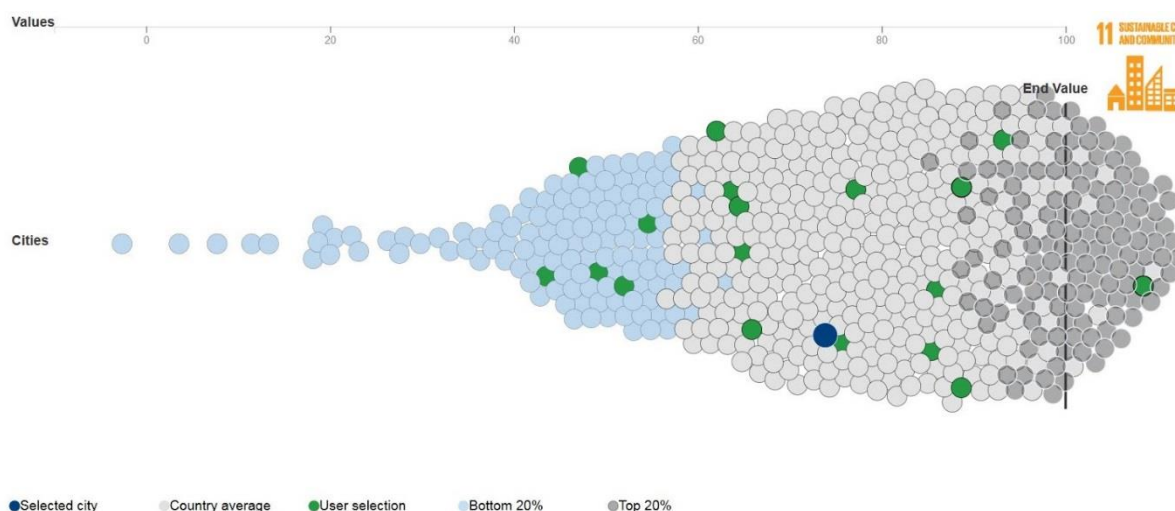


Figure 13: Visualizing cities on SDG 11 (OECD, 2020)

From figure 14, we can see that on SDG 12 Responsible Consumption and Production results are mixed and there is data lacking. Riga, Tallinn and Stockholm have a 100 value, followed closely by Bratislava. Still in the top 20%, they are followed by our two Spanish cities and Munich. Milan and Turin have the lowest score on this SDG, while Ghent, Ljubljana and Marseille score average. However, from a regional analysis, Athens and Luxembourg score

even lower than our Italian cities on this dimension, with respectively 15,03 and 7,03 (OECD, 2020).

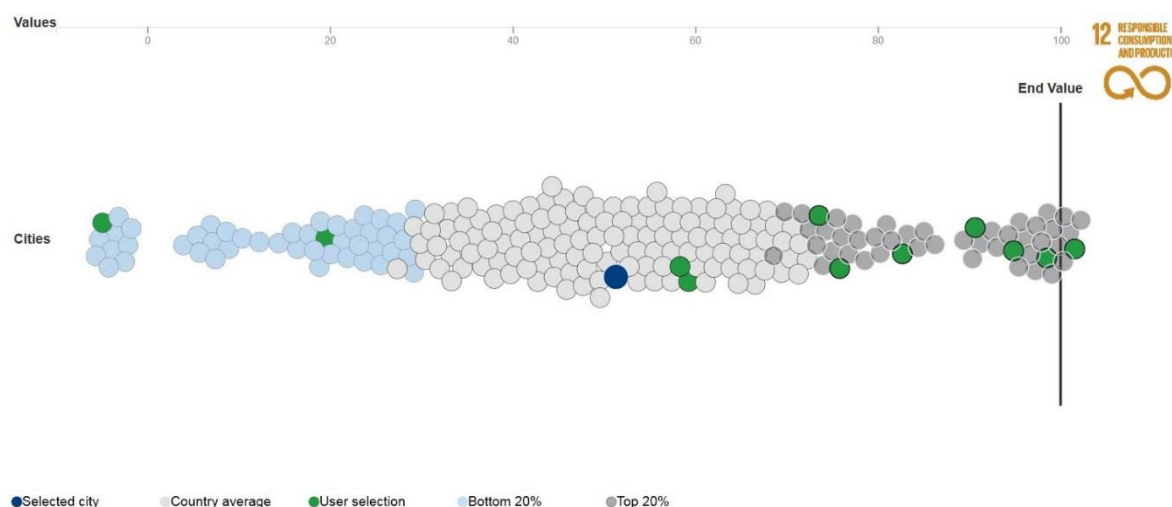


Figure 14: Visualizing cities on SDG 12 (OECD, 2020)

For SDG 13, Climate Action, scores again are widely diverging. The city of Utrecht nearly reaches 2030 value. In the upper 20% also appear Luxembourg, Tallinn and Stockholm (cfr. figure 15). Warsaw, Ljubljana and Athens end the ranking, Athens appearing at the bottom left. Other cities end up around their country average (OECD, 2020).

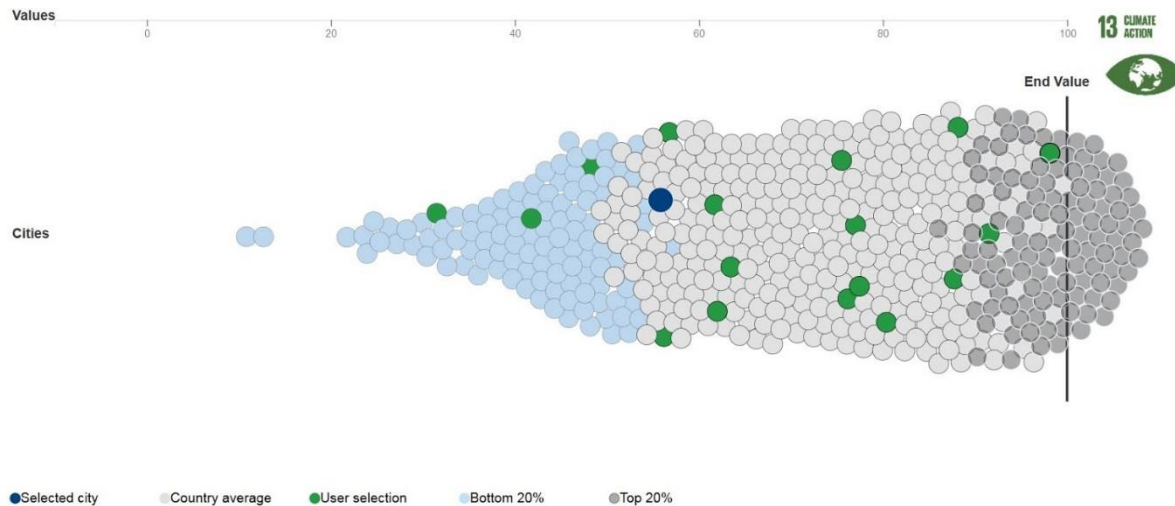


Figure 15: Visualizing cities on SDG 13 (OECD, 2020)

On SDG 15 Life on Land, Warsaw almost reaches a 100 value, followed by Bratislava, Luxembourg, Munich and Vienna. Still in the top 20%, Marseille (blue dot) and Barcelona appear. Bilbao is by far the lowest scoring city, completely at the left side, while Tallinn and Stockholm also score in the bottom 20% (cfr. figure 16) (OECD, 2020).

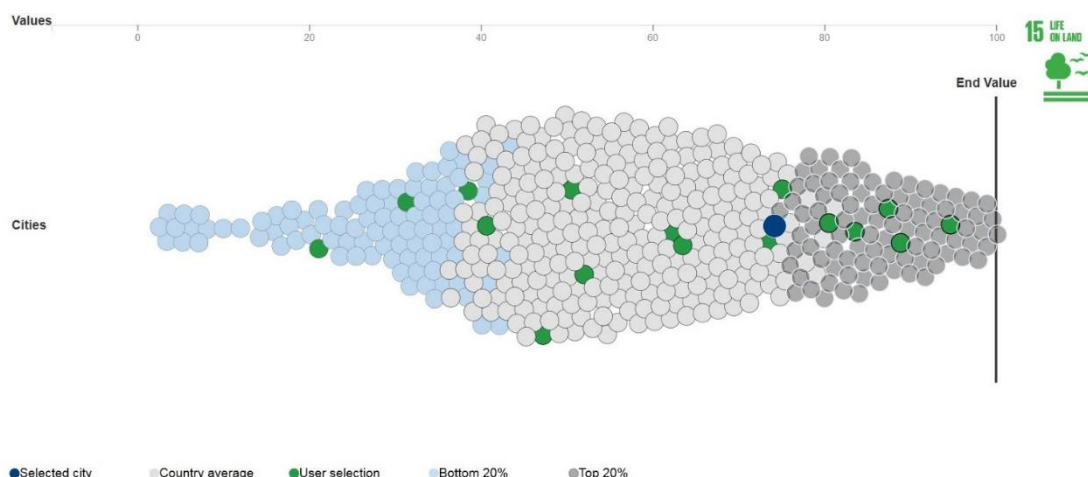


Figure 16: Visualizing cities on SDG 15 (OECD, 2020)

For the last SDG we analyze, Peace, Justice and Strong Institutions, only few cities have quantified data but all obtain a score between 95 and 100 amongst Ghent, Ljubljana and Prague, Riga, Marseille, Bratislava and Tallinn. The region of Munich also scores 100 on this SDG and Utrecht is also close from attaining this. Regions of Luxembourg and Athens score particularly low on this dimension (OECD, 2020).

2.6.3 Food Sustainability Index

The 2018 Food Sustainability Index of the Barilla Center for Food and Nutrition is based on three pillars; sustainable agriculture, nutritional challenges and food loss and waste. It allows us to have a first insight on food smartness of countries. The index provides a wide analysis, including all European countries in its global study with data on 67 countries. Several of our analyzed countries are issued the score ‘very high’ in the global ranking on food sustainability; namely France, that wins the first position in this global ranking and the Netherlands in the second position, followed by Czech Republic, Sweden, Austria, Poland and Germany. While Estonia, Italy, Luxembourg, Portugal and Spain obtain a ‘high’ result, Belgium scores ‘medium’. European countries such as Malta, Latvia, Slovakia, Slovenia and Bulgaria appear at the very bottom of the ranking, with a ‘low score’, while Greece and Romania appear just a bit above with a ‘medium score’. It is interesting to dig deeper in the different pillars of this analysis to understand how countries got to that position. On the pillar of food loss and waste, Belgium, Greece, Malta, Bulgaria, Slovakia and Slovenia all obtain a ‘low score’, while Austria, Latvia, Germany and Portugal score medium. On sustainable agriculture, Austria, Germany and Poland obtain the first positions. Belgium has a ‘very high’ score, just after the

Netherlands and followed by Czech Republic. Sweden, Portugal, France, Estonia and Italy have a ‘high’ score and Spain and Greece a ‘medium’. While Malta scores ‘high’ this time on sustainable agriculture, Greece, Cyprus, Slovenia, Slovakia, Latvia, Luxembourg and Bulgaria again score ‘low’ on this dimension. The last pillar, ‘nutritional challenges’, globally has much better results for European countries. Either France, Estonia, Austria, Portugal, Sweden, the Netherlands and Belgium score ‘very high’, while Spain, Greece, Luxembourg, Poland, Latvia and Czechia score ‘high’ and Italy ‘medium’. Slovakia and Slovenia respectively score ‘very high’ and ‘high’ this time (BCFN, 2018). The building of our food smart framework will allow us to compute scores for each city on food smart categories.

2.6.4 Discussion

The previously analyzed smart city rankings, combined with the OECD and IEEP analysis on the SDGs for cities and countries and the 2018 Food Sustainability Index of the BCFN generally show low scores in food sustainability and smartness of the cities of Athens, Bratislava, Lisbon and Riga. For Ljubljana, rankings are divergent, sometimes making the city score in bottom positions, for example in the Lisbon ranking of European Smart Sustainable Cities or Barilla Food Sustainability Index, sometimes making it compete with best practice cities for instance in the European Smart City ranking 2014. From the FAO, we would expect Ljubljana and Vienna to score best in Food Supply and Distribution and Riga in Food Waste (FAO, 2020). Of the twelve cities added to the sample, none were part of the Food Smart City for Development 2015 and part of them are not signatories cities of the MUFPP, namely Bratislava, Stockholm, Tallinn, Munich, Prague, Lisbon and Luxembourg. Their addition will allow us to understand whether non signatory cities would be less food smart than signatories. Besides, our sample of twenty cities will also prove whether analyzed smart city indexes and SDG scores allow us to predict food smartness accurately thanks to further analysis in R.

2.7 Urban food challenges in global megacities

While growing larger, it might become a challenge for European cities to keep up on their journey towards food sustainability, facing steady demographic expansion. However, European cities could nurture their inspiration from Asian megacities’ best practices, that have the potential to become food innovation hubs (PricewaterhouseCoopers [PWC], Rabobank & Temasek, 2019).

Asian cities are exposed to demographic challenges in a much broader extent, being the fastest urbanizing region in the world (PWC, Rabobank, & Temasek, 2019). More than 48% of Asians live in cities that had to host 200 million of new citizens in the decade 2000 (Loire, 2016). Besides, it is expected that 65% of the world's middle class will live in Asia by 2030. This growing middle class puts new strains on the food industry, becoming more demanding on food freshness, safety, quality and delivery. At present time, Asia is unable to meet those requirements, facing wastage and mediocre food quality, while still relying on food imports from Africa, Europe and America. Besides, more than in Europe, Asia is composed of countries with a range of different economic developments, customer preferences, currencies and legislations. 80% Of consumed food is made by smallholders farmers, generally known to be reluctant to invest in high quality. Generally speaking, these Asian farms are smaller and have less budget for technological investment than in Europe. Moreover, rice they massively produce is extremely exposed to climate change. Supply chains tend to be wide, fragmented and opaque (PWC, Rabobank & Temasek, 2019).

Either the Arcadis 2018 Sustainable Cities Index, the IMD Smart City Index 2019 and the Food Sustainability Index 2018 give different parts of Asia very different scores. Arcadis shows in its 2018 Sustainable Cities Index how the top twenty ranking of global cities mostly are European with as exceptions Singapore, Hong Kong and Seoul. At the same time, some large Asian cities bear the bottom of the ranking, particularly in India, Indonesia and China (Arcadis, 2018). Halve of Asian countries have their own smart city strategy, namely India, Thailand, Malaysia, Indonesia, China and Singapore, the two latter having the most developed (Crook, Matsumoto, & Tanaka, 2019). On food sustainability, while the region of East-Asia and the Pacific scores better than Europe, with a 71.6 score versus 68.2, South-Asia scores significantly lower than both regions with a 62.8. However, the Barilla Center for Food and Nutrition Foundation gives Asia a better global score than Europe on Food Waste. Both on nutritional challenges and sustainable agriculture, while East-Asia outperforms Europe, it is not the case of South-Asia that scores low (BCFN, 2018).

As an example, India and Indonesia face main issues regarding sustainability and urban food. India scores average on the BCFN 2018 Food Sustainability Index; while the country scores very high on food waste, it scores poorly on nutritional challenges (BCFN, 2018). Among India's most populated cities, Mumbai and New Delhi bear bottom positions on sustainability (Arcadis, 2018). The IMD Smart City Index gives Mumbai the same poor score with a 78th position on 102 and a 68th position for New Delhi. Despite the fact that India has its own 'India's

Smart Cities Mission' since 2015, the city has few government incentives to support innovation in the agri-food sector, combined with poor talent competitiveness and few large agri-food businesses (PWC, Rabobank & Temasek, 2019). On food sustainability, Indonesia is completely at the bottom of the ranking (60th on 67). It faces major challenges on sustainable agriculture, food waste and nutritional challenges (BCFN, 2018). In both the Arcadis Sustainable Cities ranking and IMD Smart City Index, its capital Jakarta scores low, while no other Indonesian city appears in the top rankings (Arcadis, 2018; IMD, 2019).

In China, urbanization has boomed over the past forty years, the country going from 18% of its population living in urban areas to 58% in 2017 (United Nations, (2018) as cited in Crook, Matsumoto, & Tanaka (2019, p.10))¹⁰. Aside from this, Wenxuan and Chengwei (2018) identify the country's economic slowdown, rising unemployment, increasing social and economic disparities, mediocre public services and social security as well as political corruption and food security issues as main challenges. However, China has a high score on food sustainability, ranking in the first position fighting food waste (BCFN, 2018). Also a signatory city of the MUFPP, Beijing, however scores 73rd on 100 on the sustainable city index, while scoring average on the smart city index (Arcadis, 2018; IMD, 2019). Other Chinese cities such as Wuhan and Chengdu score poorly as sustainable cities (Arcadis, 2018).

The situation is completely different for other megacities in Asia. According to PWC, Rabobank & Temasek (2019), Singapore, Tokyo, Seoul and Hong Kong can become important food hubs. Japan and South Korea respectively have a 'very high' and 'high' Food Sustainability Index score, Japan scoring outstandingly on nutritional challenges and obtaining a 6th position in the overall ranking (BCFN, 2018). While Tokyo and Seoul do not yet appear as very smart cities according to IMD, Arcadis shows how both are however becoming sustainable (Arcadis, 2018; IMD, 2019). Seoul is a signatory city of the Milan Urban Food Policy Pact (MUFPP, n.d.) and is involved in major actions around becoming food smart. The IMD Smart City Index highlights Singapore as the smartest city in the world, while it scores in the top five positions as sustainable city (Arcadis, 2018; IMD, 2019). Singapore has developed its own strategy on food security, increasing local production, diversification of food sources and stockpiling. The city joined the FAO in 2013 and is focusing particularly on food security and food safety, while food processing and urban agriculture are other priorities. To respond to

¹⁰ Crook, J., Matsumoto, T., & Tanaka, K.(2019). Trends for smart cities strategies in emerging Asia. *OECD Regional Development Working Papers*. Edition OCDE, Paris

the lack of technological investment faced by most Asian farms, Singapore has put an emphasis on agricultural innovation to better farming methods (FAO, n.d.). Through breakthrough technologies, it can benefit from crop farming and vertical farming methods (PWC, Rabobank & Temasek, 2019). These methods could allow cities to increase crop yield to face rising demand for food in cities consequently to massive urban growth. Singapore also deals with important public health issues, struggling with a high rate of overweight citizens. The city emphasizes on promotion of physical activity and reinforcement of public policies. On food safety, the city developed a food safety system on a risk-based approach, ensuring products are safe based on the accreditation at source, control and testing, certification and traceability (FAO, n.d.).

In Asia, the lack of government incentives and support to startups, investment risk and missing knowledge hold back the progress of the food industry on sustainability. Greater cross-sectoral collaboration and involvement of financial institutions combined with corporate and private equity investors are needed to progress (PWC et al., 2019).

2.8 Food systems at the light of current sanitary crisis (COVID-19)

Apart from the sanitary and economic crisis the COVID-19 triggers, it also exacerbates current crisis on food security, inequality and nutrition and puts the instabilities and risk of our food system into the public eye.

A 2015 citation of the World Health Organisation on food safety in a globalized world rightly reflects current situation, claiming “Contamination at one end of the food-chain can affect populations on the other side of the world.” (World Health Organisation, 2015, p.1). It seems clear that the high European food safety standards we prize could not prevent the COVID-19 crisis from happening by only regulating our own food. COVID-19 shows how different food safety standards at one point in the world triggered a worldwide crisis due to globalization, without even spreading through food. As the disease is said to originate from a wet market in Wuhan, it questions the future and hygiene standards of wet markets and street food in the world. In that light, Wuhan is planning on launching a campaign by investing \$28 million to increase hygiene in farmer’s markets (Reuters, 2020). At the same time, world leaders all around the globe ask for wet markets to close, to avoid the future breeding of diseases through wildlife animals (Peta, 2020). Parallely, the World Health Organisation calls for better safety regulation and hygiene standards when reopening wet markets around the world to reduce

transmissions risks of pathogens from animals to humans (World Health Organisation, 2020). Overall, whether the future of wet markets is threatened or not, the whole pandemic crisis might drastically impact food safety measures in the world and could have long-lasting effects on our food legislation.

According to Panayota Nicolarea, from the Milan Urban Food Policy Pact Secretary, the sanitary emergency has translated into a food emergency, leading to the breakdown of our current food system. The intertwining of all pillars of sustainability in food systems is an observation that has become visible in current crisis. Access to food, dependency on food exports between countries, food price volatility have all been significantly impacted by this ongoing crisis (P. Nicolarea, Skype call, April, 22, 2020). IPES-Food (2020) further details the pain points of our food system brought forward by the sanitary crisis.

First, our industrial agriculture triggers habitat loss and creates favorable conditions for viruses to appear and spread. The intensive livestock production as well as increasing human and wildlife contact we experience are enhancing risks of viruses emerging and spreading.

Secondly, the sanitary crisis has worsened the situation of people already struggling with extreme poverty, hunger and malnutrition (FAO, 2020; IPES-FOOD, 2020). The economic activity interruption in Pakistan threatens the affordability of Pakistani to access even one meal a day. Besides, Ghana has seen food prices increase by 20-30%, impacting people in poverty. In Latin American countries, lots of children rely on school nutrition programs as their source of food, making them very vulnerable to school closures. Quality of diets are also affected, with a scarcity of fresh produce triggering diet-related diseases. Thirdly, the resilience of food systems is pressured through disruptions triggered. Restrictions on flows within and across countries hinder food logistics, disturb the entire food supply chain and affect food availability (IPES-FOOD, 2020; FAO, 2020). As an example, seasonal laborers crossing borders each year to work in farms have seen their access forbidden. Besides this, access to animal feed has been restricted and the capacity of slaughterhouses reduced. Supermarkets, faced with sudden surges in demand are struggling to respond, used to 'just in time' provisioning models. Faced to export restrictions some countries take, crucial flows of food are disrupted. As an example, Vietnam has suspended its rice export, leaving Malaysia with concerns on its rice supply. In shorter supply chains, the closure of territorial markets, main means for populations in some Southern countries to access food, has triggered the cut off of vital food provisioning routes (IPES-FOOD, 2020).

In a BBC interview on the 21st of March 2020, Maximo Torero, chief economist at the UN's Food and Agriculture Organization (FAO) further goes on food export bans. He highlights the importance of not taking the same measures as those taken during past 2007-2008 food crisis, namely the closing of borders for food export. Despite current impulsive and large scale food purchases amongst populations, there is enough stock and supply of staple commodities (e.g. wheat, sugar, rice, corn) and therefore there is no reason for countries to impose any measure restricting trade and mobility of commodities. Production and logistics sides of food systems remain the most affected. For high value commodities such as fruit and vegetables, the situation is highly complicated as those products are considered labor intensive as labor is highly affected by current health threat. Staple commodities on the contrary are capital intensive and less impacted by workforce productivity, but major threats remain governments restrictions on the mobility of commodities (BBC, 2020). Creating barriers will on the contrary affect anything else without any benefits, including producers that will be restricted in their export. In 2008, this led to difficulties for both low-income countries that were food dependent, as for humanitarian organizations that struggled to intervene with supplies (FAO, 2020).

The resiliency of small-scale farmers, their ability and potential to meet the needs of local populations has been prized throughout this crisis. Small-scale farmers have rapidly turned to new ways of selling products, using innovative coping mechanisms such as digital technologies, community-supported agriculture schemes and new direct-sell delivery systems. As an example, an important number of farmers in Norway have started using Facebook groups to propose their products. In Germany a lot of farmers have adapted by selling their products to local shops that operate normally (Euractiv, 2020). Community Supported Agriculture models, a risk-sharing mechanism connecting closely producers and consumers is used increasingly and offers interesting ways to cope with the crisis. It has proven to be quick to respond to the current emergency by providing food to communities in a way that ensures sanitary recommendations. Enforcing reliability and food safety, CSA networks have been exploding along with the relocalisation of farming practices (Urgenci, 2020; Euractiv, 2020). Lots of farmers have also been successfully reaching out to other farmers to deal with this sanitary crisis (Euractiv, 2020). Some concluding remarks were given by Panayota, seeing this crisis as an opportunity to rethink our food systems that currently do not work. As past example, a few years ago an important storm outbreak in Baltimore forced people not to get food for several weeks. The city had to come up with a plan that then became the basis of a more resilient food system in their city (P.Nicolarea, Skype call, April, 22, 2020). Briefly said, the crisis has brought on the

development of more resilient food systems, with many examples of cities and communities having taken quick measures to ensure food provisioning and production (IPES-FOOD, 2020).

2.9 Preamble to our quantitative analysis

Throughout our report, we decided to make a selection of European cities to study their food smartness. Initially, we selected the eight European cities having participated in the Food Smart City for Development 2015 as we might expect them to have more achievement since they engaged as first in the Milan Urban Food Policy Pact. This is the case for Ghent, Bruges, Bilbao, Barcelona, Milan, Turin, Utrecht and Marseille. We then added twelve additional cities that score differently on both SDGs scores and smart city indexes in order to add diversity to our analysis both in terms of geography and culture as in terms of food smartness expectations. Our sample was extended to Ljubljana, Bratislava, Riga, Athens, Vienna, Luxembourg, Munich, Warsaw, Prague, Tallinn, Lisbon and Stockholm. Our analysis will therefore lead us to calculate a precise food smartness score for all twenty cities in order to evaluate the influence of a set of explanatory variables on food smartness in R. Aside from this, our analysis aims at gaining insights on whether smartness of a city, early engagement in FSC4D and SDG score are good predictors of the food smartness of a city. It will also be interesting to see whether being signatory city of the MUFPP leads to better food smart outcomes.

3 Quantitative Analysis

3.1 Review of the Milan Urban Food Policy Pact Monitoring Framework

At present time, the indicator framework proposed by the Milan Urban Food Policy Pact is not being fully completed by cities. Reason for this are numerous and partly explained by the contact persons we met.

As the MUFPP framework is still a very new tool, cities often need some more time and/or resources to complete it and keep it up to date. A weakness of the framework mentioned is the extreme specificity of some indicators, as some information is hard to gather. While some cities only prioritize certain food smart categories to collect data on, others simply do not fill it in due to the heavy workload it requires. Panayota Nicolarea, member of the MUFPP secretariat, stated for example that Milan focuses particularly on the gathering of data on the Food Waste pillar

(P. Nicolarea, Skype call, April 22, 2020). As said previously, the way of approaching measurements is not outlined by the MUFPP, while the framework is not used as mean of comparison between cities. This lack of comparison basis across cities and through time was deplored by Chiara Pirovano from the Milan Urban Food Policy Pact office. On top of that, she cited as weakness both the absence of context-specific data of the framework and the absence of measurements on the strength of the associative context in cities. While information is sometimes available at city-level, scales do not always coincide with what cities already have as data. Moreover, the gathering of data is made tough due to competences that aren't managed at city level but at regional or national level and on which the city has no information on (C. Pirovano, Skype call, April 6, 2020). As Panayota Nicolarea mentioned, the framework is not mandatory to fill in and no check-ups are being done on what cities implement regarding food smart initiatives. Therefore, it is hard at this stage to have a complete overview of what is done at city-level (P. Nicolarea, Skype call, April 22, 2020).

3.1.1 Methodology

To palliate to some of these flaws, we have reviewed the Milan Urban Food Policy Pact and its 44 indicators to propose a simplified version of the framework which would mobilize available data. Both quantitative and qualitative data are used in the framework. For indicators that are hardly accessible for all cities, MUFPP indicators are replaced by alternative indicators that approximate initial indicators. The reviewed framework leads to scores for each MUFPP category of practices and a global food smart score for each city. Detailed version of the alternative framework is given in appendix 8, table 42 and table 44.

3.1.2 Outcomes

BCN	LJ	SK	TOR	BIO	VIE	MA	LX	GH	MI	BG	MUN	RG	TLL	BA	ATH	WS	UT	LUX	PRA
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.602	0.577	0.561	0.547	0.532	0.5	0.494	0.493	0.476	0.473	0.47	0.469	0.453	0.415	0.413	0.409	0.402	0.39	0.377	0.35

Table 2: Food smart ranking

Table 2 ranks our sample of twenty cities according to their final food smart score. Barcelona appears as the most food smart of our cities, followed respectively by Ljubljana and Stockholm. Utrecht, Luxembourg and Prague end the ranking. The difference between the food smart score of Barcelona compared to the last city, Prague, is significant. It is interesting to see that cities in their positions are widely dispersed among geography or cultural environment. We emitted

the hypothesis that Milan Urban Food Policy Pact Signatory cities might obtain better food smart scores than other cities. Even if some trend goes in that direction, results show that this is not entirely true. Stockholm for example obtains the third position among our twenty cities while not being a signatory city of the MUFPP. However, aside from Stockholm, other non-signatory cities end up in the bottom half of our ranking. Besides, early engagement in the FSC4D project of the MUFPP does not seem to influence food smartness, as the eight initial cities are spread out through the ranking, e.g. Barcelona being first and Utrecht 18th. In our theoretical part, we were also curious whether there might be some correlation between food smartness and smartness of a city. The outcome of our food smart framework indicates that this cannot be proven. For the cities of Warsaw and Bratislava, we can indeed observe both a poor score in smartness in mentioned rankings and food smartness. The same way, Utrecht did not appear in any smart city ranking and scores poorly on food smartness. However, the city of Luxembourg shows the opposite; the city stood particularly out in smart city rankings, but its food smart score ranks him in the penultimate position. Complete overview of cities' scores can be found in appendix 8, table 43.

Food Waste

Among our sample of twenty cities, most are active in the Food Waste category. It is Barcelona that obtains the highest Food Waste score (cfr. table 3). In our previous analysis, the BCFN Food Sustainability Index 2018 appointed the countries of Belgium, Greece, Slovakia, Slovenia as scoring poor on food loss and waste (BCFN, 2018). Following its country, Bratislava indeed scores poor on this dimension. However, Ljubljana, Ghent and Bruges do not follow their countries' score and obtain excellent positions in the ranking. While our contact persons of Ghent and Bruges ranked Food Waste within their top three priorities, it is surprisingly not the case for our Ljubljana contact. Spain did not appear as a country scoring outstandingly on food waste and loss in the BCFN index, but our FSC4D analysis already highlighted the importance of food waste practices in Barcelona.

BCN	LJ	BG	GH	SK	BIO	UT	TOR	MI	LX	LUX	MA	VIE	ATH	WS	TLL	RG	MUN	PRA	BA
1	2	3	3	3	4	5	6	7	8	9	10	10	11	12	12	13	14	15	16
0.65	0.568	0.568	0.568	0.568	0.563	0.521	0.46	0.431	0.423	0.415	0.376	0.376	0.364	0.343	0.343	0.295	0.25	0.198	0.170

Table 3: Food Waste pillar ranking

Social and Economic Equity

For Social and Economic Equity, Ljubljana this time reaches top position, as can be seen in table 4. Again, our contact person did not mentioned this category in its top three. Ghent reaches bottom position while we concluded this pillar as being part of the top three priorities of the city (FAO, 2018). It can be seen that all Eastern cities obtain top positions in this food category. To analyze why this might be the case, we look for the parameters that influence the implementation of Social and Economic Equity in cities in our analysis.

LJ	RG	TLL	LX	BA	SK	WS	ATH	VIE	BIO	BCN	PRA	MUN	MA	LUX	TOR	MI	UT	BG	GH
1	1	1	2	3	4	4	5	6	7	7	8	9	10	11	12	13	14	15	15
0.66	0.66	0.66	0.654	0.63	0.61	0.61	0.6	0.57	0.53	0.53	0.52	0.47	0.43	0.36	0.34	0.33	0.29	0.53	0.53

Table 4: Social and Economic Equity pillar ranking

Food Governance

Turin is the best scoring city on Food Governance (cfr. table 5). The city has its own inter-departmental food policy council and food policies. In opposition, Prague, Athens and Tallinn obtain a zero score on this dimension, as they do not have any particular Food Governance body nor food action plans or policies.

TOR	BCN	MI	MA	GH	BG	LJ	MUN	BIO	VIE	SK	LX	RG	BA	WS	LUX	UT	TLL	PRA	ATH
1	2	2	2	2	2	2	2	3	3	3	4	5	5	6	6	6	7	7	7
0.83	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.5	0.5	0.5	0.333	0.167	0.167	0.083	0.083	0.083	0	0	0

Table 5: Food Governance pillar ranking

Sustainable Diets and Nutrition

As can be seen in table 6, scores on Sustainable Diets and Nutrition appear as less spread out than last category. Bilbao obtains top position when it comes to Sustainable Diets and Nutrition, followed by Riga. Our two Belgian cities and Bratislava fit the bottom positions of our ranking. The last positions of these cities in this ranking might appear as a surprise as the BCFN appointed Slovakia, Belgium and France as scoring particularly good in nutrition. Inversely, the BCFN Food Sustainability Index appointed Italy as the country among those of interest with the lowest score on nutrition, while Turin obtains the third place in our ranking (BCFN, 2018). These results are not necessarily contradictory, we might legitimately expect that a low score in this category reflects a lower need to implement nutrition practices and as a consequence a

lower nutrition practice score.

BIO	RG	MUN	TOR	BCN	WS	SK	TLL	VIE	UT	PRA	LX	LUX	MI	ATH	LJ	MA	GH	BG	BA
1	2	3	3	4	4	4	5	5	6	7	8	9	10	10	11	11	11	12	13
0.82	0.8	0.77	0.77	0.76	0.76	0.76	0.75	0.75	0.74	0.73	0.71	0.7	0.67	0.67	0.66	0.66	0.66	0.65	0.63

Table 6: Sustainable Diets and Nutrition pillar ranking

Food Supply and Distribution

Turin scores the best for the Food Supply and Distribution category. It does not appear as a surprise that Barcelona obtains the second position as this category is among main priorities, as for the cities of Ljubljana and Lisbon. Parallely, for Luxembourg and Marseille that score the poorest, relevant contact person of their cities indeed did not mention Food Supply and Distribution as being one of their main focus area. Further results can be consulted in table 7.

TOR	BA	BCN	LX	ATH	RG	LJ	SK	VIE	BIO	MI	TLL	WS	BG	UT	GH	PRA	MUN	LUX	MA
1	2	2	3	3	3	3	4	5	6	7	8	8	8	9	9	9	10	10	11
0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.51	0.40	0.38	0.37	0.36	0.36	0.36	0.35	0.35	0.35	0.34	0.34	0.18

Table 7: Food Supply and Distribution pillar ranking

Food Production

For Food Production, Marseille this time goes from last to first in the ranking, as can be seen in table 8. Its country obtained a high score on sustainable agriculture and Food Production is part of its top three priorities cited by our contact person, as for Vienna. In the food sustainability index, Latvia, Greece, Luxembourg, Slovenia and Slovakia scored particularly low on sustainable agriculture. Our Food Production scores go partly in that direction, Athens and Riga being in the lowest positions. However, Luxembourg, Bratislava and Ljubljana are spread out over the mid-positions of the ranking. Aside from that, Warsaw being last appears as a surprise as Poland scores excellent on sustainable agriculture according to BCFN (BCFN, 2018). However, our contact person did not mentioned this topic as being the city's focus area either.

MA	BCN	VIE	GH	SK	BIO	LJ	BG	TLL	MI	LUX	UT	TOR	BA	MUN	LX	ATH	PRA	RG	WS
1	2	3	3	4	5	6	7	7	8	9	9	10	11	11	12	13	13	14	15
0.64	0.48	0.42	0.42	0.41	0.40	0.39	0.38	0.38	0.37	0.36	0.36	0.35	0.34	0.34	0.32	0.3	0.3	0.27	0.25

Table 8: Food Production pillar ranking

3.2 Dataset and descriptive statistics

Our research question is framed as following;

What parameters are European cities driven by in their transition towards Food Smart Cities?

The aim of our research will be to understand what influences the implementation of specific food smart categories and what influences the development of food smart cities. Our quantitative data is encompassed in seven dimensions, namely economic, environmental, sociodemographic, socio-economic, political and organizational, educational and health. Data was gathered from international and European institutions and agencies, such as Eurostat, the World Bank, OECD, FAO, Eurostat, the World Health Organization,... Besides this, data was collected on each city's score on the seventeen SDG as well as on the overall SDG index score thanks to the Sustainable Development Solutions Network. Among those variables, we then selected the variables that would be the most relevant for our research question and hypothesis and would have the least redundancy and correlation, to end up with a total of 26 variables to conduct our statistical analysis. A complete view on our variables and the references for the different cities can be found in appendix 7, table 41.

We proceed to a summary function of our dataset to have a view on mean, median, maximum, minimum and quartiles of our set of 26 variables for the 20 observations we have.

Sociodemographic parameters

Important variables in this section are;

- The demography of the chosen city [# inhabitants]
- Its area [km²]
- Its population density [#inhabitants/km²]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Demography	118325	351105	648330	816166	1337880	1911728
Area	39.0	97.22	170.5	214.41	305.75	517.0
Popudensity	0.85	2.302	3.66	5.124	6.524	17.03

Table 9: Summary function of socio-demographic parameters

When looking at the summary function in table 9, it directly appears that the demography of our twelve cities is very variable, the minimum going from 118,325 inhabitants (Bruges) while

the maximum value reaches 1,620,343 (Barcelona). Concerning the surface area of the city and the population density, we can once more observe very large variations.

Social and Economic Equity parameters

Here we make use of two parameters;

- The EU ranking of Regional Human Development Index
- The GINI coefficient [0-1 scale]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
RHDI	2	50	118.5	107.5	171	232
GINI	0.2480	0.2825	0.3030	0.3021	0.3220	0.3610

Table 10: Summary function of Social and Economic inequities parameters

For the variable RHDI, we see a very important spread of values as Stockholm is second in the ranking, while Riga is 232th. The mean is situated at 107.5 and the median at 118.5, letting us think that few cities are part of the top positions of the ranking. The GINI has a quite narrow range, from 0.2480 to 0.3610. The median and mean lie at 0.3030 and 0.3021 respectively, letting us expect quite evenly spread data (cfr. table 10).

Political and Organizational parameters

We include in this section;

- Strength of the engagement of civil society through voter turnout rate [0-10 sale]
- European Quality of Government Index per region [percentage]
- Confidence in the local government [percentage]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Civicengagement	2.8	5.025	6.3	6.53	7.9	10.0
EQI	22.9	38.73	52.85	53.0	70.5	80.20
Confidencegov	21.36	25.17	31.26	37.68	49.09	72.57

Table 11: Summary function of Political and Organizational parameters

Concerning civic engagement, some cities score very poorly, 2.8 out of 10, while others obtain a maximum of 10 out of 10. However, the mean and median are situated above average, at 6.53 and 6.3, assuming rather above average scores for most cities. EQI has very diverse values ranging from 22.9 to 80.20. The mean and median are situated just above average, at 52.85 and

53, predicting rather above average values for most cities. Eventually, Confidencegov ranges from 21.36 to 72.57, with a median far below average of 21.26 and a mean far below average of 37.68, letting us expect poor scores (cfr. table 11).

Environmental parameters

All chosen environmental parameters are;

- Pollution Index [percentage]
- Food waste per capita per year [kg/capita/year]
- Ratio between gross inland energy consumption and GDP [ratio]
- Pay-as-you-throw food waste management system [binary]
- Cropland as a proportion of total area [percentage]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Pollution	17.09	22.98	35.01	39.62	59.4	69.61
Foodwasteca	50.0	56.75	59.5	62.3	65.0	87.0
Energyintensity	84.0	94.0	108.5	111.1	126.2	170.0
Croplandpercent	10.26	22.69	41.55	39.99	58.73	66.0

Table 12: Summary function of environmental variables

For the parameter energy intensity, results are spread out (cfr. table 12). However, mean value remains far from the maximum value of 170 obtained by Tallinn. For food waste per capita, we observe that the majority of cities do not exceed the third quartile of 65, while the mean is 62.3. The percentage of cropland is very different from one city to another, which may significantly impact the Food Production pillar within cities. We add the factor PAYT in our environmental parameters, characterizing the waste collection fee systems of cities.

Educational parameters

Educational variables are:

- Early leavers from education and training in region (18 to 24 years old) [percentage]
- Population from 25-64 year with at least tertiary education in city/region [percentage]
- Employment in knowledge-intensive services in region [percentage]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Earlyleavers	1.6	5.075	7.2	7.650	9.90	17.0
Terteduc	19.3	36.95	41.10	40.43	44.91	57.40
Klsectoremploy	31.64	36.20	45.81	43.61	48.83	61.05

Table 13: Summary function of educational parameters

The percentage of early school leavers ranges from 1.6 to 17%, with a median and mean situated at 7.2 and 7.65%. The mean and median are decentered towards lower values. The third quartile shows that most cities do not exceed 9.90%. Concerning tertiary education, the cities range from 19.3 to 57.4%, with a mean and median very decentered towards higher values, letting us expect a majority of cities having relatively high percentages of tertiary education within our value range. The knowledge-intensive sector employment percentage varies from 31.64 to 61% with an important majority of cities being under 48.83%, as the third quartile indicates (cfr. table 13).

Economic parameters

We kept several economic variables;

- Export in food industry[billion €]
- Country turnover of the food industry [million €]
- Disposable income per capita in the region [0-10 scale]
- Research and Development expenditure as proportion of GDP in region [percentage]
- Population working in the food industry [percentage]

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Export	0.773	3.210	10.31	13.609	19.568	52.26
Turnoverindus	377.7	2942.7	8817.9	18282.0	40658.9	62934.9
Income	1.40	3.65	4.55	4.35	5.20	6.80
RDexpend	0.630	1.505	1.955	2.117	2.670	3.780
Employfood	0.0046	0.012	0.0157	0.01536	0.019	0.024

Table 14: Summary function of economic parameters

The two first parameters export and turnoverindustry that are widely diverse among cities reflect the very different economic landscapes of the food industry in concerned countries. Income is measured on a 0 to 10 scale regarding disposable income and shows a very low minimum value and a maximum value very far from the best score of 10. Regarding employment in the food industry, it can be seen that employment in the food sector remains low, with a minimum percentage of 0.46% and a maximum of 2,4% (cfr. table 14).

Health parameters

- Death due to diabetes mellitus [percentage]
- People satisfied with availability or quality of healthcare in region [percentage]
- Hospital bed rate in region [#inhabitant]
- Welfare regime cluster

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Deathmellitus	13.74	14.96	20.79	23.27	28.66	43.26
Qualhealthcare	31.16	56.68	74.14	70.05	87.90	92.56
Hospbeds	23.3	39.27	52.30	51.79	55.25	82.20

Table 15: Summary function of health parameters

Quality of healthcare is the only subjective parameter with confidencegov of our database, rating citizens' satisfaction regarding healthcare in their region or town. Immediately, it can be seen from table 15 that results vary heavily among maximum and minimum value, the inhabitants of Athens having the lowest value and the inhabitants of Ghent and Bruges the highest. Hospital beds is also a parameter that marks significant differences among our cities. To these variables, we add the factor welfsyst, characterizing the welfare regime cluster of the concerned country; Eastern, Southern, Conservative or Northern.

Sustainable Development Goals

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
SDGscore	55.1	61.9	65.25	65.44	70.3	74.7

Table 16: Summary function of SDGscore parameter

Results on the total SDG scores do not appear as very spread out across cities (cfr. table 16). Indeed, values range from 55.1 to 74.7, with a mean and median both centered around 65, which is nearly perfectly in the middle of our minimum and maximum value.

3.3 Hypothesis

This section retakes all hypothesis we want to test, both for the prediction of food smartness and the implementation of specific food smart categories practices. Hypothesis are issued from literature review mentioned previously completed by personal assumptions.

P: What explains the important differences of food smartness scores across cities in Europe?

R1: Which variables drive cities to become food smart?

Hypothesis: The demography of a city (De Cunto et al., 2017), the GINI coefficient (De Cunto et al., 2017), deaths due to diabetes mellitus (De Cunto et al., 2017), energy intensity (De Cunto et al., 2017), total SDG score, civic engagement, population density, employment in the food sector, cropland percentage, area of the city

P: Which variables influence the implementation of particular categories of food smart practices?

R1: Which variables drive cities to adopt Food Waste management practices?

Hypothesis: Tertiary education (Leal Filho et al., 2015), civic engagement, employment in the food sector, turnover food industry, pollution

R2: Which variables drive cities to adopt Social and Economic Equity practices?

Hypothesis: Employment in the food sector (Kenis & Mathijs, 2014), percentage of tertiary education (Kenis & Mathijs, 2014), GINI, RHDI, income, the type of welfare regime, the turnover of the food industry, the SDG score

R3: Which variables drive cities to adopt Food Governance practices?

Hypothesis: Civic engagement, confidence in the local government, death mellitus, welfare system, turnover of the food industry, demography, R&D expenditure

R4: Which variables drive cities to adopt Sustainable Diets and Nutrition practices?

Hypothesis: The percentage of deaths due to mellitus, nature of regime of welfare, quality of healthcare, SDG score, percentage of tertiary education, food waste per capita, cropland percentage

R5: Which variables drive cities to adopt Food Supply and Distribution practices?

Hypothesis: Income (FAO, 2019), Export (FAO, 2019), R&D expenditure, area, pollution, food waste per capita, cropland percentage, turnover of the food industry

R6: Which variables drive cities to adopt Food Production practices?

Hypothesis: Civic engagement (Morgan, 2015), R&D expenditure, income, employment in the food industry, pollution, food waste per capita, cropland percentage, area of the city, turnover of the food industry

3.4 Statistical model to predict food smartness

To estimate the relationship between dependent and independent variables of our dataset, we will fit a multiple linear regression using the Ordinary Least Squares Estimation (OLS). The mathematical model of the linear regression can be rewritten as;

$$Y_{0i} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \varepsilon_i$$

where :

$Y = \text{Foodsmartness score}$

β = regression parameter or regression coefficient

$i = \text{number of observations}$

$X = \text{explanatory variables}$

$k = \text{number of explanatory variables}$

$\beta_0 = \text{intercept}$

$\varepsilon = \text{error term or residual}$

OLS will find estimates that optimizes the Residual Standard Error (RSE) by minimizing the difference between observed and predicted results on a regression line (Kassambara, 2017).

3.4.1 Descriptive Statistics

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Foodsmartness	0.35	0.4145	0.4745	0.4770	0.5357	0.6020

Table 17: Summary function of Foodsmartness

The summary function in table 17 provides us with some valuable information on the distribution of the data for the variable Foodsmartness. As can be seen in this table, the minimum value is 0,35, while the maximum value amounts to 0,602. No city exceeds this score on a scale from 0 to 1. Median and mean show a quasi-symmetrical data distribution.

3.4.2 Normality analysis

Only if normality assumptions are met are we able to estimate the parameters ($\beta = (\beta_0, \beta_1, \dots, \beta_p)$) of our model. Four hypotheses hold when assuming normality (Segers, 2017);

- Homogeneity of residuals variance
- Absence of outliers
- Explanatory variables are independent from error term
- Error terms are independent and normally distributed with zero mean

For each of those assumptions, statistical tests and graphical representations will be used to determine if normality can be assumed.

Homogeneity of residuals variance

In a linear model, the assumption is made that the variance of residuals remains constant. The Breusch-Pagan test is used in a linear model for testing heteroskedasticity. If the variance of the error from a regression depends on the values of the independent variables, then heteroskedasticity is assumed. The test statistic uses a chi-squared distribution, with degrees of freedom corresponding to the number of parameters of the model. The null hypothesis is homoscedasticity of the model. Therefore, a p-value below an appropriate threshold value such as $p < 0.05$ would lead to the rejection of the null hypothesis and therefore the assumption of heteroskedasticity (CRAN, 2019).

Absence of outliers

Small sample sizes such as ours are particularly exposed to outliers. To analyze the presence or absence of outliers for the variable Foodsmartness, we will make use of both a boxplot analysis and a Q-Q plot analysis. A boxplot is a standardized method of displaying the distribution of data according to five measures: minimum, first quartile, median, third quartile and maximum. The graph helps to visualize how the values in the data are spread out. Examining our boxplot, the middle quartile is situated between the score of food smartness of 0,45 and 0,50. There is a relatively even proportion on both sides of the median. Outliers can be observed both above the median, at a food smartness value of 0,60 and under, at a food smartness value of 0,35 (cfr. figure 17). The Q-Q plot visualization is another tool that helps to assume normality visually. A normal probability plot should approximately follow a straight line (Segers, 2017). Since relatively few data points fall in the few lowest and highest quartiles and that some fluctuations can be seen at the extreme ends, we can suppose the data not to be perfectly normally distributed, but not too far off. We can therefore assume normality (cfr. figure 18).

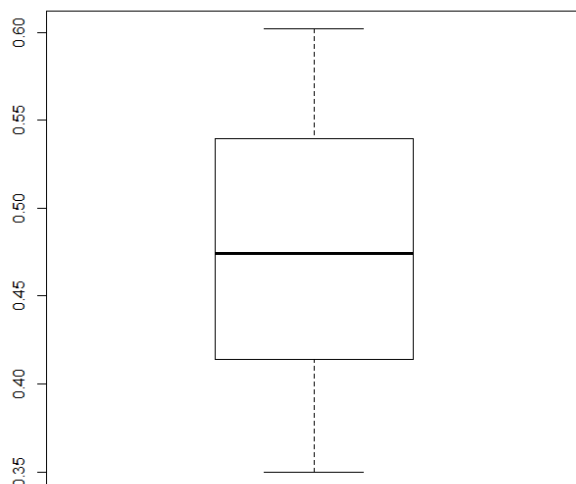


Figure 17: Boxplot of Foodsmartness

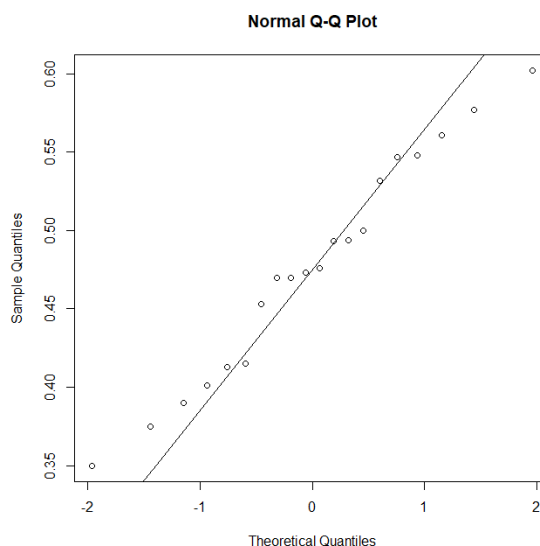


Figure 18: Q-Q Plot of Foodsmartness

We proceed to the Bonferroni adjustment or correction to look for possible outlying observations. Through the detection of type I errors, the Bonferroni correction accepts or rejects individual null hypothesis. To do so, it mobilizes the *outlierTest* function and returns the largest studentized residual through multiple hypothesis testing (Haynes, 2013).

Independence of the error term

We start by drawing the density plot of the variable Foodsmartness, to see if the data is normally distributed. We can immediately see the quasi-symmetric shape of the graph, that has a Gaussian shape (Segers, 2017). Our data is not exactly symmetric; the spread of our data is situated from 0,35 to 0,65, with a peak in density when food smartness lies between 0,45 and 0,5. However, based on this plot, we can see that the distribution is not too far off from a normal distribution (cfr. figure 19).

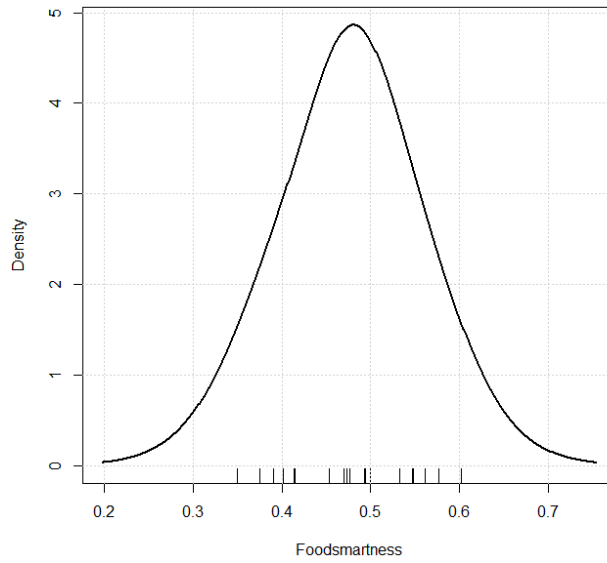


Figure 19: Density plot of Foodsmartness

Eventually, different statistical tests were undertaken to analyze the normality of our Foodsmartness variable. First, we performed the normality test of Jarque-Bera (JB), that examines whether the data's kurtosis and skewness fit a normal distribution. Skewness measures the degree of symmetry of a variable, while kurtosis indicates whether the data is heavy-tailed or light-tailed compared to a normal distribution (Van Bellegem, 2018). The JB statistic is a chi-squared distribution with two degrees of freedom and therefore can be used to determine whether the data approximates a normal distribution. The null hypothesis states that both the skewness and the excess kurtosis equal zero, which corresponds to a normal distribution. The formula of Jarque-Bera is computed as follows:

$$JB = \frac{n}{6} \left(S^2 + \frac{1}{4} (K - 3)^2 \right)$$

With skewness S and kurtosis K computed as follows;

$$S = \frac{\hat{\mu}_3}{\hat{\sigma}^3} = \frac{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^3}{\left(\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \right)^{\frac{3}{2}}}$$

$$K = \frac{\hat{\mu}_4}{\hat{\sigma}^4} = \frac{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^4}{\left(\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \right)^2}$$

where n is the number of observations, $\bar{x}$ is the sample mean, $\hat{\sigma}^2$ is the estimate of the variance or second central moment, $\hat{\mu}_4$ and $\hat{\mu}_3$ are the estimates of third and fourth central moments (rdocumentation, n.d., Van Bellegem, 2016).

Further, we computed the statistical test of Shapiro-Wilk. The Shapiro-Wilk test is a normality test that verifies the null hypothesis that a sample comes from a normal distribution. The following formula represents the Shapiro-Wilk statistic:

$$W = \frac{(\sum_{i=1}^n a_i x_{(i)})^2}{\sum_{i=1}^n (x_i - \bar{x})^2}$$

Where $x_{(i)}$ is the i -th order statistic and $\bar{x} = \frac{(x_1 + \dots + x_n)}{n}$ is the sample mean. The a_i coefficients correspond to $(a_1, \dots, a_n) = \frac{m^T V^{-1}}{C}$ where V is the covariance matrix of the normal order statistic, the vector m is $m = (m_1, \dots, m_n)^T$ and C is a vector norm corresponding to $C = \|V^{-1}m\| = (m^T V^{-1} V^{-1} m)^{\frac{1}{2}}$ (Van Bellegem, 2018).

Eventually, the Anderson-Darling test was performed. This test analyzes the goodness-of-fit to the distribution specified by the null argument. Assumption is made that the values are identically distributed and independent with a cumulative F distribution function. The null hypothesis states that F is the function referred to by the null argument (CRAN, 2019).

Eventually, for testing the independence of the error term in the model we will mobilize two tests. The first, Durbin-Watson, is one of the most widely used test for analyzing the presence of autocorrelation in a model and remains valid even in small sample sizes. By calculating upper and lower significance bounds for different combinations of observations and parameters and comparing these to the DW statistic, conclusions can be drawn regarding the degree of correlation of autoregression (AR) form in the model. As cut-off value, Watson and Teeklucksingh (2002) state the absence of autocorrelation when DW is close to the value 2 and a significant positive correlation when $DW < 2$. As the DW statistic is symmetric around 2, likewise we can legitimately state that if $DW > 2$ there is no autocorrelation within our model while $DW < 2$ would have meant a negative autocorrelation (Watson & Teeklucksingh, 2002).

Secondly, the Breusch-Godfrey test is another statistical test on models performed to determine whether there is autocorrelation in the error term of a regression model. A test statistic is obtained, which determines whether the null hypothesis, the absence of serial correlation of any order up to p , is rejected or not. Unlike the Durbin-Watson test, the Breusch-Godfrey test can detect autocorrelation up to any order p and can handle a broader range of regressors. However, it cannot distinguish between serial correlation of autoregression (AR) or moving average form (MA) (Watson & Teeklucksingh, 2002).

Application on the variable Foodsmartness

Table 18 retakes the normality tests we considered above for the variable Foodsmartness. Having obtained a statistic value for Jarque-Bera of 0.7093 and a p-value of 0.7014, we fail to reject the null hypothesis that the data is normally distributed. Both our kurtosis and skewness analysis lead to the same conclusion, as skewness is close to zero and kurtosis less than 3, criteria for indicating a normal distribution. Further, we obtained a value of 0.9726 for the Shapiro Wilk statistic and a p-value of 0.8093. Once more, this leads to the failure to reject the null hypothesis that data is normally distributed. Eventually, the variable Foodsmartness obtains a value for the Anderson-Darling statistic of 0.227 and 0.7864 as p-value. With this outcome, we fail to reject the null hypothesis that F is the function specified by the null argument. Based on the considerations made above, we can legitimately assume that the variable is normally distributed, based on the series of normality tests lead.

Foodsmartness	Jarque-Bera	Skewness	Kurtosis	Shapiro-Wilk	Anderson-Darling
Statistic (<i>p-value</i>)	0.7093 (0.7014)	-0.0438	2.0815	0.9726 (0.8093)	0.227 (0.7864)

Table 18: Normality tests dependent variable Foodsmartness

3.4.3 Model fitting

3.4.3.1 Model Evaluation metrics

In this thesis, we will make use of the following evaluation metrics;

- R-squared (R^2) and adjusted R-squared
- Akaike's Information Criterion (AIC)
- Second-order Akaike Information Criterion (AICc)
- Root Mean Squared Error (RMSE)

R-squared and adjusted R-squared

R-squared measures the proportion of variance of the dependent variable explained by the model's independent variables. In brief, it measures the quality of adjustment. The higher its value, the best the model. In this thesis, we use the corrected R-squared in consideration with total number of variables in the model, namely the adjusted R-squared. As R-squared increases

with the number of variables, the adjusted R-squared allows us to ensure that variables weakly correlated with the dependent variable are not kept within the model (Kassambara, 2017).

Akaike's Information Criterion (AIC)

Akaike's Information Criterion (AIC) is an estimator of the quality of statistical models that aims at penalizing the presence of non-necessary variables in a model. The criterion balances goodness-of-fit and simplicity of a given model through maximum likelihood estimation (Kassambara, 2017). Its function is given in (1).

$$AIC = 2k - 2 \ln(L) \quad (1)$$

Akaike's Information Criterion correction (AICc)

To avoid the probability of selecting models that have too many parameters and therefore overcome the risk of overfitting, we use the AICc. The AICc is a correction of the AIC for small sample sizes such as ours ($n=20$). An extra penalty term is introduced in the AICc for the number of parameters (CRAN, 2019). The AICc formula is computed as follows (2);

$$AICc = AIC + \frac{2k^2 + 2k}{n - k - 1} \quad (2)$$

where k represents the number of parameters and n the size of our sample (CRAN, 2019). As for AIC, the lowest the AICc, the better the model.

RMSE

The root-mean-square error or RMSE computes the difference between observed values and the predicted values of a model, using the following formula (3);

$$RMSE = \sqrt{\sum_{i=1}^n \frac{(\hat{y}_i - y_i)^2}{n}} \quad (3)$$

where n is the size of our sample, $\hat{y}_i$ are predicted values and y_i observed values.

The value of RMSE is always non-negative. The closer to zero, the better the model fits the data. A larger RMSE indicates that the model fails at accounting for important features underlying the data (Kassambara, 2017).

3.4.3.2 Feature Selection

Exhaustive search

To select the best model to predict food smartness, we first conducted an exhaustive search as our database of 26 variables allows us to proceed that way. By crossing variables, we select the model that obtains the highest R^2 and lowest AIC and proceed to step-by-step variable deletion to find the best fit. This method make us select model 4 that can be found in appendix 4, table 27, with the other best scoring models of our exhaustive search.

Boruta

Boruta is the second feature selection method we use. It is a wrapper method evaluating subsets of variables and proceeding to classifications using the random forest algorithm. By triggering decision trees, it eventually rejects or confirms variables for model building (Pastor Sanz, 2019). In our case, the Boruta method confirms three variables as being meaningful for Foodsmartness; popudensity, terteduc and welfsyst. Related boxplots appear from figure 20, with confirmed variables in green and rejected in red boxplots.

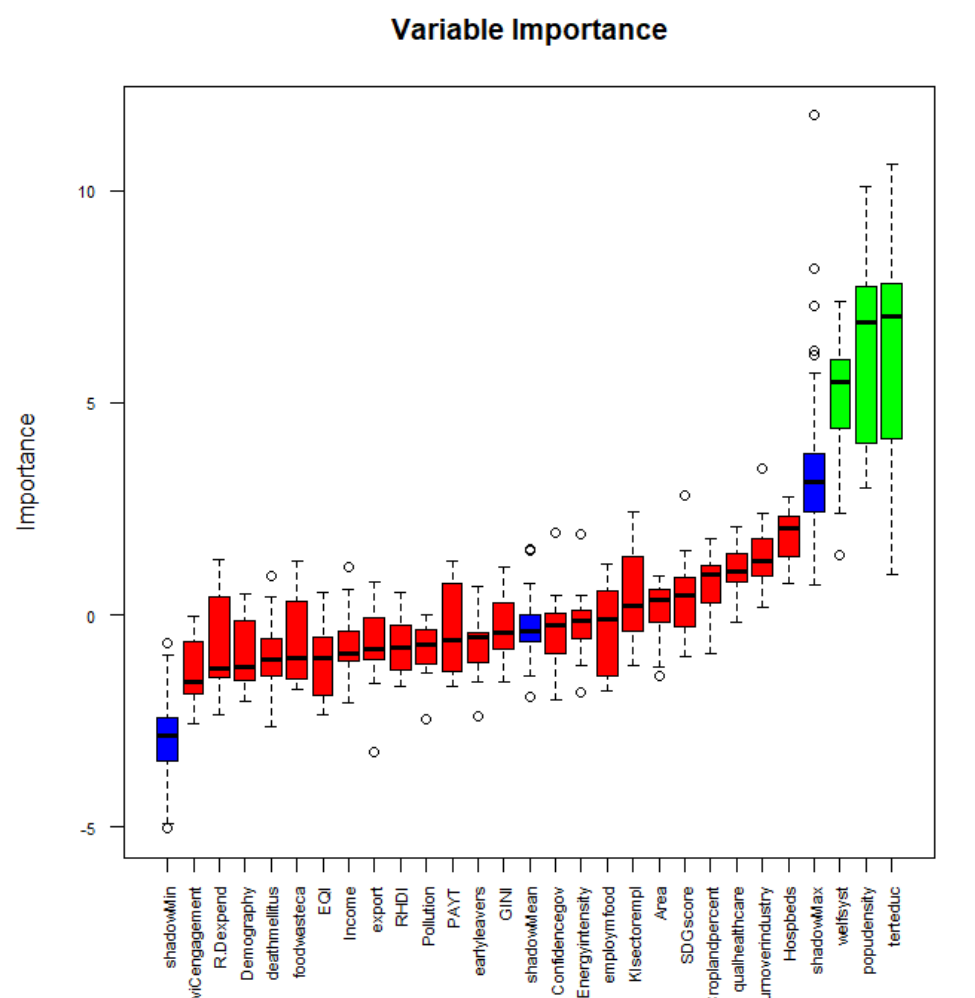


Figure 20: Boruta feature selection Foodsmartness

SFS and SBS algorithms

The Sequential Forward and Backward Selection algorithms are very common and popular sequential search algorithms. The Sequential Forward Selection starts from a basic model with only an intercept and then constructs predictive models by adding one by one variables, using a ‘bottom-up’ approach. Statistical tests are conducted at each step to determine whether those variables are important to add to the predictive model. Variables with small p-values, under a predefined threshold, are added to the model. The algorithm goes on until no variables are significant enough to be added to the predictive model (MathWorks, n.d.) The Sequential Backward Selection algorithm performs the exact opposite steps, starting from a full model with all variables and eliminating variables one by one to obtain a statistically better predictive model (MathWorks, n.d.).

SFBS and SFFS

While our previously introduced sequential search algorithms use the AIC as selection criterion, the SFFS and SFBS, called advanced sequential search algorithms, make use of the determination coefficient, R-squared. The SFFS, also called Sequential Forward Floating Selection and the SFBS, called Sequential Backward Floating Selection have as aim to get rid of nesting effects, using a floating selection approach. Concretely, SFFS starts from an empty set and after each step forward it iteratively proceeds to backwards steps until the objective function stops increasing. Obviously, it is the opposite for SFBS, which starts from the full set and implements forward steps after each backward step while the objective function increases (Kerschke & Trautmann, 2018).

3.4.3.3 Application to Foodsmartness

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	SFS	SBS	SFFS	SFBS	Boruta	Selected≥ 3	Exhaustive search
Area	1	1	0	0	0	0	1
CiviCengagement	0	1	0	0	0	0	1
Confidencegov	1	1	0	0	0	0	1
Croplandpercent	1	0	0	0	0	0	0
Deathmellitus	0	0	0	1	0	0	0
Demography	1	1	1	0	0	1	1
Earlyleavers	1	1	1	0	0	1	1
Employmfood	1	1	1	1	0	1	1

Energyintensity	1	1	0	0	0	0	1
EQI	0	0	0	0	0	0	0
export	0	0	0	1	0	0	0
Foodwasteca	1	0	1	0	0	0	0
GINI	0	0	1	0	0	0	0
hospbeds	0	0	0	1	0	0	0
income	0	1	1	1	0	1	1
KIsectoremploy	0	0	1	1	0	0	0
PAYT	0	0	1	0	0	0	0
Pollution	1	0	1	0	0	0	0
Popudensity	1	0	1	0	1	1	0
qualhealthcare	1	1	0	1	0	1	1
R.Dexpend	1	1	0	1	0	1	1
RHDI	1	1	0	0	0	0	1
SDGscore	1	0	1	1	0	1	0
terteduc	1	0	1	0	1	1	0
Turnoverindustry	0	0	0	1	0	0	0
welfsyst	1	1	1	1	1	1	1
R ²	1	0.969	0.845	0.9144	0.5262	0.8979	0.969
Adjusted R ²	1	0.8222	0.2637	0.7289	0.357	0.7228	0.8222
(<i>p-value test</i>)	(0.00296)	(0.007)	(0.3885)	(0.0302)	(0.04289)	(0.01932)	(0.007)
AIC	-291.31	-87.66	-53.47	-69.3449	-51.124	-67.81	-87.66
AICc	-1131.31	93.67	252.53	50.66	-41.79	574.448	93.67
RMSE	0.000061	0.0125	0.027167	0.02019	0.0474	0.0221	0.0125

Table 19: Feature selection and model creation Foodsmartness

Based on the six feature selection processes introduced above, we create models composed by the selected features of each method. We obtain five different models to explain food smartness, as the exhaustive search and the SBS algorithm lead us to create the same predictive model. A last method was added to previous models by creating a model with all variables selected at least three times by our different feature selection methods (model 6). The model evaluation metrics introduced above were used to measure whether the models are a good fit to the data (cfr. table 19).

Based on those metrics, it appears that one model stands out, the model composed of the variables proposed by the SFS algorithm, model 1. Indeed, this model has the highest R-squared and adjusted R-squared, both equal to 1, the lowest AIC, -291, the lowest AICc, -1131.31, and the lowest RMSE, 0.000061, of all models retained. We therefore assume the food smartness of a city to be best explained by following predictive model:

$$\begin{aligned}
\text{Foodsmartness} \sim & \text{Area} + \text{Demography} + \text{Confidencegov} + \text{Croplandpercent} \\
& + \text{earlyleavers} + \text{employmfood} + \text{Energyintensity} + \text{foodwasteca} \\
& + \text{Pollution} + \text{popudensity} + \text{qualhealthcare} + \text{R.Dexpend} + \text{RHDI} \\
& + \text{SDGscore} + \text{terteduc} + \text{welfsyst}
\end{aligned}$$

Area, confidence in the government, the percentage of early school leavers, the energy intensity use, the employment in the food sector, the food waste per capita and a Southern welfare system regime are negatively correlated with the food smartness of a city.

A bunch of variables of our model are highly significant at a 0.001 significance level, namely welfare system, R&D expenditure, demography, energy intensity, area, confidence in the local government, cropland and the proportion early leavers. However, three variables do not have a significant level of influence on food smartness as they have a p-value exceeding 0.1. Those variables are the percentage of employment in the food sector, the quality of healthcare and the percentage of people following tertiary education. Nevertheless, their subtraction from the model leads to a model of lower quality regarding evaluation metrics.

In our statistical model (model 1), we obtained a value for the Breusch-Godfrey statistic of 5.06 and a p-value of 0.02445. Taking a threshold value of 0.05, we can reject the null hypothesis of absence of serial correlation. For the Durbin-Watson statistic, we obtain a statistic of 2.566 and a p-value of 0. As the statistic is greater than 2, we reject the presence of autocorrelation in our model (Watson & Teeklucksingh, 2002). Our model gives a value of 16.931 for the Breusch-Pagan statistic and a p-value of 0.5279, leading to the failure to reject the null hypothesis of homogeneity (CRAN 2019). Eventually, the Bonferroni test appoints the city of Riga as being an outlier in model 1 (cfr. table 20).

Model 1	Breusch-Pagan	Durbin-Watson	Breusch-Godfrey	Bonferroni test
Statistic (p-value)	16.931 (0.5279)	2.566 (0.000)	20 (0.000)	Riga : 0.3629 (0.018)

Table 20: Normality analysis model 1

3.5 Statistical model to predict Food Smart categories score

3.5.1 Model fitting Food Waste score

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	SFS	SBS	SFFS	SFBS	Boruta	Selected≥ 3	Exhaustive search
Area	1	1	1	0	1	1	1
CiviCengagement	1	1	1	0	0	1	1
Confidencegov	1	1	0	0	0	0	1
Croplandpercent	1	0	1	0	0	0	1
Deathmellitus	1	0	0	1	0	0	0
Demography	0	1	1	0	0	0	1
Earlyleavers	1	1	0	0	0	0	1
Employmentfood	0	1	0	1	0	0	0
Energyintensity	0	1	1	0	0	0	0
EQI	1	0	0	0	0	0	1
export	0	0	1	1	0	0	1
Foodwasteca	0	0	0	0	0	0	1
GINI	0	0	0	0	0	0	0
hospbeds	1	0	0	1	1	1	0
income	0	1	1	1	0	1	0
KIsectoremploy	1	0	1	1	0	1	0
PAYT	1	0	1	0	0	0	0
Pollution	1	0	0	0	0	0	0
Popudensity	0	0	1	0	0	0	1
qualhealthcare	1	1	0	1	0	1	0
R.Dexpend	0	1	0	1	0	0	0
RHDI	0	1	0	0	0	0	0
SDGscore	1	0	1	1	1	1	1
terteduc	1	0	1	0	0	0	1
Turnoverindustry	1	0	0	1	1	1	1
welfsyst	1	1	1	1	0	1	1
R ²	1	0.9615	0.936	0.798	0.592	0.8339	0.994
Adjusted R ²	1	0.8537	0.694	0.361	0.484	0.605	0.962
(p-value test)	(0.003)	(0.013)	(0.099)	(0.236)	(0.0065)	(0.038)	(0.0079)
AIC	-258.41	-56.93	-44.66	-25.81	-39.740	-33.694	-90.278
AICc	-1098.4	124.404	261.338	94.18	94.186	26.97	593.72
RMSE	0.0001	0.026	0.034	0.060	0.085	0.0544	0.0103

Table 21: Feature selection and model creation Food Waste

Our analysis leads us to seven different models predicting the Food Waste score of a city (cfr. table 21), from which the Boruta figure and the exhaustive search can be found in the appendix 5.1, figure 33 and table 28. One model stands out, the model with the variables recommended by the SFS method. Indeed, the model has the best R² and adjusted R², both amounting to 1, the lowest AIC, -258.41, the lowest AICc, -1098.4 and the RMSE the closest to zero. Testing Breusch-Pagan on this model, we can affirm the homoskedasticity of the model with a p-value of 0.3766 and a BP value of 19.25. Parallely, Breusch-Godfrey leads to the confirmation of the

independence of the error term with its p-value of 0.0000 and LM test of 20. The model is articulated as follows:

$$\begin{aligned} \text{Food.waste} \sim & \text{Area} + \text{CiviCengagement} + \text{Confidencegov} + \text{Croplandpercent} \\ & + \text{deathmellitus} + \text{earlyleavers} + \text{EQI} + \text{hospbeds} + \text{Klsectoremploy} \\ & + \text{PAYT} + \text{Pollution} + \text{qualhealthcare} + \text{SDGscore} + \text{terteduc} \\ & + \text{turnoverindustry} + \text{welfsyst} \end{aligned}$$

The variables area of the city, the percentage of civic engagement, the percentage of early school leavers, the EQI score, the employment in the knowledge intensive sector, the quality of the healthcare services, the turnover of the food industry and an Eastern or Southern welfare system are all negatively related to the Food Waste score of a city. The variable Southern welfare system is the only variable that appears to have a very low influence on the model, with a p-value above 0.1. Confidence in the government, the percentage of early school leavers, pollution, the quality of healthcare and the turnover of the industry are linked at a 0.05 p-value level, while all other variables are highly significant, at a level of 0.01.

3.5.2 Model fitting Social and Economic Equity score

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	SFS	SBS	SFFS	SFBS	Boruta	Selected≥3	Exhaustive search
Area	1	1	1	0	0	1	0
CiviCengagement	1	1	1	0	1	1	1
Confidencegov	1	1	1	0	0	1	0
Croplandpercent	1	1	1	0	0	1	0
Deathmellitus	0	0	0	1	0	0	0
Demography	1	1	1	0	0	1	0
Earlyleavers	0	1	0	0	0	0	1
Employmentfood	1	1	1	1	0	1	1
Energyintensity	1	1	0	0	0	0	0
EQI	0	0	0	0	0	0	1
export	0	0	1	1	1	1	1
Foodwasteca	0	1	0	0	1	0	1
GINI	1	0	1	0	1	1	1
hospbeds	1	0	0	1	0	0	0
income	1	1	1	1	1	1	1
Klsectoremploy	0	0	1	1	0	0	0
PAYT	0	0	1	0	0	0	1
Pollution	1	0	1	0	0	0	0
Popudensity	1	0	0	0	0	0	1
qualhealthcare	0	1	0	1	1	1	1
R.Dexpend	1	1	1	1	0	1	0
RHDI	1	1	0	0	0	0	1

SDGscore	0	1	1	1	0	1	1
terteduc	1	1	0	0	0	0	1
Turnoverindustry	0	0	0	1	1	0	1
welfsyst	1	1	1	1	0	1	1
R ²	1	1	0.998	0.818	0.818	0.992	0.999
Adjusted R ²	0.999	0.999	0.979	0.4224	0.712	0.9610	0.9982
(p-value test)	(0.011)	(0.017)	(0.019)	(0.190)	(0.001)	(0.002)	(0.033)
AIC	-208.53	-190.03	-102.42	-22.14	-34.21	-80.33	-163.2
AICc	-1048.53	-1030.03	Inf.	97.86	-16.214	225.67	-1003.21
RMSE	0.000	0.00077	0.007	0.066	0.0656	0.014	0.0015

Table 22: Feature selection and model creation for Social and Economic Equity

The same methodology was applied to Social and Economic Equity, for which the Boruta and the exhaustive search tables can be found in the appendix 5.2, figure 34 and table 30. Out of our feature selection and model evaluation, we again decided to keep model 1 created thanks to the SFS feature selection method. It provides us with an AIC of -208.53 and a corrected AIC criterion of -1048.53, which are the lowest values obtained among our models. Besides, both our R-squared and adjusted R-squared obtain values of 1, while our Root Mean Square Error approximately obtains a zero value. Breusch-Pagan leads us to reject the heteroskedasticity of the model with a p-value of 0.4109 and a BP value of 18.695. Besides, our error term is independent as Breusch-Godfrey gives a p-value of around 0.0000 and LM test of 20 (cfr. table 22). The model is as follows;

$$\begin{aligned}
 \text{Social and Economic Equity} \sim & \text{Area} + \text{CiviCengagement} + \text{Confidencegov} \\
 & + \text{Croplandpercent} + \text{Demography} + \text{employmfood} + \text{Energyintensity} \\
 & + \text{GINI} + \text{Hospbeds} + \text{Income} + \text{Pollution} + \text{popudensity} + \text{R.Dexpend} \\
 & + \text{RHDI} + \text{terteduc} + \text{welfsyst}
 \end{aligned}$$

Civic engagement, that is negatively correlated with Social and Economic Equity, is the most significant variable among our model, at a 0.01 level. Confidence in the local government, demography, energy intensity, hospbeds, income, RHDI, tertiary education and Eastern and Southern welfare system regime have an inverse relationship with Social and Economic Equity. Except income and pollution, all variables are significant at least at a 0.05 level.

3.5.3 Model fitting Food Governance score

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	SFS	SBS	SFFS	SFBS	Boruta	Selected≥3	Exhaustive search
Area	0	1	0	1	0	0	1

CiviCengagement	1	1	1	1	0	1	1
Confidencegov	0	1	0	1	0	0	0
Croplandpercent	0	1	1	1	0	1	0
Deathmellitus	0	0	1	0	0	0	0
Demography	0	1	1	1	0	1	1
Earlyleavers	1	1	1	0	0	1	0
Employmfood	0	1	0	1	0	0	1
Energyintensity	1	1	0	0	0	0	0
EQI	1	0	0	0	0	0	1
export	1	0	1	1	0	1	1
Foodwasteca	1	1	0	0	0	0	0
GINI	0	0	0	1	0	0	1
hospsbeds	0	0	0	0	0	0	0
income	0	1	0	1	0	0	1
Klsectoremploy	0	0	0	1	0	0	1
PAYT	1	0	1	1	0	1	0
Pollution	0	0	1	1	0	0	0
Popudensity	1	0	0	0	0	0	1
qualhealthcare	0	1	1	0	0	0	0
R.Dexpend	0	1	0	1	0	0	0
RHDI	0	1	0	0	0	0	1
SDGscore	1	1	1	1	0	1	1
terteduc	1	1	0	0	1	1	1
Turnoverindustry	0	0	0	0	1	0	1
welfsyst	0	1	1	1	0	1	1
R ²	0.933	0.999	0.869	0.9644	0.497	0.801	0.999
Adjusted R ²	0.859	0.999	0.5846	0.662	0.438	0.528	0.993
(p-value test)	(0.000)	(0.024)	(0.089)	(0.265)	(0.003)	(0.067)	(0.006)
AIC	-23.8	-150.21	-4.25	-22.344	0.644	0.08	-101.0
AICc	20.768	-990.21	115.75	101.35	3.31	60.746	Inf.
RMSE	0.073	0.002	0.1028	0.0717	0.2013	0.126	0.0075

Table 23: Feature selection and model creation for Food Governance

For Food Governance, we can easily opt for model 2 based on the supremacy of all its evaluation metrics compared to other models (cfr. table 23). Boruta analysis and exhaustive search can be found in the appendix 5.3, figure 35 and table 32. This time we obtain our model thanks to the variables selected by the SBS method. Its RMSE, Akaike criterion and corrected Akaike criterion are by far the lowest, while having R-squared and adjusted R-squared very close to 1. We therefore obtain the following model;

$$\begin{aligned}
 \text{Foodgov} \sim & \text{Area} + \text{CiviCengagement} + \text{Confidencegov} + \text{Croplandpercent} \\
 & + \text{Demography} + \text{earlyleavers} + \text{employmfood} + \text{Energyintensity} \\
 & + \text{foodwasteca} + \text{Income} + \text{qualhealthcare} + \text{R.Dexpend} + \text{RHDI} \\
 & + \text{SDGscore} + \text{terteduc} + \text{welfsyst}
 \end{aligned}$$

With a p-value of 0.3371 and a BP value of 19.923 we reject the heteroskedasticity of the model. Besides, Breusch-Godfrey confirms independence of the error term with a p-value of around zero and an LM test of 20. Among these variables, not all appear as significant. The area of a city, the proportion of people having received tertiary education and having a Social Democratic or Southern welfare regime are negatively correlated with Food Governance practices and significant at a 0.05 level. Surprisingly, our output shows that confidence in the local government is negatively correlated with the implementation of Food Governance. Still at a 0.05 level, the percentage of cropland within a city, its expenditure in research and development and its demography are directly correlated with the Food Governance score and evolve in the same direction. Remaining variables have lower significance level than 0.05.

3.5.4 Model fitting Sustainable Diets and Nutrition score

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	SFS	SBS	SFFS	SFBS	Boruta	Selected≥ 3	Exhaustive search
Area	0	1	1	1	0	1	0
CiviCengagement	0	1	0	1	0	0	1
Confidencegov	0	1	0	1	0	1	1
Croplandpercent	1	1	1	1	0	1	0
Deathmellitus	1	0	1	0	1	1	1
Demography	1	1	1	1	0	1	1
Earlyleavers	1	1	1	0	0	1	0
Employmentfood	0	1	0	1	0	0	1
Energyintensity	1	1	0	0	0	0	0
EQI	1	0	1	0	0	0	0
export	0	0	0	1	0	0	0
Foodwasteca	1	1	1	0	0	1	0
GINI	1	0	1	1	1	1	1
hosptbeds	0	0	0	0	0	0	0
income	0	1	0	1	0	0	0
KIsectoremploy	1	0	1	1	0	1	1
PAYT	1	0	1	1	0	1	0
Pollution	1	0	1	1	0	1	0
Popudensity	1	0	1	0	0	0	1
qualhealthcare	0	1	1	0	0	0	1
R.Dexpend	1	1	1	1	0	1	1
RHDI	0	1	0	0	0	0	1
SDGscore	0	1	0	1	0	0	1
terteduc	1	1	1	0	0	1	1
Turnoverindustry	1	0	0	0	0	0	1
welfsyst	1	1	1	1	0	1	1
R ²	1	0.9938	0.999	0.9359	0.2923	0.971	0.999
Adjusted R ²	0.999	0.8824	0.998	0.3914	0.209	0.818	0.987

<i>(p-value test)</i>	<i>(0.01)</i>	<i>(0.258)</i>	<i>(0.037)</i>	<i>(0.43)</i>	<i>(0.053)</i>	<i>(0.077)</i>	<i>(0.011)</i>
AIC	-253.87	-121.88	-200.12	-77.14	-59.09	-95.13	-154.58
AICc	-1093.87	-961.88	-1059.127	64.47	-56.43	588.86	Inf.
RMSE	0.000	0.004	0.0004	0.029	0.045	0.009	0.002

Table 24: Feature selection and model creation for Sustainable Diets and Nutrition

For Sustainable Diets and Nutrition, the model we created with the SFS selected variables leads us to the model we keep (cfr. table 24). With an Akaike criterion of -253,87, an adjusted AIC of -1093,87 and both R-squared metrics close to one, this model outweighs by far the others we tested. The Boruta and extensive search analysis can be found in appendix 5.4, figure 36 and table 34.

$$\begin{aligned}
 \text{Sustainable Diets and Nutrition} \sim & \text{Croplandpercent} + \text{Demography} + \text{Deathmellitus} \\
 & + \text{earlyleavers} + \text{Energyintensity} + \text{EQI} + \text{foodwasteca} + \text{GINI} \\
 & + \text{KIssectorempl} + \text{PAYT} + \text{Pollution} + \text{popudensity} + \text{R.Dexpend} \\
 & + \text{terteduc} + \text{turnoverindustry} + \text{welfsys}
 \end{aligned}$$

When evaluating the normality of the model kept, we obtain a Breusch-Pagan test statistic of 19.94 and a p-value of 0.2773, leading us to reject the heteroskedasticity of the predictive model. Besides this, the Breusch-Godfrey statistic is 18.775 and the p-value 0.000015, showing independence of the error term.

The model leads to some very significant variables. At a 0.001 level, employment in the knowledge-intensive sector in a city is negatively correlated with the implementation of Sustainable Diets and Nutrition practices. Besides, with a 0.01 level of significance, the demography of a town, the food waste per capita per year, the implementation of a Southern or Eastern welfare regime in a city are negatively linked to the presence of Sustainable Diets and Nutrition practices. On the contrary, it is interesting to see that the proportion of inhabitants that died from diabetes mellitus is directly linked to the score in Sustainable Diets and Nutrition. Still at a 0.01 level, expenditure in research and development, the implementation of a Social Democratic welfare regime cluster and the proportion of population with tertiary education. Turnover in the food sector is the only variable in the model that is not significant, but its deletion would lead to important trade-offs in our evaluation metrics.

3.5.5 Model fitting Food Supply and Distribution score

Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
SFS	SBS	SFFS	SFBS	Boruta	Selected≥3	Exhaustive search

Area	0	1	0	1	0	0	0
CiviCengagement	0	1	0	1	0	0	1
Confidencegov	1	1	0	1	1	1	1
Croplandpercent	0	1	1	1	0	1	0
Deathmellitus	0	0	1	0	0	0	0
Demography	0	1	1	1	0	1	1
Earlyleavers	0	1	1	0	0	0	0
Employmentfood	1	1	0	1	0	1	1
Energyintensity	1	1	1	0	0	1	0
EQI	1	0	1	0	1	1	1
export	1	0	1	1	0	1	1
Foodwasteca	0	1	1	0	0	0	0
GINI	0	0	0	1	0	0	1
hospsbeds	1	0	0	0	0	0	0
income	0	1	1	1	0	1	1
KLsectoremploy	1	0	1	1	0	1	1
PAYT	1	0	1	1	0	1	0
Pollution	1	0	1	1	0	1	0
Popudensity	1	0	0	0	0	0	1
qualhealthcare	0	1	1	0	1	1	0
R.Dexpend	1	1	0	1	0	1	1
RHDI	1	1	0	0	0	0	1
SDGscore	1	1	0	1	0	1	1
terteduc	1	1	1	0	0	1	1
Turnoverindustry	1	0	1	0	0	0	1
welfsyst	1	1	1	1	1	1	1
R ²	1	0.997	0.978	0.978	0.472	0.883	1
Adjusted R ²	0.999	0.9497	0.580	0.787	0.283	-0.112	1
(p-value test)	(0.022)	(0.171)	(0.469)	(0.175)	(0.081)	(0.6528)	(0.004)
AIC	-198.28	-115.40	-72.92	-74.69	-35.46	-41.61	-268.28
AICc	-1038.29	-	-912.92	76.713	-26.127	INF	-1108.28
		955.4006					
RMSE	0.001	0.005	0.0144	0.0387	0.07	0.033	0.00011

Table 25: Feature selection and model creation for Food Supply and Distribution

Concerning Food Supply and Distribution, our analysis has lead us to opt for the last model, with the variables found through exhaustive search (cfr. table 25). The R-squared and adjusted R-squared of 1, the very low AIC and AICc, respectively from -268.28 and -1108.28 and the very low value for RMSE of 0.00011 are the best values possible across all models tested. The Breusch-Pagan test gives a value of 18.403 for BP and a p-value of 0.43, confirming the rejection of the heteroskedasticity of the model. Additionally to that, the Breusch-Godfrey statistic equals 20 with a p-value close to zero, leading to confirm the independence of the error term. The Boruta analysis and exhaustive search analysis can be found in appendix 5.5, table 36 and figure 37. Our predictive model is as follows;

$$\begin{aligned}
 \text{Food Supply and Distribution} &\sim \text{CiviCengagement} + \text{Confidencegov} + \text{Demography} \\
 &+ \text{employmfood} + \text{EQI} + \text{export} + \text{GINI} + \text{income} + \text{Klsectoremploy} \\
 &+ \text{popudensity} + \text{R.Dexpend} + \text{RHDl} + \text{SDGscore} + \text{terteduc} \\
 &+ \text{turnoverindustry} + \text{welfsyst}
 \end{aligned}$$

Some variables are negatively correlated, such as Confidencegov, EQI, demography, GINI, popudensity and turnoverindustry. The least significant variable is popudensity, which has a p-value at a level of 0.1. All other variables are very significant at a 0.01 p-value level.

3.5.6 Model fitting Food Production score

	Model 1 SFS	Model 2 SBS	Model 3 SFFS	Model 4 SFBS	Model 5 Boruta	Model 6 Selected ≥ 3	Model 7 Exhaustive search
Area	1	0	0	1	0	0	1
CiviCengagement	1	1	0	1	0	1	1
Confidencegov	0	0	0	1	1	1	0
Croplandpercent	1	1	1	1	0	1	1
Deathmellitus	1	1	1	0	0	0	1
Demography	0	0	1	1	0	1	1
Earlyleavers	1	1	1	0	1	1	0
Employmfood	0	1	1	1	0	0	0
Energyintensity	1	1	0	0	0	1	0
EQI	1	1	0	0	1	1	0
export	1	1	1	1	0	0	0
Foodwasteca	1	1	0	0	0	0	0
GINI	0	1	0	1	0	0	0
hospbeds	1	1	0	0	0	0	0
income	0	0	0	1	0	1	0
Klsectoremploy	1	1	0	1	0	1	1
PAYT	0	1	1	1	0	1	0
Pollution	1	1	0	1	0	0	0
Popudensity	0	0	0	0	0	0	1
qualhealthcare	1	0	0	0	1	0	1
R.Dexpend	0	0	1	1	0	0	1
RHDl	0	0	0	0	0	0	1
SDGscore	1	0	1	1	1	1	1
terteduc	0	0	0	0	0	0	1
Turnoverindustry	1	1	1	0	0	1	1
welfsyst	1	0	1	1	0	1	1
R ²	0.998	0.996	0.912	0.980	0.660	0.940	0.995
Adjusted R ²	0.968	0.981	0.722	0.806	0.538	0.713	0.969
(p-value test)	(0.137)	(0.001)	(0.032)	(0.161)	(0.006)	(0.090)	(0.006)
AIC	-	-	-	-83.42	-51.18	-65.74	-114.1
	131.26	120.17	62.297				

AICc	-	0.005	57.703	68.69	-	240.26	569.8986
	971.26				41.845		
RMSE	0.003	0.005	0.024	0.0317	0.047	0.02	0.0057

Table 26: Feature selection and model creation for Food Production

The predictive model chosen to predict the score of Food Production of a city is as follows:

$$\begin{aligned}
 \text{Food.Production} \sim & \text{Area} + \text{CiviCengagement} + \text{Croplandpercent} + \text{Deathmellitus} \\
 & + \text{Earlyleavers} + \text{Energyintensity} + \text{EQI} + \text{export} + \text{foodwasteca} \\
 & + \text{hospbeds} + \text{KIsectorempl} + \text{Pollution} + \text{qualhealthcare} + \text{SDGscore} \\
 & + \text{turnoverindustry} + \text{welfsyst}
 \end{aligned}$$

The model has a very good R^2 of 0.998 and adjusted R^2 of 0.968, as can be seen in table 26. Besides, it has the lowest AIC, -131.26 and AICc, -971.26 of all models, as well as the closest RMSE to zero, with a value of 0.003. Testing the normality of our chosen model, we obtain a BP statistic of 18.677 and a p-value of 0.412, leading to reject the heteroskedasticity of the model. Besides, the Breusch-Godfrey test gives us an LM statistic value of 20, with a p-value very close to zero, which confirms the independence of the error term. Some variables appear to be negatively correlated such as area, cropland percentage, civic engagement, deathmellitus, energyintensity, export and SDGscore. Turnover of the food industry is the only variable significant at 0.1 p-value level, all other variables being above that threshold. The Boruta and exhaustive search analysis can be found in appendix 5.6, figure 38 and table 38.

3.6 SDGs significance for food smart categories

As mentioned in section 2.5.1, the MUFPP links each pillar and its indicators to the achievement of a set of SDGs. An analysis of the summary function on SDGs can be found in appendix 6, table 40. We have therefore analyzed the relationship between SDG achievements and food pillar scores. SDG analysis tables for all pillars can be found in appendix 5. Out of our analysis, no SDGs appear as significant for their related food smart category, except for Social and Economic Equity (cfr. appendix 5.2, table 31). From table 31 in appendix 5.2, we obtain that model 5 composed of the combination of SDG 1 and SDG 12 optimizes both AIC criterion and adjusted R-squared and we therefore choose this model. Both SDG 1 No Poverty and SDG 12 Responsible Consumption and Production are significant at a 0.05 level for Social and Economic Equity.

4 Discussion

4.1 Food smartness

Previously hypothesis made stated that the score of food smartness of a city depends on its demography, GINI, deaths due to mellitus, energy intensity, total SDG score, civic engagement percentage, the population density, the employment in the food sector, the percentage of cropland and the area of the city. The results obtained confirm the influence of the above mentioned variables on the food smartness score of a city, except for GINI, death mellitus and the strength of engagement of the civil society. Literature stated that obesity rates, population structure and poverty rates shape the willingness to design food smart practices (De Cunto et al., 2017). From our results including obesity and poverty rates through related indicators, we reject these assumptions by concluding to the non-significance of these parameters for defining food smartness.

As stated previously, Maye (2019) indicated ecological pressures as being push factors for the implementation of urban food systems. In accordance with this, the influence of environmental parameters seems to stand out in our quantitative model. Indeed, a high percentage of cropland area, a high level of pollution, a low amount of food waste per capita and a low energy intensity of a city appear beneficial to the food smartness score of this city. The city of Barcelona, which scores first in our food smartness ranking, is a good example to illustrate this. Indeed, the city has a level of pollution above the sample average, one of the lowest food waste per capita, a below average energy intensity and an average cropland area percentage. Besides this, all socio-demographic parameters seem very related to food smartness, negatively for the area of a city, positively for the demography and population density. Again, Barcelona is the perfect example to illustrate this. Indeed, the city has a very high number of inhabitants, with an area far below the average area size of our sample and a very high population density. However, the only presence of those three parameters is not sufficient to state the food smartness of a city, as our second and third ranked cities do not have similar configurations, having rather smaller population sizes, larger areas and smaller population densities. Additionally, the lack of more economic variables comes as a surprise. Indeed, the export, income or turnover of the food industry do not appear to have influence on the food smartness of a city and the employment in the food sector has a very weak significance to predict food smartness. Only the expenditure in research and development plays a significant role. Munich for example is a city that scores above average in all economic variables such as income, export, turnover of the food industry,

employment in the food industry and expenditure in research and development but is ranked 13th out of 20th in the food smartness ranking. Being a strong economic actor therefore does not necessarily lead to being food smart. Educational variables are also part of the predictive model, as the percentage of tertiary education followers and the percentage of early school leavers influence the score of food smartness. Eventually, the quality of healthcare services and the type of welfare system seem very significant to predict food smartness. An Eastern or Social Democratic welfare system is positively correlated with food smartness, while a Southern welfare system is negatively correlated. Our top three ranking of food smartness has all three welfare systems, as Barcelona has a Southern welfare system, Ljubljana an Eastern welfare system and Stockholm a Social Democratic welfare system. This once more confirms the non-possibility of predicting with only the type of welfare system which city will be food smart and confirms the complexity of our model, that has to be taken as a whole.

As a conclusion, and at the risk of appearing simplistic, we would draw the typical food smart city as a city of a relatively small area size with a high population density, important ecological pressures, an Eastern or Social-Democratic welfare system and a strong educational system.

4.2 Food Waste score

We assumed the score of Food Waste of a city to be influenced by the percentage of civic engagement of the city population, the employment in the food sector, the turnover of the food industry, the level of pollution in the city and the percentage of inhabitants following tertiary education. At the light of the model composed, we confirm the significance of all those variables, except employment in the food sector.

What stands out in the model proposed, is the presence of all political and organizational parameters. The strength of the engagement of the civil society and the EQI index are negatively and very strongly correlated with Food Waste while confidence in the local government is positively correlated. This is quite surprising as literature review and interviews conducted had lead us to believe that this category remained importantly related to the contribution of inhabitants themselves. Moreover, all health variables are present in the predictive model. The higher the percentage of deaths due to mellitus, the lower the quality of the healthcare services and a Conservative welfare system enhances chances of having a good score in Food Waste. At the contrary, an Eastern or Southern welfare system influences negatively the score on Food

Waste. However, our top three cities in Food Waste contains both an Eastern and Southern welfare system. Besides, all educational parameters are present in the model, which does not come as a surprise considering the importance of education we mentioned in the theory in the fight against food waste. Quite logically, the variable early school leavers is negatively correlated with Food Waste, while tertiary education and the employment in the knowledge intensive sector are positively related to Food Waste. Bruges, third city in our Food Waste ranking, excels in those three parameters, being comparatively better than most other cities. Surprisingly, no socio-economic inequities appear, leading us to the conclusion that the socio-economic inequity context does not influence the Food Waste score of a city. Regarding environmental parameters, the pay-as-you-throw factor, the percentage of cropland area and the level of pollution affect the food waste score of a city, all three positively linked to Food Waste. As an example, our top three cities all are very good in at least two of those three variables. Indeed, Barcelona has a high pollution level and comparatively a high cropland percentage. However, it does not have a pay-as-you-throw system as in Bruges, the third city in our Food Waste ranking. Additionally to this, Bruges has a very high cropland area percentage, influencing its Food Waste score positively. Following the positive link between PAYT and Food Waste practice score, the two last cities of our ranking, Prague and Bratislava, do not have any PAYT system. The amount of food waste per capita is surprisingly missing in our predictive model, the variable being not significant to predict the Food Waste score. Different reason might be evoked for this, such as being a consequent effect rather than a cause. Besides, we could assume that indifferently from their food waste per capita, cities make effort to improve their Food Waste score. Once more, very few economic variables seem to predict the Food Waste score of a city, except the turnover of the food industry. As a result, Munich scoring very good in economic parameters appears as 14th out of 16 in the Food Waste ranking.

4.3 Social and Economic Equity score

The hypothesis made for the variables influencing the socio-economic food score of a city was the influence of the GINI coefficient, the employment in the food sector, the RHDI coefficient, the percentage of inhabitants following tertiary education, the income, the type of welfare system, the turnover of the food industry and the SDG score of the city. All of these hypothesis were true except the last two parameters, namely SDGscore and turnover of the food industry. Overall, our framework showed the strong position of Eastern and Northern cities in this category, dominating the eight first positions of the ranking.

It turned out that civic engagement was the most significant variable for Social and Economic Equity, negatively correlated with it. We can indeed observe that Ghent and Bruges scoring the poorest in this dimension score the best in civic engagement, while the opposite is also true; Ljubljana scoring the poorest in civic engagement obtains top position in our Social and Economic pillar ranking, followed by other cities scoring poor in civic engagement. We might interpret this in the sense that social and economic practices tend to be implemented by local governments to balance low inhabitants initiative-taking in a city. We also observed that Eastern and Southern welfare regimes were negatively correlated with this pillar, which is surprising seeing the results. Employment in the food sector has a direct relationship with Social and Economic Equity, which is interesting as we stated in the theoretical part that this dimension had as example social cohesion through the encouragement of employment in the food industry (Kenis et al., 2014). Besides, we observe that several economic parameters influence this pillar; GINI being positively correlated with it, while income negatively. Overall, Eastern and Southern cities in our sample have the highest GINIs, while scoring low regarding disposable income per capita. We can therefore assume an inverse relationship between these economic indicators scores and the implementation of Social and Economic Equity practices in a city. Besides, all our Eastern cities except Prague score the lowest on the Regional Human Development index, which perfectly illustrates the inverse relationship with Social and Economic Equity score. To explain this surprising trend, Maye (2019) and Rikolto (2019) stated that a city implements food smart practices according to its current challenges, which might explain the necessity for some cities to take the lead in Social and Economic Equity practices more than others. Again, we can legitimately assume that strong economic actors therefore do not necessarily lead to being the food smartest.

SDGs 1 and 12 have a direct relationship with the implementation of this food smart category. While SDG 1 has an inverse relationship with Social and Economic Equity, SDG 12 appears as having a positive link with it. Ljubljana indeed has a low score on No Poverty but scores average on Responsible Consumption and Production. Turin is a better illustration of this output, scoring low on Responsible Consumption and Production and high on No Poverty, while ending up in the bottom position of the ranking.

4.4 Food Governance score

From our framework, we saw a significant dispersion of results across cities, Southern cities having top positions in the ranking. We assumed Food Governance to be influenced by the civic

engagement, R&D expenditure, confidence in the local government, the percentage of deaths due to mellitus, the type of welfare system, the turnover of the food industry and the demography of a city. All of these parameters effectively influence Food Governance score, except turnover in the food industry and deaths due to diabetes mellitus. As expected, political and organizational variables do influence the implementation of Food Governance in a city. Surprisingly, confidence in the local government is negatively related to Food Governance, while civic engagement is positively linked to it. We conclude Food Governance to be negatively correlated with a Southern welfare regime. However, all three first cities in the ranking have Southern welfare regime clusters and none of them appear at the very bottom of the ranking except Athens, explaining the necessity of the aggregation of all our parameters to have a full overview. Area has an inverse relationship with Food Governance. This trend is confirmed by several cities; Bruges and Ghent being small cities appear at the third position of the ranking, while Prague, that ends the ranking, is one of our biggest cities in area. However, demography size has a direct relationship to Food Governance that is not always reflected in our cities from the ranking. Prague for example has an important demography and scores last, while Barcelona that has the most inhabitants scores at the third position. The implementation of this food smart pillar is also highly influenced by educational considerations, as the significance of the proportion of inhabitants having had tertiary education and the percentage of early leavers from education influence global Food Governance score. Lastly, Food Governance tends to be implemented in cities where R&D expenditure is important, which is in line with remarks made by Borrelli, Deakin and Diamantini (2018) on the influence of future technologies on new forms of participative food governance. The link between SDG 16 Peace, Justice and Strong Institutions and Food Governance might have been expected as Athens scoring the lowest on this SDG is the last in Food Governance ranking, but this did not appear true from our statistical analysis.

4.5 Sustainable Diets and Nutrition score

The above mentioned hypothesis made on which variables influence Sustainable Diets and Nutrition designated the percentage of deaths due to mellitus, the nature of the welfare system, the quality of the healthcare services, the SDG score, the percentage of tertiary education, the food waste per capita and the cropland percentage of a city. Based on the model created, we can confirm most of those variables as being of influence, except the SDG score and quality of the healthcare services.

More than was expected, environmental variables all appear significant to explain the Sustainable Diets and Nutrition score of a city. All are positively correlated with this food smart category, except the kilograms of food waste per capita, negatively correlated. Besides that, educational parameters all appear as significant too, especially the employment in the knowledge intensive sector, very strongly negatively correlated with the Sustainable Diets score. No logical reason could be found for this quite surprising link. As an example, our three first cities ranked on sustainable diets have comparatively small values of employment in the knowledge intensive sector. Once more, economic variables appear to have few connection to Sustainable Diets and Nutrition, except for the expenditure in research and development. As opposed to death due to diabetes mellitus that is significant, neither the proportion of hospital beds nor the quality of healthcare services appear as significant to explain the Sustainable Diets score of a city. It also comes as a surprise that a Southern or Eastern welfare system negatively influences the sustainable diets score considering city outcomes. On socio-demographic parameters, a small population size and a high population density explain the Sustainable Diets score. Bilbao, the first ranked city on sustainable diets, is a good example, having a small population compared to other cities and a relatively high population density.

4.6 Food Supply and Distribution

The variables we assumed to influence the Food Supply and Distribution score of a city were research and development expenditure, the area, the level of pollution, the food waste per capita, the percentage of cropland, the income, export and the turnover of the food industry. Surprisingly, of those variables, only income, export, research and development expenditure and turnover of the food industry influence the Food Supply and Distribution score.

All political and organizational as well as all economic variables seem to influence the Food Supply and Distribution score of a city. As Supply and Distribution aims at ensuring the availability of food, the FAO (2019) mentioned net trade and income as important parameters in Food Supply and Distribution. In line with this, export, turnover of the industry and income are indeed significant. However, Munich is the perfect example of a city scoring above average in economic parameters, but that only lies at the 10th position out of 12 in the Food Supply and Distribution ranking. This shows that economic performance in itself does not explain the Food Supply and Distribution score of a city. Confidence in the government, turnover of the food industry and EQI are strongly and negatively correlated with Food Supply and Distribution. The size of the population negatively affects the Food Supply and Distribution of a city. This

helps Bratislava, second ranked city in this category, forward in the ranking. An unexpected outcome is the absence of environmental parameters influencing the Food Supply and Distribution of a city. Other unanticipated results are the negative link between SDG score and the GINI score of a city and this city's Supply and Distribution score. This second output reflects the fact that the wider the gap between poor and rich in a city, the less the city will be inclined to implement short supply chains and incite for locally produced food chains. Lastly, the negative link with SDG score is difficult to interpret as it encompasses very diverse measures and considerations, however our analysis between food supply and SDGs 2,11,12 and 13 did not lead to significant results.

4.7 Food Production

The previously stated hypothesis mentioned that the variables research and development expenditure, income, the employment in the food industry, the level of pollution, the food waste per capita, the percentage of cropland the area of a city, the civic engagement and the turnover of the food industry. As outlined by our quantitative analysis, all appear as significant except the three first parameters. Several environmental parameters influence Food Production, namely the percentage of cropland in the area, the food wasted per capita, the pollution index of the city and the energy intensity. It is surprising to see that there exists a negative correlation between the percentage of cropland in a city and its Food Production score. However, while Marseille, which has a limited proportion of cropland percentage, ends up first, Vienna, which has the highest percentage of cropland ends up third in the ranking, which shows that this parameter is not significant taken alone. Energy intensity also has a negative link to Food Production. Aside from environmental parameters, health parameters have an important link with Food Production score; namely quality of healthcare, death due to diabetes mellitus having a negative link with it and the hospital bed rate in the city. Besides, political and organizational variables such as European Quality of Government Index and civic engagement are linked to Food Production, the first positively, the second negatively. The negative link between civic engagement and Food Production is quite surprising as our literature review part outlined the importance of community involvement for urban Food Production (Morgan, 2015). The turnover in the food industry appears as the only significant variable at 0.1 level, all others being above. Marseille has an excellent turnover in the food industry. Food Production is negatively linked to the SDG score, which we might have expected the opposite as Marseille, Barcelona and Stockholm either score high in Food Production and SDG score, relatively to other cities.

4.8 General observations

A first interesting observation is the presence of three different variables that recurrently appear of strong influence in our seven predictive models. The variable welfare system has come up in all our models, both influencing the general food smartness score of a city and its six underlying categories. The variable percentage of cropland area can be found in all models, except in the model predicting Food Supply and Distribution. Eventually, the variable tertiary education is present in all models except the Food Production model. This outcome underlines the importance of the welfare system, the percentage of cropland area and the percentage of the population of a city following tertiary education in the implementation of food smart practices and its underlying categories.

Further, while we came to the conclusion in the literature review part of this thesis that Food Waste and Food Governance were the most addressed categories, the contact persons we spoke to helped us to refine this analysis. Through our contacts with different city representatives and experts, we could confirm that most cities prioritize food waste initiatives. Six cities out of fifteen put it as their first priority and four other cities put it as second or third priority. The second most prioritized category appears to be Food Production, appearing in the top three priority of eight cities out of fifteen. Eventually, Food Supply and Distribution and Sustainable Diets and Nutrition appear both as third priority, cited both seven times out of fifteen in the top three of cities. With regards to those observations, we refute the recurrence of Food Governance assumed in our literature review, the category being only cited four times out of fifteen as prioritized and confirm the recurrence of Food Waste initiatives. Besides, several of our cities authorities did not implement anything at all regarding Food Governance. Regarding the top four categories most addressed mentioned by Candel et al. (2017), we confirm here the prioritization of Food Waste, Sustainable Diets and Nutrition and Food Production, but refute the prioritization of Social and Economic Equity initiatives. Indeed, this category appears of penultimate importance in the prioritization of cities. Inversely, the category Food Supply and Distribution that was cited as ‘insufficiently addressed by cities’ by Candel et al. (2017) appears as a top priority for many cities.

Moreover, the literature review undertaken emphasized the importance of some specific SDGs on the measurement of food categories. However, the statistical analysis lead in this study refutes the significance of those specific SDGs on the food categories scores. Only exceptions

are some specific SDGs that effectively influence Social and Economic Equity. Yet, we cannot reject the possibility that the integration of those SDGs to other explicative variables could effectively together have an influence on food categories. Besides, our variable SDG score that aggregates all 17 variables was significant in several models.

Eventually, our analysis concluded that European small area-sized cities with high population densities and important population sizes tend to outperform bigger ones on food smartness. Seeing our analysis of Asian megacities and food smartness, we can legitimately think that our outcomes cannot be extrapolated to Asian megacities as the ones we analyzed. With its important investment in agricultural innovation, the implementation of its food security strategy and investment in the sensitizing of its inhabitants regarding healthy diets, Singapore is an example of a city of almost six million inhabitants, a medium population density and an area exceeding by far the ones of the European cities we focus on, while probably outweighing our analyzed cities on food smartness.

5 Conclusion

Our society is currently faced with important challenges of scarcity of resources, climate change, the disappearance of European farms and the reliance on international food import, worsening food access, changing consumption patterns and important obesity rates. Parallely, questions raise on who should take the lead in bringing change in our food systems. Without putting in place a clear food governance system at local level and going on overlooking local actors, change might not happen at all. The six pillars of the Milan Urban Food Policy Pact; Food Waste, Food Supply and Distribution, Sustainable Diets and Nutrition, Social and Economic Equity, Food Production and Food Governance open the path to address each of those challenges we are faced with to ensure resilient, sustainable and secure urban food systems through the development of food smart cities.

However, literature on the specific topic of food smart cities is at this time still very scarce. Our report aims at shedding light on this still very new concept and tries to understand what lies behind the implementation of a food smart city. Besides, research is still very theoretical on food smart cities and does not refer to parameters that might lead cities to implement food smart practices. Knowing what push factors drive cities to implement food smart practices is particularly important to understand the reason, necessity and consequences of the implementation of food smart initiatives. Further, the framework we built contributes to bringing a new insight on this topic by trying to practically quantify the food smartness of cities. Indeed, the food smart framework developed by the MUFPP is not being used in its entirety at present time, while the importance of measurement in the implementation of food smart cities is crucial to monitor change, share best practices and identify key areas to invest time and resources.

Out of our analysis, the food smartness of a city appears to be influenced by a wide range of variables measuring very diverse dimensions such as environmental, health, economic, socio-economic equity, socio-demography and educational context of a city. Regarding socio-demographic variables, area, demography and population density seem to influence the food smartness of a city. However, from economic variables, only research and development expenditure and employment in the food industry seem significant. Concerning environmental parameters, the percentage of cropland area of the city, the pollution level, the amount of food waste per capita and the energy intensity are significant variables. A political and organizational significant variable retained is the confidence given to the government. Regarding educational

parameters, the percentage of the population following tertiary education and the percentage of early school leavers are significant. On health variables, the quality of the healthcare and the type of welfare system influence the food smartness of a city considerably. On socio-economic inequities, the variable RHDI seems significant, together with the total SDG score of a city. The food smartness of a city therefore mainly depends on environmental, socio-demographic, educational and health variables, while very few variables come from the political and organizational, economic and socio-economic inequities dimensions.

Concerning food smart pillars, different dimensions seem significant for each category of food practices. Concerning Food Waste, the majority of significant variables come from political and organizational, health, educational and environmental dimensions. However, few variables represent socio-demographic, economic and socio-economic inequities. Regarding Social and Economic Equity and Food Governance, the selected variables for our predictive model come from all dimensions; health, education, economic, environmental, political and organizational, socio-economic inequity and socio-demographic. For Sustainable Diets and Nutrition, educational and environmental parameters are particularly significant, while economic variables do not seem related at all. Besides, socio-demographic parameters seem to influence Sustainable Diets and Nutrition. For the category Food Production, turnover in the food industry is the most significant variable. Except this, no economic or socio-economic variable influence this category. Health and environmental parameters are particularly linked to Food Production practices score. The same can be said for political and organizational variables. Regarding Food Supply and Distribution, variables mainly come from political and organizational, socio-demographic, economic, socio-economic inequities and educational dimensions, while very few variables come from environmental and health dimensions.

The scores put forward by our alternative framework can be used to assess current state of advancement of cities towards being Food Smart and particular food smart categories. That way, cities can position themselves in specific food smart categories and either further specialize themselves in the ones they are strong in, either develop in weaker categories. Besides, results obtained by our statistical analysis are a call to action for various cities to invest and start their journey towards being Food Smart, by deconstructing preconceived ideas such as economically better scoring cities or with bigger population sizes being in the best position to invest in Food Smart cities. Still, implementing food smart practices represents a significant investment that should be spent wisely. Knowing what factors drove cities to implement food smart cities is a way to analyze for peer cities what consequences their implementation had on

the city and analyze the efficiency of investments. Knowing which cities have similar category scores and similar demographic, economic, environmental, political or social parameters allows a city to compare itself and adopt efficient practices following a likewise city. As an illustration, the city of Rotterdam might look for cities having similar parameters and legitimately inspire itself from the practices of a likewise city by mimicking them if they appear as being successful. On many dimensions, Rotterdam has quite similar parameters as Utrecht, e.g. a similar pollution index combined with an absence of pay-as-you throw system, a conservative welfare regime and a similar high confidence in the government score and a high percentage of tertiary education. As Utrecht, the city might consider investing in food waste practices considering these parameters. In addition, our findings claimed that cropland area is positively correlated with food waste initiatives and Rotterdam appears as having almost three times more cropland area than Utrecht. Besides, the pollution index of Rotterdam is significantly higher than that of Utrecht, while we claimed the pollution index to be proportionate to the food waste score. As a conclusion, we might legitimately consider that investing further in food waste practices might be a great opportunity for the city of Rotterdam. Eventually, results can also enhance knowledge sharing and collaboration among cities and best-practice sharing to guide cities in their transformation towards sustainable urban food systems. The outcomes put forward in this research can serve as a basis for future discussions on the subject in order to boost initiatives, increase awareness as well as decision-making on sustainable urban food systems.

Clearly, the COVID-19 pandemic has proven the efficiency of smart cities and the flourishing of new forms of food systems of direct consumption and locally traded food. As such, the sanitary crisis might trigger more involvement of local authorities particularly in the Food Supply and Distribution, Food Governance and Food Production pillars, inciting for more locally produced food and resilient food systems. Indeed, COVID-19 shows the need and opens the path to securing our food supply through shorter supply chains. On such short notice, lots of interesting initiatives have come up as alternatives to our traditional food system to cope with the current sanitary crisis. However, new habits are not necessarily meant to stop with the crisis and might become the way forward for sustainable urban food systems. The need for further developing urban farming has been emphasized and gives a further opportunity for food smart cities to develop. Burning question is: What impact will this COVID-19 situation with its enforced emergency measures leave on the resilience and organization of our future urban food systems once the crisis over?

6 Limitations

Our report has some important limitations that must be highlighted.

Firstly, an initial choice of cities was done on personal and arbitrary criteria and had as aim to have a view on the diversity of European cities. The results we obtained were compared within those cities and rankings would obviously have changed if initial choices would have been different. Besides, it must be specified that this report has not as aim to categorize cities or to compare them in any way.

Secondly, different limitations are specific to the regression ; sampling error, measurement error and specification error (Van Belleghem, 2018). For the specification error, we already showed a bunch of variables that could not by themselves be representative of the explanatory variable. The measurement error is linked to imprecise data. Data used in this report mostly comes from official, local, national or European websites and whenever possible, extracted from this year or last year. However, data availability is often limited; the timeframe might have been a little extended and some information was taken from country or regional level rather than at city level. Moreover, we contacted local authorities and experts to broaden our data and knowledge about cities. In that light, some answers received were subjective which might have led to different personal interpretations of the same question. Further, due to delays concerning the emergency in current pandemic crisis in municipalities, we could not always reach one contact person per city, which obviously can impact the accuracy of the data. Eventually, a sampling error might have occurred by having taken a limited amount of observations. However, gathering the necessary data for filling the alternative framework we built up and assembling parameters for all our twenty cities was a heavy computation that we applied on twenty cities, which is a relatively small sample for statistical analysis and might lead to inaccurate results at some times. However, we were extremely careful regarding the assumption of normality and proceeded methodically to its verification.

Thirdly, a very important limitation of our framework concerns food smart outcomes interpretation. It must be specified that a high food smart score for a category does not necessarily reflect a positive situation. As already stated, a city implements food smart practices according to current challenges, which might explain the necessity for certain cities to take the lead in Social and Economic Equity practices more than others. Furthermore, by looking for significant variables that drive European cities in their path to food smartness, some variables

might be interpreted as a cause for food smartness while they might be a result. We can at this stage only separate causes and consequences by critical reasoning.

Lastly, as mentioned in our literature review part, the sanitary crisis has a direct effect on the future of food system and its limits. The timing of our master thesis did not allow us to take a bigger step back on the impact of the crisis on our food systems. However, it would have been interesting to observe direct effects of current sanitary crisis COVID-19 on our food systems and the way they will shape food smart cities in the future. This might be the subject of a further research aiming at identifying the effect of the pandemic on urban food systems.

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Contact Persons

Karine De Batselier (Klimaatcoördinator Stad Brugge)- 27/03/2020

Katrien Verbeke (Coordinator of local food policy at City of Ghent) - 15/04/2020

Anne-Marie Gout (Senior Beleidsadviseur Gezondheid / Thema Voedsel en voeding at Gemeente Utrecht)- 15/04/2020

Zala Strojín Božić (Circular economy manager Ljubljana) - 15/05/2020

Marko Urdzik (President of FoodBank Slovakia) - 19/05/2020

Panayota Nicolarea (Secretariat of the Milan Urban Food Policy Pact) - 22/04/2020

Chiara Pirovano (Sustainability Senior Advisor, Food Policy Office at Municipality of Milan) - 6/04/2020

Louison Lançon (Co-founder and Treasurer Association Let's Food Marseille)- 10/05/2020

Tadeja Kvas Mayer (Ministry of Agriculture, Forestry and Food Ljubljana)-18/05/2020

Laure Gaillard (Chief of sustainable food, agricultural economy and innovation Aix Marseille Provence)-22/03/2020

Adelheid Sagmeister (Coordinator for the Milan Urban Food Policy Pact- City of Vienna)- 28/05/2020

Francisco Sarmiento (FAO office in Lisbon)- 28/05/2020

Johan Rindevall (Business Area Manager Matcentralen Stockholm)- 28/05/2020

Maud LORANG (Assistante scientifique ville de Luxembourg)-28/05/2020

Claudia Vihma (Project Manager Estonian Food bank) - 28/05/2020

Nicole Isaac (Assistante déléguée à l'environnement Ville de Luxembourg)- 29/05/2020

Evelin Piirsalu (Senior Expert Environmental Management Programme at Stockholm Environment Institute)- 1/06/2020

Georg Sedlmeir (City Of Munich, Department Of Health And Environment)- 2/06/2020

Ignace Bosteels (Administrateur délégué Voedselbank West-Vlaanderen)- 2/06/2020

Denys Vyncke (voorzitter voedselbank Oost-Vlaanderen)- 2/06/2020

Ana Vara (Comissao de Voluntarios Banco Alimentar Lisboa)- 3/06/2020

Agita Kraukle (food bank manager Latvijas Samariešu apvienība)- 3/06/2020

Alena Hrdličková (Mayor's Office Prague, International Relations and Protocol Unit)- 5/06/2020

Rostislav Racek (Project Manager FoodBank Prague)- 5/06/2020

Judita Eisenberger (EU and International Affairs Specialist Prague Institute of Planning and Development)- 5/06/2020

Alen Novit (Director of SIBAHE, Slovenian Food Bank)- 5/06/2020

Monja Majerus (Directory Division de la Gestion de la comptabilité et de l'entraide agricole Luxembourg))-11/06/2020

Joanna Galek (Director food bank Warsaw)- 15/06/2020

Dimitris Konstantopoulos (International Cooperation & Public Relations Department, Mayor's office City of Athens)- 23/06/2020

Appendix

Appendix 1: Description of European Union's initiatives on food practices

Still at European level, FOODMETRES, the 'Food Planning and Innovation for Sustainable Metropolitan Regions' (2012-2015) project of the European Innovation and Research department, aimed at assessing environmental and socio-economic impacts of food system in metropolitan regions. It involved universities, food institutes, charities and think-tanks (De Cunto et al., 2017; Wascher, Kneafsey, Pintar, & Piorr, 2015), while targeting six main cities: Rotterdam, Berlin, London, Milan, Ljubljana, and Nairobi. Projects in those cities entailed peri-urban agriculture, food festivals or algae experimentation (Wascher, Kneafsey, Pintar, & Piorr, 2015).

Another European initiative raised in 1994, in the light of contestations between European and national authorities power of its member states, the European Commission launched the URBAN initiative, giving birth to the URBACT project parallelly. At the time, URBAN aimed at fostering socio-economic situations of less advanced European urban areas, through its URBAN I and URBAN II projects, spreading over the time horizon 1994 until 2006 (Dukes, 2008). The impact of this URBAN project is to have changed administrative and political planning at urban level (Dukes, 2008). URBACT I and II aimed at backing further those cities helped by URBAN I and II to find innovative solutions to urban development. The URBACT framework contains four pillars; environment, economy, inclusion and governance. The environment theme contains all aspects related to a food smart city; food, waste, circular economy, etc. (Radecki, Tommis, & Suska, 2017). In the same line, the Urban Innovative Actions (UIA) of the European Union supports sustainable urban development through integrated projects such as Openagri in Milan developing peri-urban agriculture (De Cunto et al., 2017).

The UTURN project of the European Horizon 2020 Agenda is an example of a project analyzing innovative food transportations methods involving nine European cities partners. Moreover, it involves universities, companies, technology-and consultancy partners and consultancies in a closer collaboration (De Cunto et al., 2017). The final result will deliver a 'smart' transport matching framework working on a collaborative platform.

Appendix 2: Overview of good practices from FSC4D partners

This section aims at analyzing good practices from the six European signatory cities of the Food Smart Cities for Development and their advancement towards becoming food smart.

A first analysis on the advancement of a country or city towards the SDGs can already provide signs on whether cities have started their journey towards becoming food smart, as the MUFPP links each food smart pillar to a set of related SDGs (cfr. section 2.5.1).

Spain

The global SDG Index score of Spain of the Institute European Environmental Policy (2019) is 66.8, which is slightly under the European Union average of 70.1. Our analysis will only draw attention on the advancement of Spain towards SDGs that are considered as being relevant to being food smart. Figure 21 gives a visual representation to back our analysis. In that light, the IEEP (2019) shows how the SDGs ‘Zero Hunger’ and ‘Life on Land’ remain major challenges for the country, the latest still currently experiencing a decreasing score trend. The low share of mean area protected in terrestrial sites and protected area in freshwater sites important to biodiversity explain this latest poor result, as well as the Red List Index of species survival. For the ‘Zero Hunger’ objective, the prevalence of obesity in Spain, combined with the poor Yield Gap Closure and Human Trophic Level lead to this result (IEEP, 2019). While the poor Human Trophic level analyzing the amount of specific food people eat shows how Spanish have been eating more fat and meat in the past years, the poor yield gap closure shows a lack in productivity between yield potential and effective average yield from crops. The SDGs ‘No Poverty’, ‘Quality Education’, ‘Sustainable Cities and Communities’, ‘Responsible Consumption and Production’ and ‘Climate Action’ still face significant challenges. While the SDG trends show how SDG 4 ‘Education’ is currently increasingly being addressed, ‘Climate Action’ has still a decreasing trend. Besides, the country is most advanced towards fulfilling SDG 3 ‘Good Health and Wellbeing’, SDG 6 ‘Clean Water and Sanitation’ and SDG 16 ‘Peace, Justice and Strong Initiatives’ (Institute European Environmental Policy, 2019).

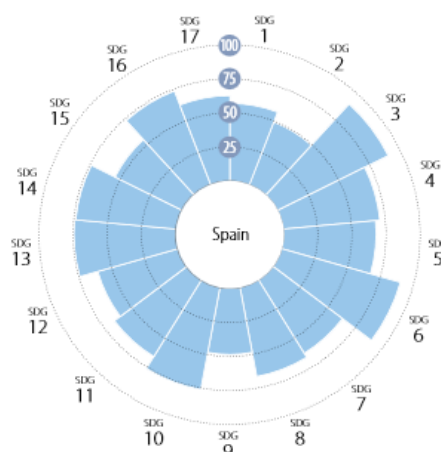


Figure 21: Spain performance by SDG (IEEP, 2019)

According to the Sustainability ranking of the Barilla Center for Food and Nutrition (BCFN) (2017), Spain scores in a third position on food waste and loss, behind France, on an analysis of 25 worldwide countries. In a broader analysis of 67 countries one year later, Spain obtains a ‘high’ score on the global Food Sustainability Index 2018 of the BCFN. Concretely, its ‘high’ result on nutritional challenges is counterbalanced by a ‘medium’ result on sustainable agriculture. The country obtains a ‘very high’ result on managing food waste and loss, obtaining the 12th position in a 67 country ranking of the 2018 Food Sustainability Index (BCFN, 2018). The cities of Barcelona and Bilbao have been selected for our analysis.

Barcelona (ES)

Firstly, we will analyze cities on their advancement towards the SDGs. The OECD enables to measure the distance of cities towards the achievement of the SDGs. We focus our analysis on the SDGs previously highlighted as significative for the food smartness of a town. Immediately, from the figure 22 can be seen that the city reached 2030 ambitions on SDG 2 Zero Hunger. Barcelona scores particularly bad on Clean Water and Sanitation despite the average score of its country. The same goes for Climate Action and Sustainable Cities and Communities, where Barcelona scores lower than Spain (OECD, 2020).

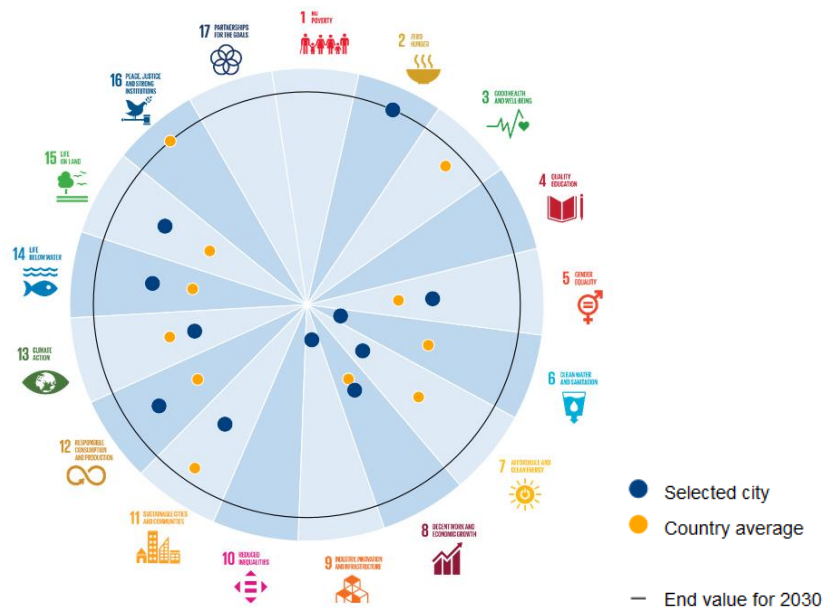


Figure 22: Measuring the distance to SDGs in Barcelona (OECD, 2020)

Secondly, Barcelona is actively involved in activities aimed at improving in the six MUFPP categories. The City Council of Barcelona is willing to focus on local and agro-ecological development and supports therefore local food initiatives (MUFPP, 2019). Barcelona has adopted a Good living Strategy involving Barcelona's City Council, GRAIN Foundation and Revista Soberanía Alimentaria. The document adopted was based on workshops and conferences regarding urban food systems and involved various stakeholders in collective discussion processes (MUFPP, 2019; De Cunto et al., 2017). Barcelona's strategy contains five goals; food sovereignty, sustainable consumption and food waste, agriculture and local production, with 35 sub-goals (Candel, 2019). The aim of the strategy is to build food sovereignty in Barcelona and consists of an outline for the food policy guidelines of Barcelona (De Cunto et al., 2017). Therefore, food sovereignty gives the food strategy in the town an overarching theme (Candel, 2019). The person in charge of food policies in the city is a commissioner of cooperative economy, social solidarity and consumption (De Cunto et al., 2017). The city also cooperates with the Spanish Network of Healthy Cities and the Ministry of Health to keep track of health issues in the town (De Cunto et al., 2017).

On Food Waste, the city of Barcelona collaborates with the Catalan region and the national level with the 2020 REFRESH platform, assembling stakeholders from the entire food supply chain in an exchange of solutions to avoid food waste (De Cunto et al., 2017). Further, the city of Barcelona and its City Council have organized various projects centered on food waste reduction. This has happened through waste prevention plans and sensibilization campaigns in

local markets. The city is strongly committed towards raising awareness through communication plans. A number of initiatives addressing food waste have been created through an integrated approach by the Barcelona Municipal Market Institute, under which campaigns on sustainable eating, schools and businesses (Magarini, De Cunto, & Porreca, 2018).

Investment in infrastructure such as urban food markets has become an important trend in Barcelona (De Cunto et al., 2017). Indeed, Barcelona has its own ‘institute of markets’, an autonomous actor founded in 1991 to manage municipal markets, while regulations still have to get the green light of the Barcelona City Council. The aim of the Institute of markets is threefold; designing more modern products, defining commercial promotion policies and renewing market infrastructures. It does so by involving private and public sector (De Cunto et al., 2017). Moreover, to fight urban heat with natural and climate resilient solutions, the city has designed green corridors and street trees (De Cunto et al., 2017).

Bilbao (ES)

Our analysis of Bilbao will be lead the same way, starting with an SDG analysis and then diving into major projects of the city. On figure 23, we can see that as most European cities, Bilbao already reached ambitioned 2030 levels on Zero Hunger. Surprisingly, the city has a wide gap on Life on Land compared to Spain’s higher average. The same goes for Sustainable Cities and Communities. Even if better than Spain, the city scores low on the SDG Decent Work and Economic Growth (OECD, 2020).

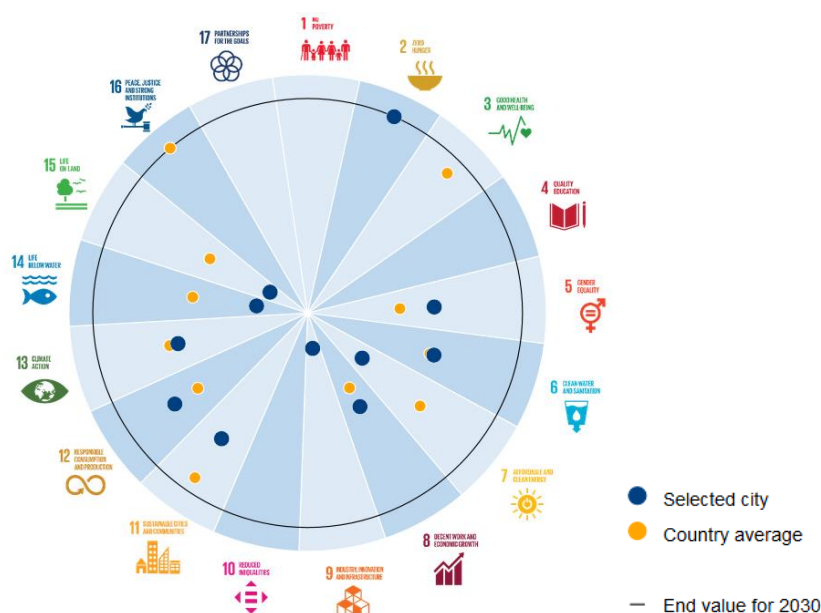


Figure 23: Measuring the distance to SDGs in Bilbao (OECD, 2020)

The city of Bilbao hosts since 2003 in November an annual fair trade week involving several NGOs and foundations with the International Cooperation Department of the City Council. During this week, a tent is built up in the city to raise awareness on responsible consumption patterns through lectures, tasting, information panels and music performance. The event attracts around 10.000 inhabitants annually (MUFPP, 2019). Moreover, to sensitize its citizens to food security, Food Waste and Social and Economic Equity, the city has launched a campaign called 'Eating Alike'. Once again, the International Cooperation Department of its City Council took the lead in the project, involving foundations and NGOs. The aim of this campaign is to promote food access, foster knowledge about food waste, hunger, poverty and malnutrition in the world through creative workshops and exhibitions (MUFPP, 2019). Besides this, the city has some innovative projects on food production, with the presence of community gardens and organic urban farming, however still highly insufficient to produce sufficient amounts of food (De Cunto et al., 2017).

Belgium

Belgium obtains a 2019 SDG Index score of 70.3, slightly above the European Union average of 70.1 (Institute European Environmental Policy, 2019). As for Spain, Belgium has major challenges remaining for the SDG 2 'Zero Hunger' and a stagnating trend on that issue. As in Spain, this is due to poor performing indicators on the Human Trophic level, but also due to the gross nitrogen balance on agricultural land and the ammonia emissions of ammonia from the country's agriculture. SDGs 4 'Quality Education', 12 'Responsible Consumption and Production', 13 'Climate Action', 15 'Life on Land' and 16 'Peace, Justice and Strong Institutions' have significant challenges left, while Belgium's advancement towards the SDGs 1, 3, 6, 8 and 11 is more advanced (Institute European Environmental Policy, 2019). As in Spain, trends show that SDG 4 'education' in Belgium is increasingly being tackled, while 'Climate Action' is still on a decreasing slope (Institute European Environmental Policy, 2019). SDGs scores can be seen on figure 24.

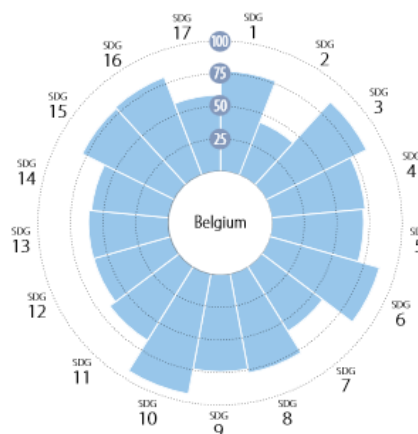


Figure 24: Belgium performance by SDG (IEEP, 2019)

In the 2018 Food Sustainability Index of the BCFN, Belgium globally performs ‘medium’. Indeed, Belgium appears to have a particularly ‘low score’ of 55.1 on food loss and waste, compared to its neighboring country France being the top performer with 85.8. It has however a ‘very high’ score both for sustainable agriculture as for nutritional challenges (BCFN, 2018). Bruges and Ghent have mobilized our attention in this analysis.

Bruges (BE)

Bruges has implemented a food policy thanks to its participation in EU-funded projects, such as LIFE+ or URBACT (De Cunto et al., 2017). The city of Bruges does not have an overarching theme for its food strategy. However, it has put up a framework with six goals; local food production, urban agriculture, gardens, fair-trade, food waste and education (Candel, 2017).

An example of good practice from Bruges is its Food Lab start-up, an action group involving forty organizations, ranging from NGOs to city services to social groceries. In the context of reaching its CO₂ targets for 2020, Bruges operates a transition movement, both by involving top-down approaches controlled by the city and bottom-up approaches, in which the city connects individuals. This is represented by the Food Lab, launched in 2015, that translates urban food strategies into concrete and innovative actions. The purpose of the Food Lab is to reduce food loss and promote sustainable and local food strategies through its three topics; food waste, short food chains and urban agriculture. The Food Lab involves civil society organizations, businesses and citizens that have expertise regarding sustainable food. (De Cunto et al., 2017; MUFPP, 2019). A Food Council provides Bruges with advice by involving a wide

range of stakeholders under which its own municipal government, also part of the Food Lab (De Cunto et al., 2017).

Besides this, the city of Bruges is involved in putting up a fair trade Expo in collaboration with the cities of Utrecht, Milan, Gent, Thessaloniki and Bilbao. This initiative rose in the context of the EU DEAR program; willing to expose fair and sustainable food to increase the public's knowledge and influence customer's purchasing behaviors. The exposition proposes information about fair trade products and the five fair trade Towns contributing in the project. It also entices visitors to become fair trade fans with an available photobooth they can contribute to (MUFPP, 2019). Still to raise awareness on fair trade, Bruges is involved in Fair Trade Town Campaigns encompassing local business and authorities as well as citizens and schools in a network to increase the sales of fair trade in the city. The local authorities have undertaken this action, stimulating fair trade at work, in schools, in their offices and in catering establishments. Moreover, the city has gained its title of Fair Trade Town already in 2008 by meeting the Five Core Goals of Fair Trade International; introducing fair trade in several aspects of the town and having its own Fairtrade steering group (MUFPP, 2019).

Besides, the city of Bruges uses an innovative and collaborative approach to combat food waste in four health care institutions. This project involves measurements and analyses of the current food waste produced and its economic impact in health care institutions, support in reducing their food waste and awareness enhancing in health care institutions. While working on Food Waste, the project also impact Food Supply and Distribution and Sustainable Diets and Nutrition (FAO, 2018). Solutions developed are spread to other institutions in the region of Flanders (Magarini, De Cunto, & Porreca, 2018). During the Milan Pact Awards, Bruges gained the 2017 edition of the food waste category, for its food waste prevention and reduction programs (Magarini & Porreca, 2019).

Ghent (BE)

The OECD shows how Ghent scores extremely good on the different SDGs, as can be confirmed from figure 25. For most of the SDGs, the city outperforms its country's score. From the SDGs that we enclose in our analysis, it reaches the maximum score on Zero Hunger and Peace, Justice and Strong Institutions. On the contrary, Ghent scores average on Good Health and Wellbeing, Responsible Consumption and Production and Sustainable Cities and

Communities. The city scores very poor on Life on Land. For these two last SDGs, the average score for Belgium is better than that of Ghent (OECD, 2020).

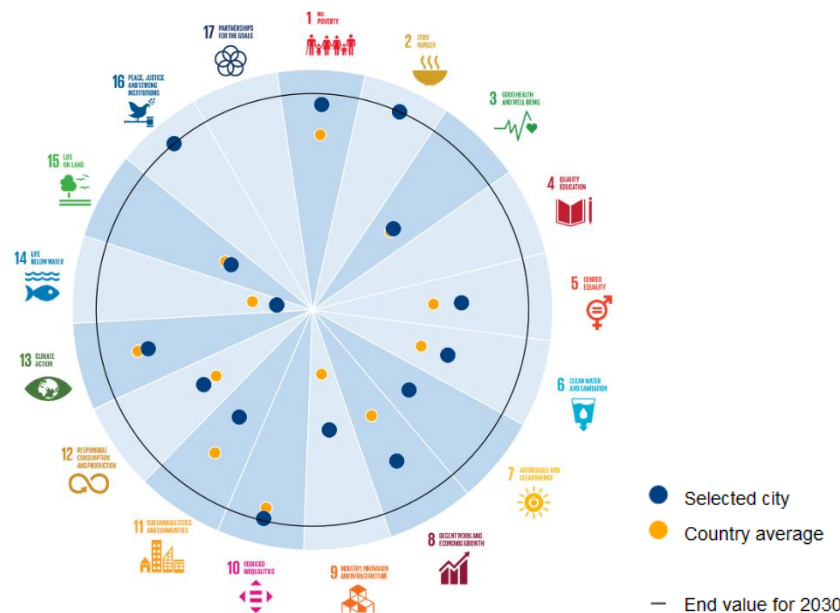


Figure 25: Measuring the distance to the SDGs in Ghent (OECD, 2020).

The city of Ghent has collected the Milan Pact Awards 2018 and is part of the RIKOLTO pact. Ghent's food practices are centered on the theme of sustainability and contain six pillars; local food production, food waste and urban agriculture as in Bruges, but also social function, circularity and sustainable consumption (Candel, 2019). Its food strategy is a result of previous cooperation with other European cities. Thanks to small-scale projects, the city is able to stimulate innovation in the food sector (De Cunto et al., 2017). Globally, Ghent focuses on a narrow and therefore specific range of food issues (Candel, 2019). It has launched in 2013 a food policy called "Gent en Garde" that includes five goals to reach a sustainable food system, based on various stakeholder consultations. The city therefore wants to put forward shorter and more visible food chains (De Cunto et al., 2017), sustainable food production and consumption, the creation of a social added value to food initiatives, the reduction of food waste and optimal reuse of food waste as raw materials (MUFPP, 2019). "Gent en Garde" has been awarded in October 2019 with a United Nations Global Climate Action Award during the COP25 climate summit in Madrid, highlighting its actions put into place to tackle climate change (Stad Gent, 2019). It shows the important efforts the city does on SDG 13 while Belgium still has significant challenges regarding Climate Action.

The city has adopted a cutting-edge co-governance approach to handle food related matters (Magarini & Porreca, 2019). This co-governance refers to the participation of private and public

spheres in a wider cooperation (Dukes, 2008). Besides, a Food Council was created in Gent, consisting of 25 members from diverse areas of interests, as important provider of feedback on its policies (De Cunto et al., 2017; MUFPP, 2019). A core team was built up within the policy council to translate ideas into operational goals and report to the food policy council, which in turn gives feedback to that team. The formal document is an open invitation to all organizations, governments, companies and associations to join in creating innovative and sustainable food strategies (MUFPP, 2019).

The City Health Council of Ghent, the Ghent Health Promotion Network and the Health Administration of the city cooperate on community-based strategies in regards with Sustainable Diets and Nutrition, often focusing on socially excluded population parts such as minorities, unemployed or refugees (De Cunto et al., 2017). Moreover, to promote a good nutrition, Ghent has adopted a multifaceted approach to offering sustainable school meals to the youth (Magarini & Porreca, 2019).

Ghent has created a place, 'De Site' project, for all its inhabitants to discuss and participate in activities linked to Food Supply and Distribution. It also stimulates farmers to get in closer contact with each other and highlights the necessity of smaller supply chains and locally marketed food instead of selling to big retailers (De Cunto et al., 2017). The city also has several community gardens and local organic farms. Its Community Food Garden enables citizens to produce and cook food together. However, they do not have the potential yet to have a strong impact on food consumption and are mainly used as a tool to raise awareness and promote social inclusion (De Cunto et al., 2017). They are seen as a way to promote interaction between people, as food has the capacity to connect individuals (Davies, 2019; Senes, Fumagalli, Ferrario, Gariboldi, & Rovelli, 2016). Moreover, Ghent hires refugees and unemployed people to collect and recycle food waste (De Cunto et al., 2017).

Both Bruges and Ghent are frontrunners in circularity in the food sector, which partly allows extremely good results on food waste and food loss. Concretely, they have implemented circular principles within their food systems to be more resource-efficient (Magarini & Porreca, 2019). In that light, the city has designed its food waste reduction program and actively promotes new ways of consumption among its citizens (De Cunto et al., 2017). The different actors involved were city agencies, agriculture associations and professionals, knowledge institutions, trade associations, private sector and NGOs (MUFPP, 2019). To tackle food waste in the horeca, the

city of Ghent created in 2015 the project the ‘Restorestje’, giving cardboard boxes for free to restaurants to let customers take food leftovers back home. 108 Restaurants currently participate in the project and 55.000 boxes have been distributed so far. The box is compostable, FSC-labelled and can be put both in the microwave and in the freezer. This initiative aims at reducing food waste in restaurants and raises awareness with information printed on the boxes, providing promotion and communication material to restaurants (Magarini, De Cunto, & Porreca, 2018). To further tackle food waste, the city has created a platform called ‘FoodSavers’ in 2017 that has as aim to collect food leftovers from retailers and the wholesale market and redistribute it to social organizations. A triple purpose is chased; fight against climate change, cut CO2 emissions and fight against poverty by providing nutritious food (Magarini, De Cunto, & Porreca, 2018). It has major impacts on three food categories; obviously Food Waste, but also Social and Economic Equity and Food Supply and Distribution (FAO, 2018). The project has as donators local supermarkets, supermarket depots, a wholesale market and a bio farm, as well as 58 receiving organizations. After the first year of its launch, 300 tons of food surpluses were redistributed and around 19.000 people were offered food (Magarini, De Cunto, & Porreca, 2018). ‘FoodSavers’ got in 2018 a Milan Pact Award 2018 for being an innovative and successful project (MUFPP, 2018).

France

The SDG Index Score of France is 74.7, the highest amongst the countries we focus our attention on (IEEP, 2019). It therefore places France in the 6th European Union position. The SDGs analysis results can be seen on figure 26. Its SDG 1 goal on ‘No Poverty’ is achieved, while SDG 15 ‘Life on Land’ remains its major challenge with a stagnating trend through time, as noticed in Spain. Biodiversity threats and the Red List Index of species survival lead to this poor result. Besides, France keeps significant challenges on 2 ‘Zero Hunger’, 4 ‘Quality Education’, 8 ‘Decent Work and Economic Growth’, 12 ‘Responsible Consumption and Production’, 13 ‘Climate Action’ and 16 ‘Peace, Justice and Strong Institutions’ (IEEP, 2019).

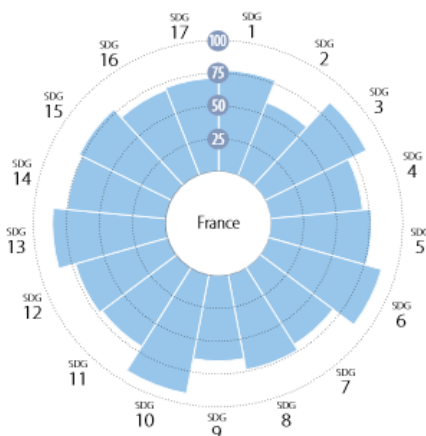


Figure 26: France performance by SDG (IEEP, 2019)

The Sustainability ranking of the Barilla Center for Food and Nutrition (BCFN) (2018) already brought significant proof of France being a top performer in Food Sustainability as the country ranks first on the 67 countries. It also scores first in food loss and food waste both in 2018 and 2017 rankings (BCFN, 2017; BCFN, 2018). In that light, the country's ability of drawing effective policies was highlighted, as well as the pro-activity of local governments to fight distributor and end user waste, through actions in schools, supermarkets and companies (BCFN, 2018). The country also scores in the top performers on sustainable agriculture with a 'high score' and a 'very high' result on nutritional challenges (BCFN, 2018). Besides, France has developed its own national food strategy (Candel & Pereira, 2017).

Marseille (FR)

The OECD shows how Marseille scores very good on water-related indicators, as can be seen from figure 27. It has excellent results on Peace, Justice and Strong Institutions, Life under water and Zero Hunger. Besides, it has a good score on Clean Water and Sanitation as well as Sustainable Cities and Communities. Surprisingly, there is a wide gap to be noticed between the strong French average on Climate Action and that of Marseille. The same goes for Good Health and Wellbeing. Moreover, Responsible Consumption and Production in Marseille seems to be low as in most analyzed cities (OECD, 2020).

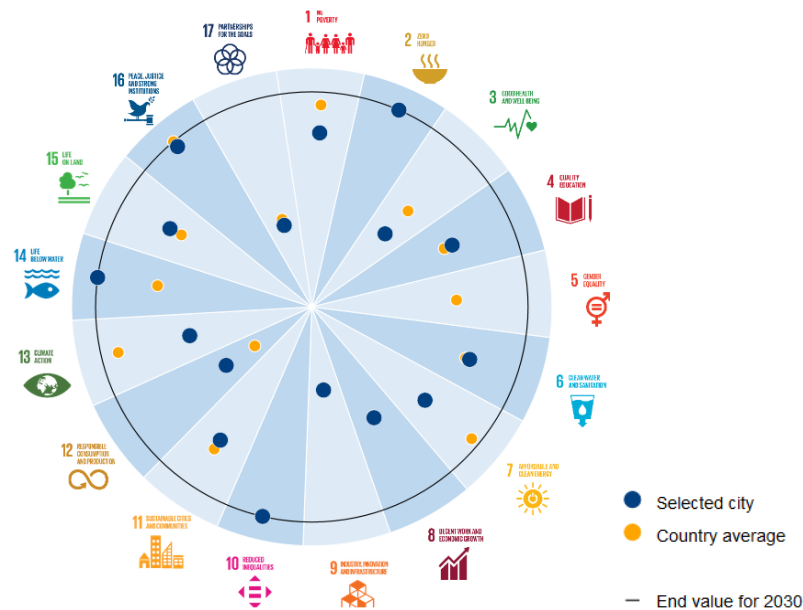


Figure 27: Measuring the distance to SDGs in Marseille (OECD, 2020)

Marseille is widely recognized for its experience in water management. The city hosts the World Water Council and contributes to the recognition of the important role of water in food systems (MUFPP, 2019). The World Water Council is a multi-stakeholder organization aiming at acting towards tackling water issues at diverse decision-making levels, focusing particularly on water security, adaptation and sustainability. The aim is to involve and engage with various actors to challenge traditional ways of thinking, such as politics, institutions, academia, civil society, etc. (World Water Council, 2019).

Besides this, some main activities are carried out related to food sustainability in Marseille, such as food workshops and events, centered towards food sustainability. With regards to food guidelines, Marseille has mainly been focusing on water guidelines. The city tries to increase the visibility and awareness of its food issues on its social media platforms. Besides this, an online app has been created that integrates all urban food projects and initiatives on a map, called “Marseille” (MUFPP, 2019).

Moreover, Marseille is part of the ‘Let’s Food Cities’ project, that fosters city-to-city cooperation to achieve sustainable urban food systems. The project started in 2017 and associated seven French cities to seven cities worldwide to achieve close collaboration on urban food systems. Marseille is partnering up with Fez, in Morocco, thanks to their existing collaboration. A close analysis was made of the food systems in those cities and has helped putting the main challenges of their food systems forward as well as solutions that could be

applied. The initiative aims at sharing knowledge and best practices as well as support their implementation in the twin cities. Based on this, a platform was created, regrouping solutions and good practices to improve urban food systems (Louison Laçon, email, 10th May, 2020).

In 2019, an exhibition called « Acteurs de Notre Assiette » took place in Marseille around the different actors of the food chain, food sustainability and healthy diets. Alternative solutions and initiatives towards food sustainability are shown to the visitors. « Les Champignons de Marseille » is an example of such initiative, growing mushrooms out of coffee waste that is collected amongst restaurants in the city. Moreover, 'le Paysan Urbain' is an innovation hub and social entrepreneurship in Marseille. The latter initiative focuses on the cultivation of micro-crops, distributed in short supply chains (MadeinMarseille, 2019).

Another awareness raising campaign in 2019 in Marseille was called « La Maison de l'Alimentation Durable ». An ephemeral concept store called « Made in Miramas » informed visitors about sustainable food. Workshops, books and sensibilization stands about food waste were offered to the visitor during three days in June. Artisans and even influencers were present to show their engagement and involvement towards food sustainability. Besides this, the organization supports around 120 families in initiatives around reducing their waste significantly in an educative program (Duprat, 2019).

Italy

The IEEP (2019) gives Italy a score of 65.3 on its global SDG Index score. This result is the lowest amongst the five country we analyze. Indeed, Italy has major challenges remaining on SDG 12 'Responsible Consumption and Production' and SDG 13 'Climate Action'. Results of the SDGs analysis can be seen on figure 28. Important nitrogen and SO₂ emissions explain this poor result, combined with energy-related- and imported CO₂ emissions. Moreover, on all other SDGs in relation to being food smart, the country has significant challenges remaining, some facing slight improvements while other completely stagnate (IEEP, 2019).



Figure 28: Italy performance by SDG (IEEP, 2019)

However, Italy was pointed out as a country scoring extremely good on sustainable agriculture by the BCFN (2017), the best on the 25 countries taking part in the survey, followed by France. This excellent score of Italy could be explained by good results on water and air, while scoring somehow poorer on land. The country has cutting-edge agronomic practices thanks to its crop diversification methods, changes in livestock diets and its adaptation of techniques to climate change (BCFN, 2017). Moreover, on food loss and waste it obtained a fourth position within the 25 states, encouraging restaurants and supermarkets to donate unused food to charities (BCFN, 2017). This position falls just behind France or Spain. The same Food Sustainability Index of the BCFN in 2018 gives Italy one year later a ‘high’ global Food Sustainability score and a ‘high’ score on food waste and loss, behind the Netherlands, France and Spain. It also obtained the same year a ‘high’ score on sustainable agriculture and a ‘medium’ score for nutritional challenges (BCFN, 2018). For that purpose, the country is developing thanks to European help the European School Fruits Scheme introducing more fruits and vegetables in schools to tackle obesity. Besides, the country has launched in 2016 a cutting edge ‘Gadda law’ on reducing food waste, providing its cities with incentives. However, there is no national food strategy in place yet and the country still faces agro-mafia threatening its progress (De Cunto et al., 2017). Our analysis sheds light on the cities of Turin and Milan and their advancement towards becoming food smart.

Milan (IT)

Analyzing the distance to the achievement of the SDGs, the city of Milan scores particularly good on Zero Hunger, as can be confirmed by figure 29. However as in Ghent, Milan scores

poor on Life on Land and Responsible Consumption and Production. Moreover, Decent Work and Economic Growth remain low, even if better than the Italian average (OECD, 2020).

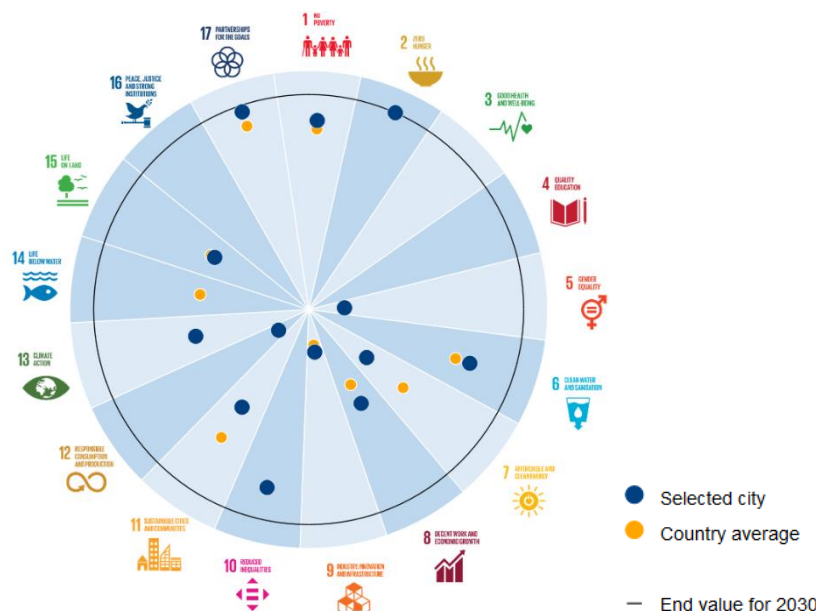


Figure 29: Measuring the distance to SDGs in Milan (OECD, 2020)

Milan has five goals to its food strategy with twelve sub-goals. Indeed, food waste, local production, sustainability, access to food, literacy and empowerment and Research and Innovation are its main focus areas (Candel, 2019). Milan has adopted its Food Policy structured in four stages, namely an analysis of Milan's food system and actors, Public consultation, objectives approval from municipal institutions and pilot projects. For its food policy, various actors were involved to create stakeholder engagement such as the municipality of Milan, civil society organizations, community districts, companies, start-up companies, foreign communities, universities, academics, researchers and international experts (MUFPP, 2019). The Food Policy Council takes the form of an appointed person, the vice-mayor, responsible for the city's food policies and is directly related to the mayor of the city. That person will be backed by a food policy officer and a food communication officer (De Cunto et al., 2017). Online tools were used to inform and engage citizens and a campaign was launched on social media, as well as different workshops. Eventually, a text was adopted for specific projects and actions to undertake to improve the food system in Milan (MUFPP, 2019). The city is mostly involved in designing a sustainable food system, raising awareness among consumers about healthy food, agri-food research and food waste (De Cunto et al., 2017). Its food policy to tackle food waste mainly impacts the categories Food Waste, Social and Economic Equity and Food Supply and Distribution (FAO, 2018). Main stakeholders involved in food policy and food actions are SMEs and academic structures.

Besides, as mentioned previously, the city of Milan, with its municipality and over 130 other municipalities worldwide, research centers, cities' networks and Foundations has created the Milan Urban Food Policy Pact. This framework gathers cities from all around the world on food sustainability, based on a Urban Food Policy Pact (De Cunto et al., 2017; MUFPP, 2019). The city is moreover engaged in a bunch of European Union projects such as the Food Smart Cities for Development of EUROPEAID, the UTURN of H2020, FOODMETRES of the FP7 projects of the Directorate General for Research and Innovation (DG RTD) and the OpenAgri of the UIA project of the Directorate General for Regional and Urban Policy (DG REGIO) (De Cunto et al., 2017). While the FSC4D has allowed the city to create and be part of a unique network of cities collaborating on food issues and to put up a coordinated urban food policy agenda, UTURN has enabled Milan to have access to a shared platform promoting knowledge-sharing and better logistics, giving the city access to matching tools to optimize food supply, food production and retail (De Cunto et al., 2017).

Besides, to reduce food waste, the city of Milan decided in 2018 to apply a waste tax reduction for food surpluses donations. The aim of this regulation is to reduce 20% of the yearly taxes for organizations donating food surpluses to social organizations. Moreover, the municipality has helped develop collaboration between a private association and a university to create a pilot project for local food surpluses redistribution. This was done by the city through offering a location to organize this 'Local Food Waste Hub'. In addition, the Milan Urban Food participates in the INTERREG CirCE that strives towards a circular economy through a multi-layered governance system. New instruments and competences for regions to promote circular economy are being developed through the project. Further, since 2013, biowaste is collected in the city to create compost that would serve for peri-urban agriculture and biogas to produce energy (Magarini, De Cunto, & Porreca, 2018). To further tackle food loss and food waste, the project 'MyFoody' motivates retailers in Milan to sell at lower price food that is near to its due date, has defaults or is in excess. Moreover, in school canteens, the city encourages children to bring leftover food from the canteen through 'food bags' home (De Cunto et al., 2017). For Food Supply and Distribution, the city has some municipal community gardens but does not take full benefit from the potential of its areas to design new gardens (Senes et al., 2016).

Turin (IT)

As Milan, Turin scores very good on the SDG Zero Hunger, while scoring very poor on both Responsible Consumption and Production and Decent Work and Economic Growth (OECD, 2020). The results of the SDGs analysis can be seen on figure 30.

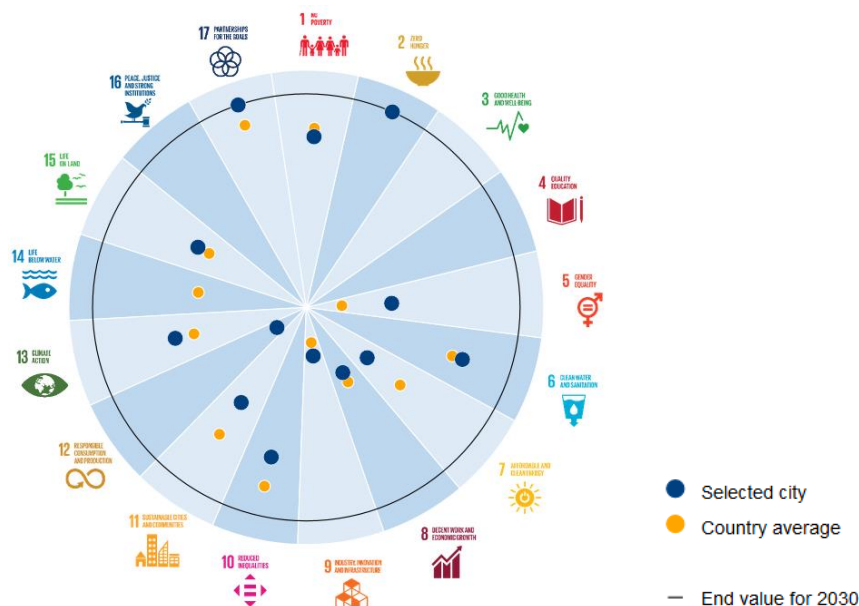


Figure 30: Measuring the distance to SDGs in Turin (OECD, 2020)

The ‘right to food’ figures in the statute of the city of Turin (De Cunto et al., 2017; Magarini & Porreca, 2019). This makes the right to free and permanent access to healthy, fair and appropriate food mandatory. The text adopted has as purpose to give consistency and dignity to its citizens’ rights as well as recognize the right to food and its multiple dimensions. Existing practices carried out are being acknowledged and deliberated under this text, such as urban markets, soup kitchens and farmer’s markets (MUFPP, 2019). The city of Turin implemented its own food strategy after collaborations with other European cities. Indeed, the city has designed its strategic plan engaging 45 actors and defining a ‘food commission’ made up from institutions from the private and public sector, as well as engaging universities. It has its own food policy council, with voluntary stakeholders within the food system (De Cunto et al., 2017).

Another initiative undertaken by the city is the Turin Food City initiative. Its vision was established during the strategic planning process for the Metropolitan Turin 2025 Strategic Plan launched by the Torino Internazionale/Strategica Association and disclosed in April 2015. The project was established through a collaborative process among key players in the city’s food system including producers, distributors, consumer associations, academics, representatives of civil society and NGOs. The city of Turin has proven to have strong innovation capacity in its whole food system, especially with regard to the safeguard of quality local food, ethno-

gastronomic events, social, educational and cultural activities and initiatives around food, urban agriculture, increasing public awareness of the importance of food to get healthy communities and food waste reduction. The vision of the city is to ensure healthy and high-quality food accessible to all (MUFPP, 2019).

Besides, Turin organizes the Salon del Gusto and the Terra Madre network. Both initiatives are organized by the city of Turin, Slow Food, the Piedmont region, Terra Madre Foundation and the Ministry of Agricultural, Food and Forestry Policies. The Salon del Gusto is a major exhibition on sustainable food and local traditions. Its aim is to promote high-quality, sustainable and local food, as well as small-scale producers. Therefore, agricultural and cultural biodiversity are at the heart of the exhibition. Besides this, a network was launched to support small-scale producers and enable them to voice themselves and have some visibility, Terra Madre. Moreover, the network provides them with tools they may need to better produce. Terra Madre is composed of more than 2000 food communities worldwide working towards reaching a more sustainable food system (MUFPP, 2019).

Turin heavily tries to influence its citizens' behaviors towards fighting food waste. The municipality is currently negotiating a tax on food thrown away by households and provides asylum seekers with the distribution of unsold food (De Cunto et al., 2017). In that light, the city fights against food waste by striving for a system that would make inhabitants pay for what they throw away (Magarini, De Cunto, & Porreca, 2018). In collaboration with Novamont Spa, the city of Turin created an initiative to ease the collection and separation of food waste in the city's municipal market. The project consists in providing food waste collecting material for open air markets. Moreover, the project called Eco Dalle Città has enlisted volunteers and various asylum seekers to make unsold food available and address the scavenging issue in markets. Indeed, as in Ghent, the city of Turin makes refugees and unemployed participate in the collection of food waste and food recycling (De Cunto et al., 2017). Moreover, the city of Turin won the 2018 prize for food waste for its innovative projects towards reaching circular markets (Magarini & Porreca, 2019).

Further, the city has organized a solidarity system of soup kitchens that enable access to food for more vulnerable people. Those soup kitchens obtain food from various sources such as food banks, retailers and the city itself (Magarini, De Cunto, & Porreca, 2018; Magarini & Porreca,

2019). For its food production, the city is still analyzing with local universities the opportunity of investing in urban food production (De Cunto et al., 2017).

The Netherlands

With its result of 71.8 on the IEPP SDG Index Score (2019), the Netherlands scores particularly high at European level, falling one place behind France and being in that light 7th European country in the ranking. The country's performance by SDG can be seen below, on figure 31. As in France, the first SDG 'No Poverty' is achieved. However, despite its outstanding position in European rankings, several goals still face major challenges in the country; SDG 2 'Zero Hunger' as Spain and Belgium, SDG 12 'Responsible Consumption and Production' as Italy and SDG 15 'Life on Land' as France and Spain. While significant challenges remain on SDG 13 and 16, SDGs 3, 4, 6, 8 and 11 have minor challenges remaining (IEPP, 2019).



Figure 31: Netherlands performance by SDG (IEPP, 2019)

Still, the 2018 Food Sustainability index of the BCFN highlights the Netherlands to perform outstandingly with a 2nd place in the 67 country ranking. The country scores in the 8th position on food loss and waste, 6th on sustainable agriculture and still 'very high' on nutritional challenges (BCFN, 2018). The country's Ministry of Economy and Agriculture, Nature Management and Fisheries merged together to better address the challenges related to food. Moreover, it has launched the City Deal initiative, a cooperation of twelve of its cities on food issues, in close collaboration with their national government (De Cunto et al., 2017).

Utrecht (NL)

The OECD shows how Utrecht scores very high both on Zero Hunger and Climate Action (cfr. figure 32). Its results on Life on Land is the lowest on the SDGs we analyze with available data (OECD, 2020).

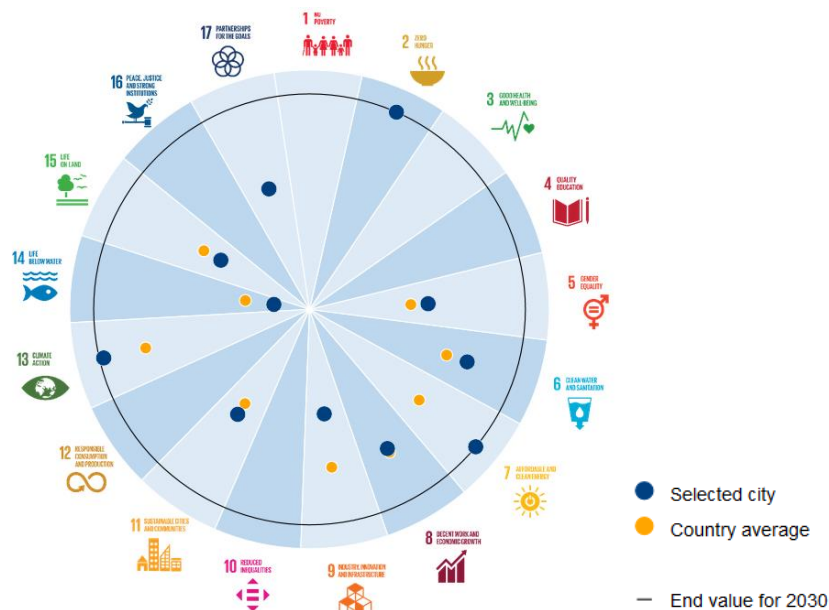


Figure 32: Measuring the distance to SDGs in Utrecht (OECD, 2020)

The city of Utrecht was prized in 2016 as being a Global Goals City. This was reached in collaboration with the city of Utrecht, the foundation Utrecht4GlobalGoals, citizens, entrepreneurs and knowledge institutions. Under this denomination, the city strives towards reaching the Sustainable Development Goals, including fighting for sustainable and healthy food as well as trying to become socially inclusive. Utrecht4GlobalGoals was created as a new organization regrouping the local Fair Trade Organization and the local Millennium Goals organization (MUFPP, 2019). Besides, the city is part of the Dutch City Deal, an urban agenda on food signed by twelve Dutch cities, focusing on governance, food education, ecological and economic sustainable innovation, regional food systems and short supply chains (De Cunto et al., 2017).

According to De Cunto, Tegoni, Sonnino, Michel, et Lajili-Djalai (2017), the city of Utrecht has not implemented any overarching strategy for its food smart policies, as it aims at remaining action-oriented. The city has been an example of good practice by building bottom-up food policies, involving a wide range of actors such as the municipality of Utrecht, citizens, entrepreneurs, social organizations, local banks and the RUAF, an important Center of Expertise and Global Partnership on Sustainable Urban Agriculture and Food Systems (MUFPP, 2019). The RUAF Foundation enables the city to visualize the region's food system

and identifying missing efforts (De Cunto et al., 2017). The city aims at relying less on its national government to be able to propose bottom-up initiatives. The main stakeholders involved in the city's food policies are companies, SMEs and researchers, while paradoxically consumers, organizations and farmers are less integrated (De Cunto et al., 2017). It works with local researchers to gather data on its implemented food system and its food waste and sourcing (De Cunto et al., 2017). The involvement of the city in the European URBACT project was a first start for the city to further deepen into food issues (De Cunto et al., 2017).

Recently, Utrecht has seen a wide variety of food initiatives emerge, such as community gardens, social restaurants and vegetable gardens. Those community gardens and local organic farming projects raise awareness on new food production methods (De Cunto et al., 2017). The municipality has put workshops into place on various food themes to raise awareness on current food issues and emphasize the need to keep working to solve those. A local food platform was created through decentralized cooperation. A local bank promoting food communities was also launched as well as promotion on research on urban food systems (MUFPP, 2019). Therefore, Utrecht truly uses food as a mean to reduce inequalities (Magarini & Porreca, 2019).

Besides this, the city of Utrecht has organized various activities around food waste reduction. First, Utrecht has a food foundation called Community and Food Surpluses that provides food-related companies that want to offer food surpluses with a platform where they can donate food surpluses to social organizations. Food donated goes directly to inhabitants to provide them with healthy food. This prevents food waste, fights against poverty and isolation. It addresses at the same time Food Waste, Social and Economic Equity, Sustainable Diets and Nutrition of the people supported and Food Supply and Distribution (FAO, 2018). The foundation wants in the future to develop a physical location in the region (Magarini, De Cunto, & Porreca, 2018). Another project in the city on food waste tries to reuse coffee waste by using a circular economy model. Coffee waste is used to grow oyster mushrooms in a train station in Utrecht. The purpose of this small-scale project is to organize and stimulate exchange between various stakeholders on this subject. At the end of the project, a multi-stakeholder meeting presented the outcomes of the project and expanded the network. The municipality has continued experiencing coffee waste separation and re-utilization with entrepreneurs from the region (Magarini, De Cunto, & Porreca, 2018). Further, to reduce food loss and waste, Utrecht organizes a competition among knowledge infrastructures and companies to develop creative ideas on reducing food waste (De Cunto et al., 2017).

Appendix 3: IMD, Arcadis and European Smart city Index methodologies and limits

To explain divergences between the outcomes of the European Smart City ranking of the Centre of Regional Science, the IMD Smart City Index 2019 and the International Sustainable City Index of Arcadis 2016 and 2018, there are likely to be many reasons.

Firstly, the two last rankings were done at global scale and not at European scale as the first ranking. In that light, only large-sized European cities were taken into account, which might explain the absence for example Bruges or Ghent in rankings. On the contrary, the European Smart City Index 2014 already excluded Milan, Prague, Barcelona, Marseille and Turin, not considered as medium-sized cities. Moreover, our rankings are separated in time; 2014, 2016, 2018 and 2019. As smart and food smart considerations only emerged lately, efforts of cities towards implementing food smart and smart measures have been growing through the past years, changing positions of cities in this topic through time. Moreover, considering criterion, the three indexes have different pillars, focusing on different criteria. While the SRF 2014 is based on smart economy, smart people, smart living, smart government, smart environment and smart mobility, the IMD 2019 is based on health and safety, mobility, activities, opportunities and governance. The Arcadis indexes 2016 and 2018 are based on three dimensions: people, planet and profit, which are broader topics than the two other indexes. That way, IMD and European Smart City Index are very close on their scope. However, compared to the two other rankings, the economic dimension is less part of the total score in the IMD Index, as opportunities are taken in a broader context. The Arcadis Index 2018 on its side puts specific emphasis on digitalization, using a proxy measure for the pace at which cities are equipping themselves to meet future needs. Therefore, the focus on different criterion influences objectives and results obtained.

Moreover, the Arcadis Index 2016 and the SRF use simple averages to conduct their analyses and no specific weightings for the different categories. However, the Arcadis 2018 Index uses simple averages except for housing costs compared to household spending, weighted in favor of the former. Besides, the methodology used by the IMD 2019 Index is different as it is based on the Human Development Index. Indeed, cities are divided into four groups based on their HDI score. Within those groups, a rating scale is applied, based on perception-scores of a city

compared to others in the same group. This system is not used by other indexes and makes comparisons difficult.

In opposition with the other indexes, the IMD bases itself entirely on the perception of inhabitants on their cities. That way, results of the IMD are subjective compared to other indexes, that base their results on tangible data. However, these personal viewpoints taken on a big sample of inhabitants are still descriptive of the current situation.

Further, unlike the other two indicators, the Arcadis 2016 and 2018 sometimes use national data if no city data is available, using the spread around national data. In comparison, the SRF does not make use of national data when data is missing, but allows up to 20% of missing data per city.

Appendix 4: Exhaustive search Foodsmartness

	FoodSmartness				
	Model1	Model2	Model3	Model4	Model5
Intercept (p-value)	1.1113 (0.323)	1.04 (0.1870)	0.877 (0.0049**)	0.8475 (0.001*)	0.8726 (0.001***)
Demography	0 (0.23)	0 (0.1162)	0 (0.0395*)	0 (0.0203*)	0 (0.0313*)
Area	-0.0019 (0.231)	(-0.0018) (0.0909.)	-0.0016 (0.0179*)	-0.0016 (0.0079*)	-0.0012 (0.0072**)
Confidencegov	-0.0054 (0.229)	-0.0052 (0.1208)	-0.0048 (0.0538.)	-0.005 (0.03*)	-0.0054 (0.0218*)
Welfsyst [T Eastern]	0.13 (0.386)	0.1247 (0.2747)	0.1092 (0.1747)	0.12 (0.084.)	0.1247 (0.0839.)
Welfare [T Social democratic]	0.122 (0.326)	0.124 (0.2062)	0.1181 (0.1438)	0.1073 (0.1023)	0.0643 (0.2355)
Welfare [T Southern]	-0.2199 (0.250)	-0.2109 (0.134)	-0.1923 (0.0508)	-0.1797 (0.0246*)	-0.1407 (0.0402)
terteduc	-0.0006 (0.779)	-0.0006 (0.7090)	-0.0005 (0.7117)	-	-
SDGscore	-0.0019 (0.803)	-0.0014 (0.7969)	-	-	-
RHDI	0.0016 (0.378)	0.0014 (0.1837)	0.0014 (0.1243)	0.0013 (0.09)	0.0006 (0.1996)
Qualhealthcare	0.0066 (0.416)	0.0059 (0.2357)	0.0053 (0.1393)	0.005 (0.100 1)	0.002 (0.2332)
R.Dexpend	0.0661 (0.291)	0.0619 (0.1483)	0.06 (0.093)	0.0667 (0.015 3*)	0.0811 (0.003**)
Income	0.0433 (0.420)	0.0395 (0.2776)	0.0405 (0.1935)	0.0379 (0.158 7)	0.0136 (0.4501)
Energyintensity	-0.0033 (0.273)	-0.0032 (0.1498)	-0.0028 (0.0256)	- 0.0029 (0.008 **)	-0.0027 (0.0096**)
Foodwasteca	-0.0006 (0.883)	-	-	-	-
Earlyleavers	-0.0197 (0.374)	-0.0182 (0.2285)	-0.0175 (0.1664)	-	-0.006 (0.335)
				(0.125	

Employmfood	-17.4156 (0.452)	-15.208 (0.2586)	-12.95 (0.1177)	-12.19 (0.084)	-6.607 (0.1935)
Civicengagement	-0.0202 (0.452)	-0.0203 (0.3390)	-0.0201 (0.2695)	-	-
				(0.208)	
(p-value test)	(0.2178)	(0.0774)	(0.0246)	(0.007)	(0.0047)
R ²	0.9715	0.9711	0.9704	0.9692	0.9564
Adjusted R ²	0.7294	0.8171	0.8592	0.8839	0.8618
Breusch- Pagan (p-value test)	19.603 (0.295)	17.673 (0.34)	17.504 (0.29)	17.914 (0.21)	18.446 (0.14)
AIC	-83.2669	-84.99	-86.47	-87.7	-82.74

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 27: Exhaustive search Foodsmartness

Appendix 5: Feature selection for food smart categories

Appendix 5.1: Food Waste

	Food waste		
	Model1	Model2	Model3
Intercept	-0.3763 (0.591)	-0.4111 (0.3609)	-0.4621 (0.1771)
Turnoverindustry	0 (0.694)	0 (0.5185)	0 (0.3561)
Welfsyst [Eastern]	0.0025 (0.983)	-0.0029 (0.9688)	0.0035 (0.9518)
Welfsyst[Social democ]	0.0704 (0.546)	0.0637 (0.3706)	0.0577 (0.2813)
Welfsyst[Southern]	-0.2849 (0.368)	-0.2655 (0.1612)	-0.2489 (0.0753.)
SDGscore	0.036 (0.095.)	0.0358 (0.0114*)	0.0353 (0.0013**)
Terteduc	0.0064 (0.253)	0.0065 (0.0794.)	0.006 (0.015*)
Popudensity	-0.0597 (0.177)	-0.0579 (0.0352*)	-0.0561 (0.0006**)
Foodwasteca	-0.0038 (0.503)	-0.0039 (0.3052)	-0.0035 (0.2052)
Export	-0.0021 (0.485)	-0.002 (0.2944)	-0.0021 (0.1719)
EQI	-0.006 (0.345)	-0.0059 (0.1516)	-0.0052 (0.0264*)
Earlyleavers	-0.0406 (0.198)	-0.0389 (0.0402*)	-0.038 (0.0092**)
Croplandpercent	0.0102 (0.191)	0.0099 (0.0428*)	0.0096 (0.0081**)
Confidencegov	-0.0046 (0.424)	-0.0043 (0.2269)	-0.0041 (0.1349)
Civicengagement	-0.0542 (0.176)	-0.0531 (0.0383*)	-0.0533 (0.0095**)
Demography	0 (0.163)	0 (0.026*)	0 (0.0037**)
Area	-0.0048 (0.163)	-0.0046 (0.027*)	-0.0045 (0.004**)
PAYT	-0.0093 (0.850)	-	-
Pollution	-0.0004 (0.846)	-0.0003 (0.7737)	-
(p-value test)	0.2405	0.04699	0.0079
R ²	0.9947	0.9944	0.994
Adjusted R ²	0.8995	0.9464	0.9623
Breusch- Pagan (p-value test)	19.905 (0.3382)	19.864 (0.2812)	19.9 (0.2248)
AIC	-88.444	-89.328	-90.2778

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 28: Exhaustive Search Food Waste

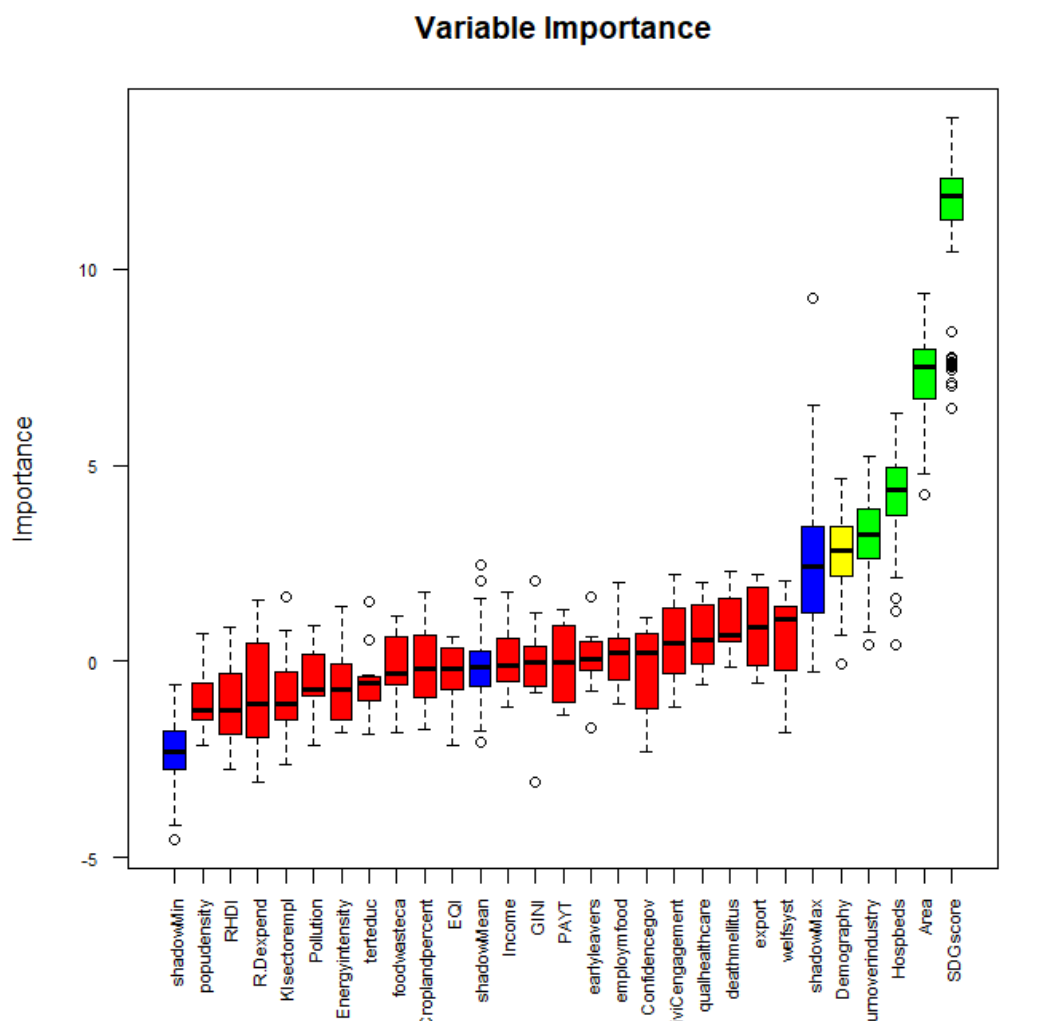


Figure 33: Boruta feature selection Food Waste

SDG analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Are SDGs 4,12 scores linked to **Food Waste** score?

Hypothesis: SDG 4, SDG 12

	Food Waste		
	Model1	Model2	Model3
Intercept (p-value)	0.4818 (0.0036 **)	0.4308 (0.0023 **)	0.4311 (0.0000 ***)
SDG4	-0.0007 (0.6734)	-0.0001 (0.9418)	-
SDG12	-0.0003 (0.7685)	-	-0.0003 (0.731)
(p-value test)	(0.8616)	(0.9418)	(0.7311)

R ²	0.0197	0.0003	0.0076
Adjusted R ²	-0.111	-0.0552	-0.0544
Breusch-Pagan (<i>p-value test</i>)	4.9834 (0.0828)	0.1904 (0.6626)	4.0348 (0.0445)
AIC	-13.7271	-17.7948	-15.5067
AICc	-10.655	-16.3	-13.8
RMSE	NA	0.1334618	NA

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 29: Model creation Food waste pillar with related SDGs

From our models, it seems that neither Quality Education nor Responsible Consumption and Production can significantly explain Food Waste (cfr. Table 29).

Appendix 5.2: Social and Economic Equity

	Social and Economic Equity		
	Model1	Model2	Model3
Intercept	-1.8695 (0.0683.)	-2.6589 (0.632)	-0.2766 (0.7737)
Civicengagement	-0.0614 (0.0189*)	-	-0.0675 (0.0303*)
Earlyleavers	-0.0306 (0.0510.)	(-0.0485) (0.485)	-0.0077 (0.3030)
EQI	0.01293 (0.0376*)	0.0246 (0.267)	0.0072 (0.1749)
Export	0.0004 (0.6213)	-0.0003 (0.985)	-0.0027 (0.4894)
Employmentfood	-8.4708 (0.2088)	-35.06 (0.648)	-12.525 (0.5948)
Foodwasteca	0.0033 (0.15)	-0.0047 (0.816)	0.0015 (0.8055)
GINI	2.2860 (0.0554.)	0.6744 (0.897)	2.989 (0.1489)
Income	0.2032 (0.0382*)	0.304 (0.392)	0.0936 (0.1172)
Qualhealthcare	-0.0044 (0.0505.)	-0.0023 (0.809)	-0.0048 (0.1906)
PAYT	-0.2194 (0.0319*)	-0.3117 (0.343)	-0.1372 (0.1116)
Popudensity	0.0083 (0.1046)	0.03 (0.410)	0.001 (0.9095)
RHDI	0.0026 (0.0644.)	0.0056 (0.441)	-
SDGscore	0.0153 (0.0540.)	0.02 (0.581)	0.0079 (0.3995)
Terteduc	-0.0069 (0.0574.)	-0.0098 (0.577)	-0.0085 (0.1814)
Turnoverindustry	0 (0.0864.)	0 (0.706)	0 (0.5118)
Welfsyst[Eastern]	0.2719 (0.0781.)	0.5561 (0.546)	0.0121 (0.9410)
Welfsyst[Socialdemo]	0.0642 (0.33)	-0.1254 (0.897)	-0.0487 (0.8599)
Welfsyst[Southern] (p-value test)	0.0404 (0.3207) (0.0326)	0.309 (0.596) (0.6216)	-0.0589 (0.7129) (0.077)
R ²	0.999	0.892	0.9906
Adjusted R ²	0.9982	-0.02638	0.9109
Breusch- Pagan (p-value test)	19.671 (0.3517)	18.112 (0.3818)	19.987 (0.2749)
AIC	-163.209	-24.6126	-73.4827

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 30: Exhaustive search Social and Economic Equity

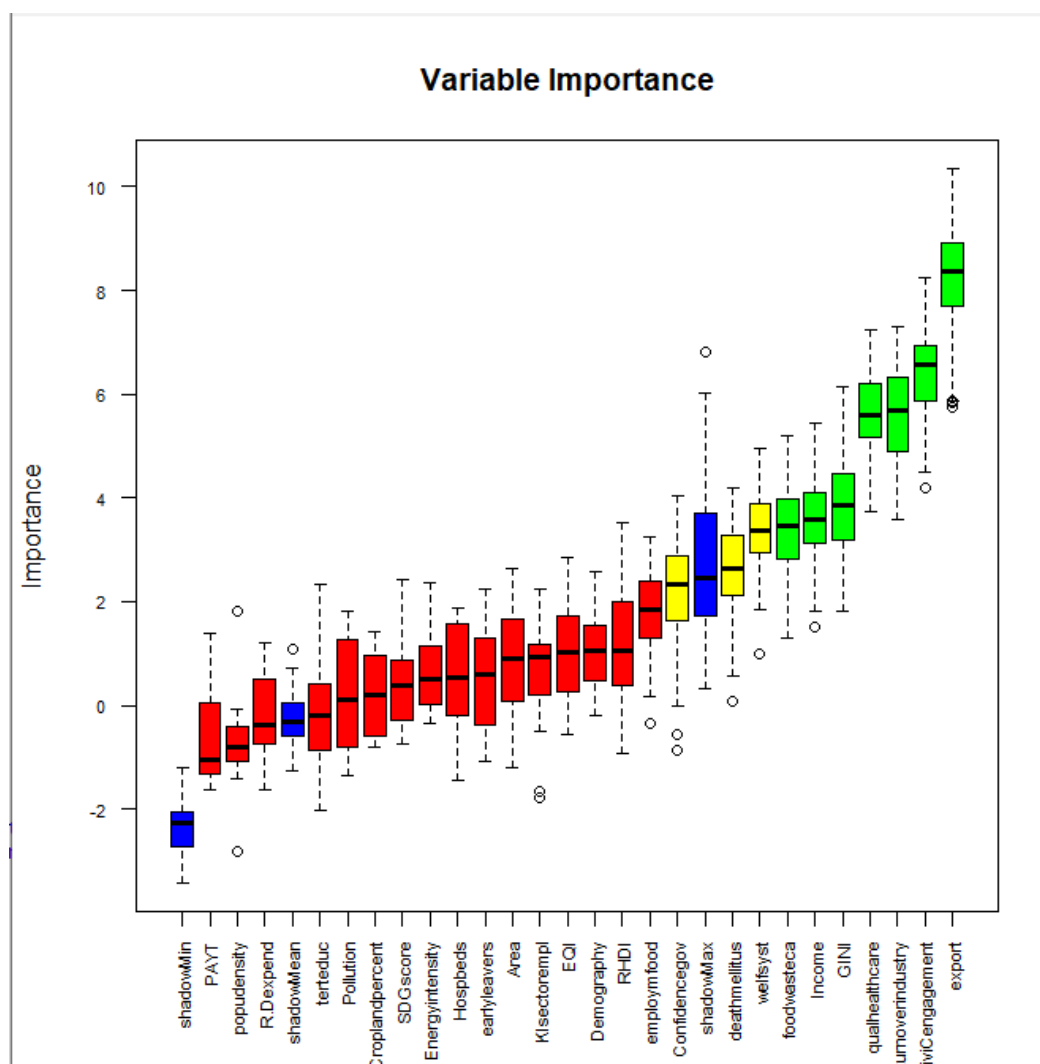


Figure 34: Boruta feature selection Social and Economic Equity

SDG Analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Are specific SDGs scores linked to **Social and Economic Equity** score?

Hypothesis: SDG 1, SDG 2, SDG 4, SDG 6, SDG 8, SDG 12 (MUFPP, 2017).

	Social and Economic Equity				
	Model1	Model2	Model3	Model4	Model5
Intercept	0.7833 (0.0022**)	0.7801 (0.0012**)	0.6999 (0.0003***)	0.6761 (0.0002 ***)	0.6655 (0.0001 ***)
SDG1	-0.0029 (0.2082)	-0.0029 (0.1217)	-0.0027 (0.1356)	-0.0034 (0.0373*)	-0.0036 (0.0223*)

SDG2	-0.0008 (0.4487)	-0.0008 (0.4223)	-0.0007 (0.4495)	-	-
SDG4	-0.0001 (0.9565)	-	-	-	-
SDG6	-0.0007 (0.5019)	-0.0007 (0.4813)	-	-	-
SDG8	-0.0011 (0.4748)	-0.0011 (0.4538)	-0.0011 (0.4008)	-0.0006 (0.5838)	-
SDG12	0.0023 (0.0712)	0.0023 (0.0554)	0.0026 (0.0181*)	0.0024 (0.0200*)	0.0021 (0.0132*)
<i>(p-value test)</i>	(0.0643)	(0.0293)	(0.0148)	(0.0067)	(0.0021)
R ²	0.6069	0.6067	0.5894	0.5702	0.5606
Adjusted R ²	0.3924	0.4429	0.4631	0.4781	0.502
Breusch-Pagan <i>(p-value test)</i>	2.4276 (0.8765)	2.0074 (0.8481)	1.6299 (0.8034)	0.8764 (0.8311)	0.9714 (0.6153)
AIC	-21.6693	-23.6643	-24.889	-26.0662	-27.6662
AICc	-5.86	-12.66	-17.44	-21.3	-24.8
RMSE	NA	NA	NA	NA	NA

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 31: Model creation Social and Economic Equity with related SDGs

From table 31, we do obtain significant results for Social and Economic Equity. Model 5 optimizes both AIC criterion and adjusted R-squared and we therefore choose this model. It states that SDG 1 No Poverty and SDG 12 Responsible Consumption and Production are significative for Social and Economic Equity.

Appendix 5.3: Food Governance

	Food Governance	
	Model1	Model2
Intercept	7.0085 (0.4682)	8.2356 (0.0071)
Turnoverindustry	0 (0.3514)	0 (0.0228)
Welfsyst [Eastern]	-1.5911 (0.066.)	-1.6085 (0.0039)
Welfsyst[Social democ]	-0.1038 (0.9105)	0.0382 (0.6708)
Welfsyst[Southern]	-0.7201 (0.6829)	-0.9782 (0.0084)
SDGscore	-0.0115 (0.8262)	-0.0195 (0.0411)
Terteduc	-0.0307 (0.2696)	-0.028 (0.0028)
Popudensity	0.0837 (0.4251)	0.0709 (0.0064)
RHDI	-0.0027 (0.5058)	-0.0033 (0.0218)
Export	-0.0273 (0.0754.)	-0.027 (0.0064)
EQI	0.0042 (0.8463)	0.0008 (0.6078)
GINI	-1.6253 (0.8369)	-2.8283 (0.046)
Klsectoremploy	-0.0385 (0.1790)	-0.0364 (0.0042)
Income	-0.154 (0.3570)	-0.1721 (0.0137)
Civicengagement	-0.0869 (0.3606)	-0.0763 (0.0111)
Demography	0 (0.7391)	0 (0.0617)
Area	0.002 (0.7460)	0.0011 (0.0543)
Employmfood	-63.7606 (0.454)	-53.039 (0.0081)
Confidencegov	0.0075 (0.8769)	-
(p-value test)	0.0863	0.0059
R ²	0.9993	0.9993
Adjusted R ²	0.9873	0.9934
Breusch- Pagan (p-value test)	19.951 (0.3356)	19.558 (0.2975)
AIC	-99.76	-101.008

Table 32: Exhaustive search Food Governance

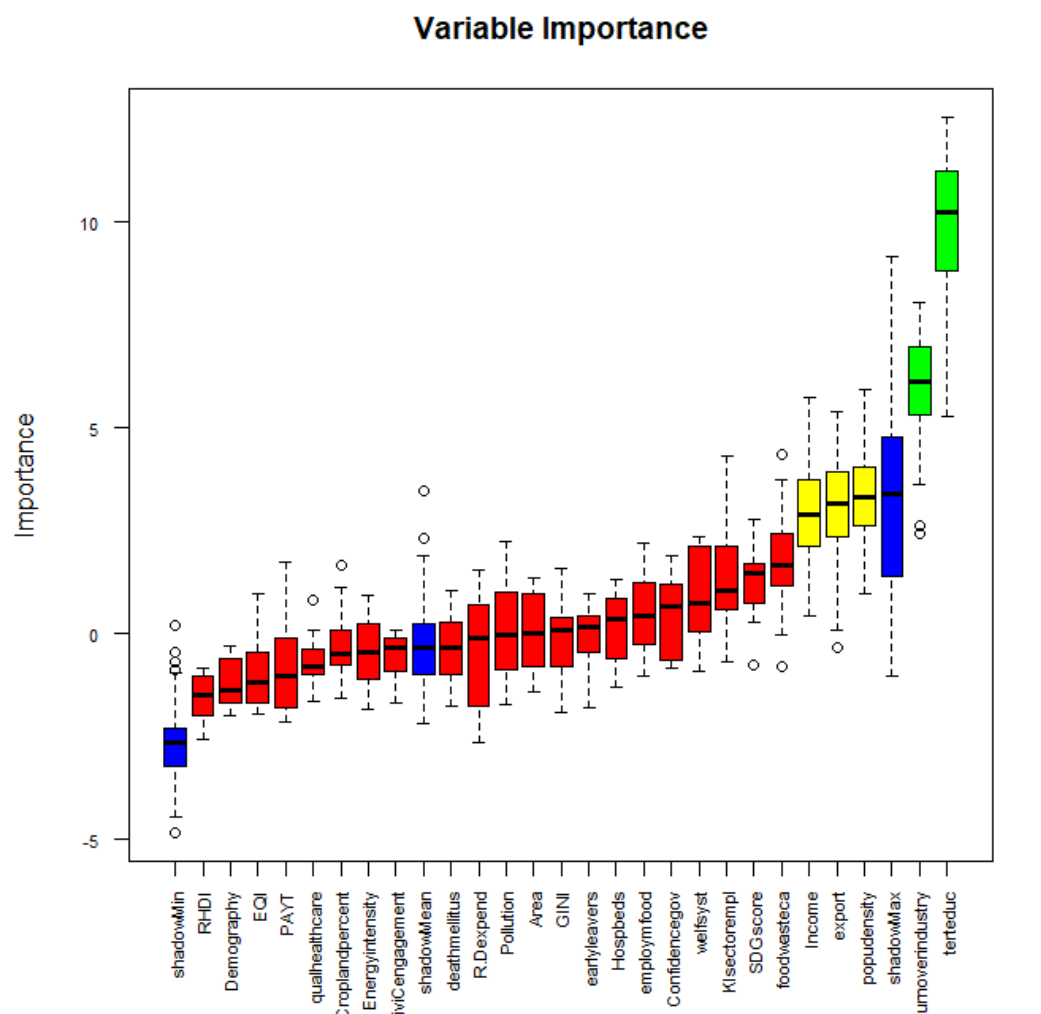


Figure 35: Boruta Feature selection Food Governance

SDG analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Is SDG 16 scores linked to **Food Governance** score?

Hypothesis: SDG 16

	Food Governance
	Model1
Intercept	0.4936
(p-value)	(0.0480*)
SDG16	-0.0007
	(0.8070)
(p-value test)	(0.8074)

R ²	0.0034
Adjusted R ²	-0.0520
Breusch-Pagan (<i>p-value test</i>)	1.0820 (0.2983)
AIC	12.3317
AICc	13.8
RMSE	0.283

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 33: Model creation Food Governance pillar with related SDGs

Out of the linear model, we conclude that SDG 16 Peace, Justice and Strong Institutions does not significantly influence the Food Governance score (cfr. table 33).

Appendix 5.4: Sustainable Diets and Nutrition

	Sustainable Diet and Nutrition		
	Model1	Model2	Model3
Intercept	1.0403 (0.0065**)	0.7871 (0.1129)	1.1658 (0.0197*)
Civicengagement	0.0134 (0.0558.)	-0.004 (0.7416)	0.0028 (0.7558)
Confidencegov	-0.0003 (0.62325)	0.0018 (0.46)	0 (0.978)
Deathmellitus	0.0087 (0.0038**)	0.0085 (0.0402*)	0.009 (0.0123*)
Demography	0 (0.0127*)	0 (0.1542)	0 (0.0505.)
Employmfood	12.522 (0.0240*)	0.6755 (0.9137)	7.1288 (0.2742)
GINI	-1.1808 (0.0295*)	0.1471 (0.8017)	-0.8075 (0.2810)
KIscoreempl	-0.0098 (0.00325**)	-0.0114 (0.0172*)	-0.01 (0.0077**)
Popudensity	0.0123 (0.01471*)	0.0099 (0.2389)	0.0135 (0.0635.)
Qualhealthcare	-0.0031 (0.0163*)	-0.0015 (0.41)	-0.0019 (0.1663)
R.Dexpend	0.0255 (0.034*)	0.0087 (0.689)	-
SDGscore	-0.0025 (0.0907.)	0.0019 (0.5129)	-0.0021 (0.4634)
RHDI	0.0002 (0.086.)	-0.0001 (0.6413)	0 (0.7292)
Terteduc	0.0077 (0.0047**)	0.0044 (0.0605.)	0.0061 (0.0217*)
Turnoverindustry	0 (0.0161*)	-	0 (0.1513)
Welfsyst[Eastern]	-0.0036 (0.8453)	-0.084 (0.2429)	-0.0619 (0.2032)
Welfsyts[Social Demo]	0.2454 (0.0075**)	0.1353 (0.1601)	0.2495 (0.0341*)
Welfsyst[Southern]	-0.207 (0.0107*)	-0.1273 (0.2380)	-0.2304 (0.0408*)
(p-value test)	0.01128	0.127	0.0461
R ²	0.9987	0.9584	0.9801
Adjusted R ²	0.9873	0.7364	0.8737

Breusch- Pagan (p-value test)	18.969 (0.3303)	19.664 (0.2358)	16.696 (0.4055)
AIC	-154.582	-87.76	-102.483

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 34: Exhaustive search Sustainable Diet and Nutrition

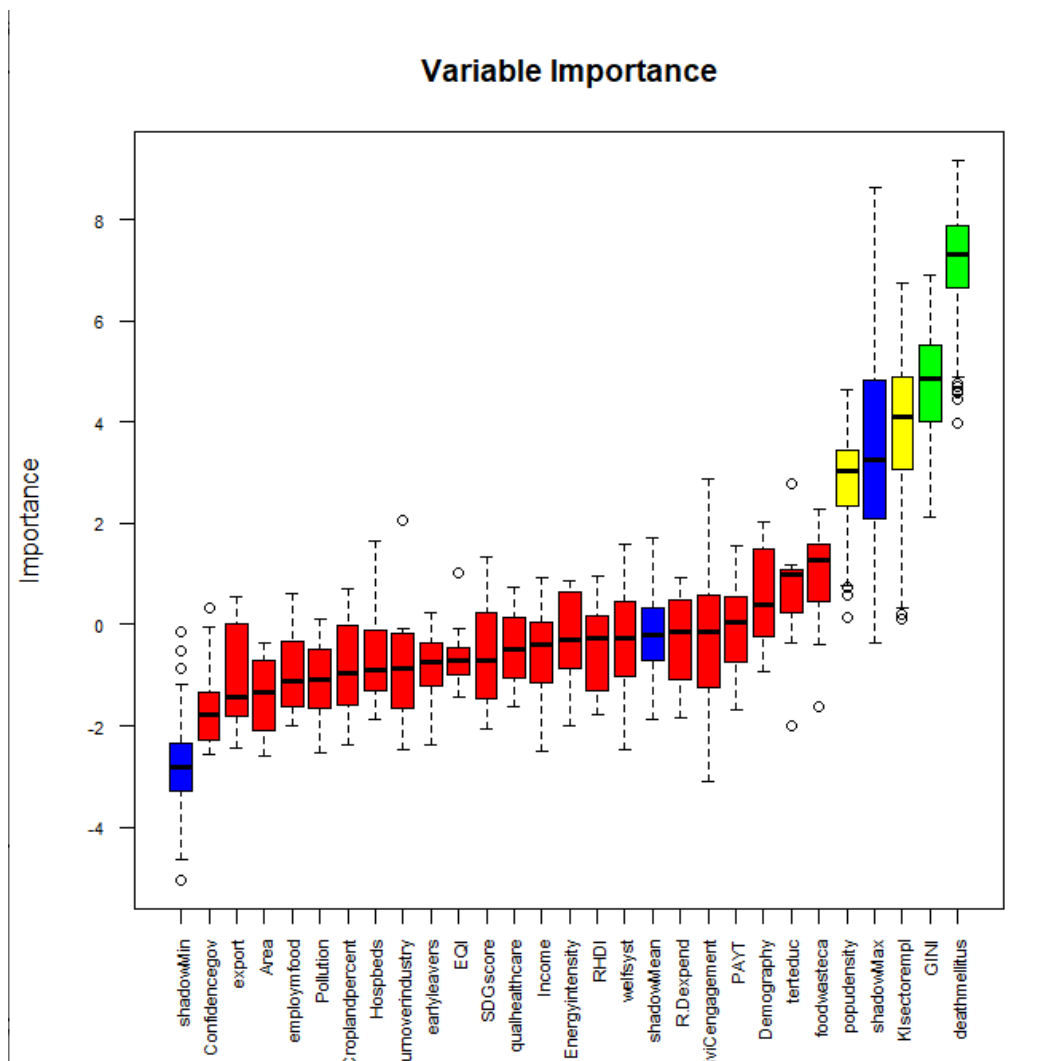


Figure 36: Boruta feature selection Sustainable Diets and Nutrition

SDG analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Are SDGs 1,2,3,12 scores linked to **Sustainable Diets and Nutrition** score?

Hypothesis: SDG 1, SDG 2, SDG 3, SDG 12

	Sustainable Diet and Nutrition			
	Model1	Model2	Model3	Model4
Intercept (<i>p-value</i>)	0.6211 (0.0000***)	0.6729 (0.0000***)	0.6588553 (0.0000***)	0.6866 (0.0000***)
SDG1	0.0003 (0.757)	0.0004 (0.594)	-	-
SDG2	0.0004 (0.457)	0.0006 (0.212)	0.0005 (0.218)	0.0005 (0.237)
SDG3	0.0002 (0.787)	-0.0003 (0.706)	0.00031 (0.648)	-
SDG12	0.0006 (0.223)	-	-	-
(<i>p-value test</i>)	(0.6471)	(0.6422)	(0.4554)	(0.7558)
R ²	0.1633	0.0967	0.0884	0.0768
Adjusted R ²	-0.0942	-0.0727	-0.0189	0.0255
Breusch-Pagan (<i>p-value test</i>)	1.6872 (0.793)	3.2108 (0.3602)	1.0403 (0.5944)	0.096712 (0.7558)
AIC	-45.2918	-52.2136	-54.0303	-55.7772
AICc	-37.66	-47.93	-51.36	-54.28
RMSE	NA	0.0511	0.0513	0.0516

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 35: Model creation Sustainable Diets and Nutrition pillar with related SDGs

SDGs 1,2,3,12 either combined or taken alone fail to be significant for this food smart pillar (cfr. table 35).

Appendix 5.5: Food Supply and Distribution

	Food Supply and Distribution		
	Model1	Model2	Model3
Intercept	-2.253e+00 (0.0049**)	-0.8559 (0.683)	-0.1882 (0.876)
Civicengagement	4.013e-02 (0.0043**)	0.0200 (0.560)	-0.0175 (0.505)
Confidencegov	-8.331e-03 (0.0033**)	-0.0064 (0.328)	-0.001 (0.869)
Demography	-8.18e-08 (0.0038**)	-	0 (0.746)
Employmentfood	5.234e+01 (0.00209**)	38.3752 (0.161)	3.39 (0.795)
EQI	-4.87e-03 (0.0032**)	-0.0049 (0.229)	-0.0022 (0.598)
Export	1.776e-02 (0.00237**)	0.0113 (0.215)	0.002 (0.726)
GINI	-1.428 e+00 (0.00644**)	-1.3305 (0.515)	0.9998 (0.597)
Income	1.045 e-01 (0.0031**)	0.0516 (0.381)	0.038 (0.541)
KIssectoremploy	4.350 e-03 (0.0093**)	-0.0003 (0.968)	-0.0033 (0.584)
Popudensity	-8.052 e-04 (0.0664.)	-0.0037 (0.736)	0.007 (0.599)
R.Dexpend	8.840 e-02 (0.0032**)	0.0378 (0.422)	0.0206 (0.745)
RHDI	2.960e -03 (0.0029**)	0.0015 (0.332)	0 (0.981)
SDGscore	1.171 e-02 (0.0048**)	0.0095 (0.456)	0.0113 (0.299)
terteduc	1.102 e-02 (0.0029)	0.0065 (0.336)	-0.0049 (0.390)
Turnoverindustry	-9.133e -06 (0.0020**)	0 (0.139)	0 (0.184)
Welfsyst[Eastern]	5.603 e-01 (0.0036**)	0.2663 (0.481)	
Welfsyst[Social Demo]	6.038e -01 (0.00211**)	0.5202 (0.150)	-
Welfsyst[Southern]	1.456e -01 (0.00967**)	0.0592 (0.837)	
(p-value test)	0.003758	0.2618	0.6057

R ²	1	0.9649	0.7739
Adjusted R ²	1	0.6667	-0.07394
Breusch- Pagan (p-value test)	19.849 (0.3414)	18.89 (0.3349)	16.994 (0.3192)
AIC	-268.2841	-65.708	-32.44184

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 36: Exhaustive search Food Supply and Distribution

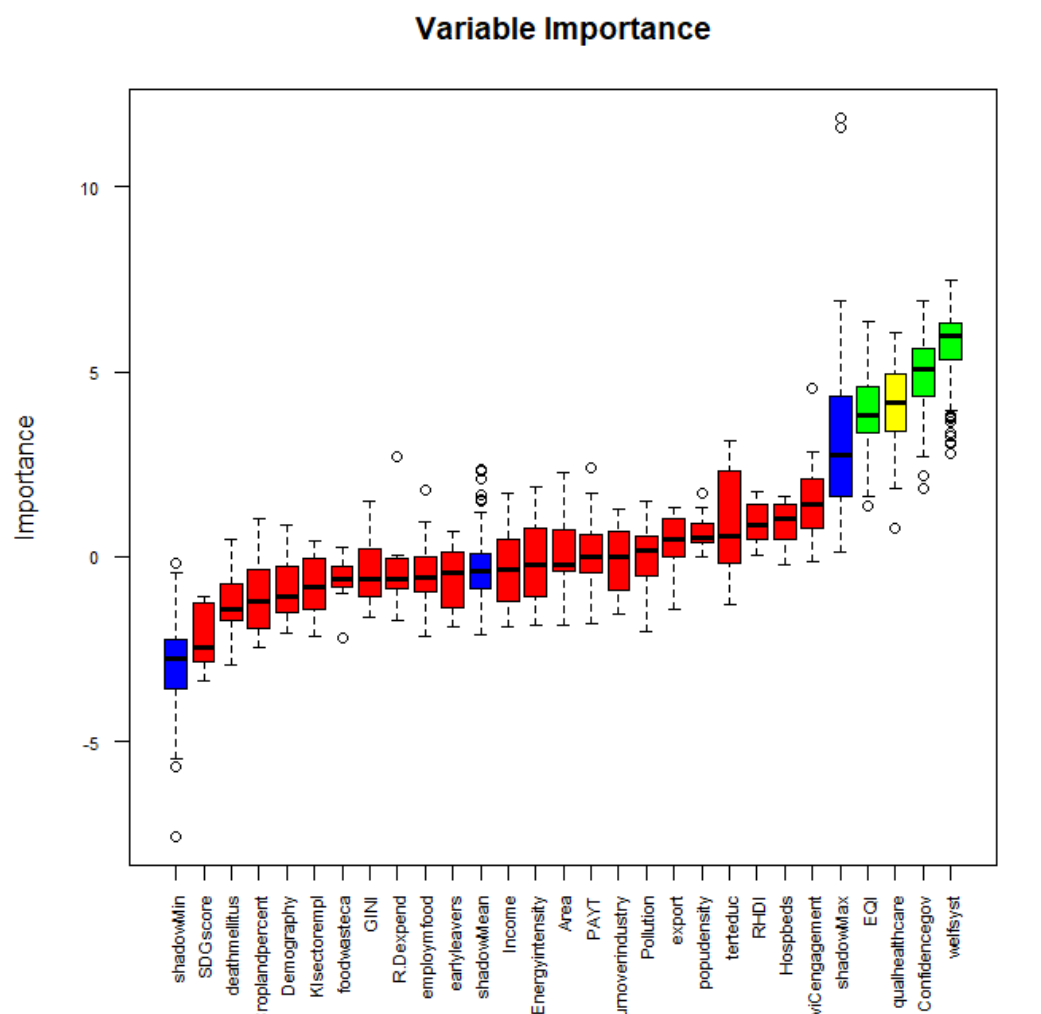


Figure 37: Boruta feature selection Food Supply and Distribution

SDG Analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Are SDGs 2,11,12,13 scores linked to **Food Supply and Distribution** score?

Hypothesis: SDG 2, SDG 11, SDG 12, SDG 13

	Food Supply and Distribution					
	Model1	Model2	Model3	Model4	Model5	Model6
Intercept (<i>p-value</i>)	0.5319 (0.0035**)	0.5264 (0.0004 ***)	0.4318 (0.0000***)	0.4928 (0.0001***)	0.3944 (0.0000***)	0.4698 (0.0000***)
SDG2	-0.0004 (0.6515)	-0.0003 (0.6503)	-0.0002 (0.7740)	-	-	-
SDG11	-0.0015 (0.9329)	-0.0012 (0.3841)	-	-0.0011 (0.4140)	-	-
SDG12	0.0005 (0.5477)	-	-	-	0.0005 (0.5590)	-
SDG13	-0.0001 (0.9454)	-	-	-	-	-0.00008 (0.5040)
(<i>p-value test</i>)	(0.8310)	(0.6505)	(0.7739)	(0.4138)	(0.5587)	(0.5037)
R ²	0.1003	0.0493	0.0047	0.0374	0.0218	0.0252
Adjusted R ²	-0.1765	-0.0625	-0.05059	-0.01605	-0.0393	-0.0289
Breusch-Pagan (<i>p-value test</i>)	2.8279 (0.587)	1.4888 (0.457)	0.3657 (0.5454)	0.0217 (0.8829)	0.8662 (0.352)	0.5454 (0.4602)
AIC	-21.8751	-29.7172	-30.7998	-31.4685	-26.3689	-31.2162
AICc	-14.24	-27.05	-29.3	-29.97	-24.65	-29.72
RSME	NA	0.094	0.096	0.0948	NA	0.0954

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 37: Model creation Food Supply and Distribution pillar with related SDGs

All combinations were made and again, given SDGs fail to be significant for our dependent variable Food Supply and Distribution, as can be seen from table 37.

Appendix 5.6: Food Production

	Food production		
	Model1	Model2	Model3
Intercept	0.264 (0.205)	0.3088 (0.3516)	0.0286 (0.851)
Area	0.0004 (0.1475)	0.0005 (0.30755)	-
Civicengagement	-0.0247 (0.0117*)	-0.0267 (0.0289*)	-0.0214 (0.0165*)
Deathmellitus	-0.0164 (0.0046**)	-0.0136 (0.0175*)	-0.0132 (0.0017**)
Demography	0 (0.4717)	0 (0.4076)	0 (0.08.)
Croplandpercent	-0.0045 (0.014*)	-0.0037 (0.0687.)	-0.0031 (0.0066**)
Welfsyst[Eastern]	0.03 (0.4647)	0.0131 (0.848)	0.0825 (0.0567.)
Welfsyst[Socialdemo]	0.1008 (0.1169)	0.1477 (0.1333)	0.0372 (0.4287)
Welfsyst[Southern]	0.1703 (0.0388*)	0.0646 (0.36)	0.1211 (0.0863.)
Turnoverindustry	0 (0.0118*)	0 (0.0198*)	0 (0.0051**)
Terteduc	-0.0021 (0.0613.)	-0.0021 (0.1715)	-0.0014 (0.1586)
SDGscore	-0.0133 (0.0205*)	-0.0125 (0.078.)	-0.0085 (0.0168*)
RHDI	0.0024 (0.0025**)	0.0023 (0.0069**)	0.002 (0.0005***)
Qualhealthcare	0.0127 (0.0048**)	0.0123 (0.0154*)	0.0099 (0.0009***)
R.Dexpend	0.0196 (0.1335)	0.0134 (0.4722)	0.0261 (0.089.)
KIsectoremploy	0.0097 (0.004**)	0.0074 (0.0126*)	0.0102 (0.0026**)
Popudensity	-0.0099 (0.0512.)	-	-0.0102 (0.0667.)
(p-value test)	0.005933	0.01284	0.00367
R ²	0.9951	0.979	0.989
Adjusted R ²	0.9691	0.9002	0.9478

Breusch- Pagan (p-value test)	18.889 (0.2745)	9.5773 (0.8455)	16.355 (0.3588)
AIC	-114.1014	-86.873	-99.832

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 38: Exhaustive Search Food Production

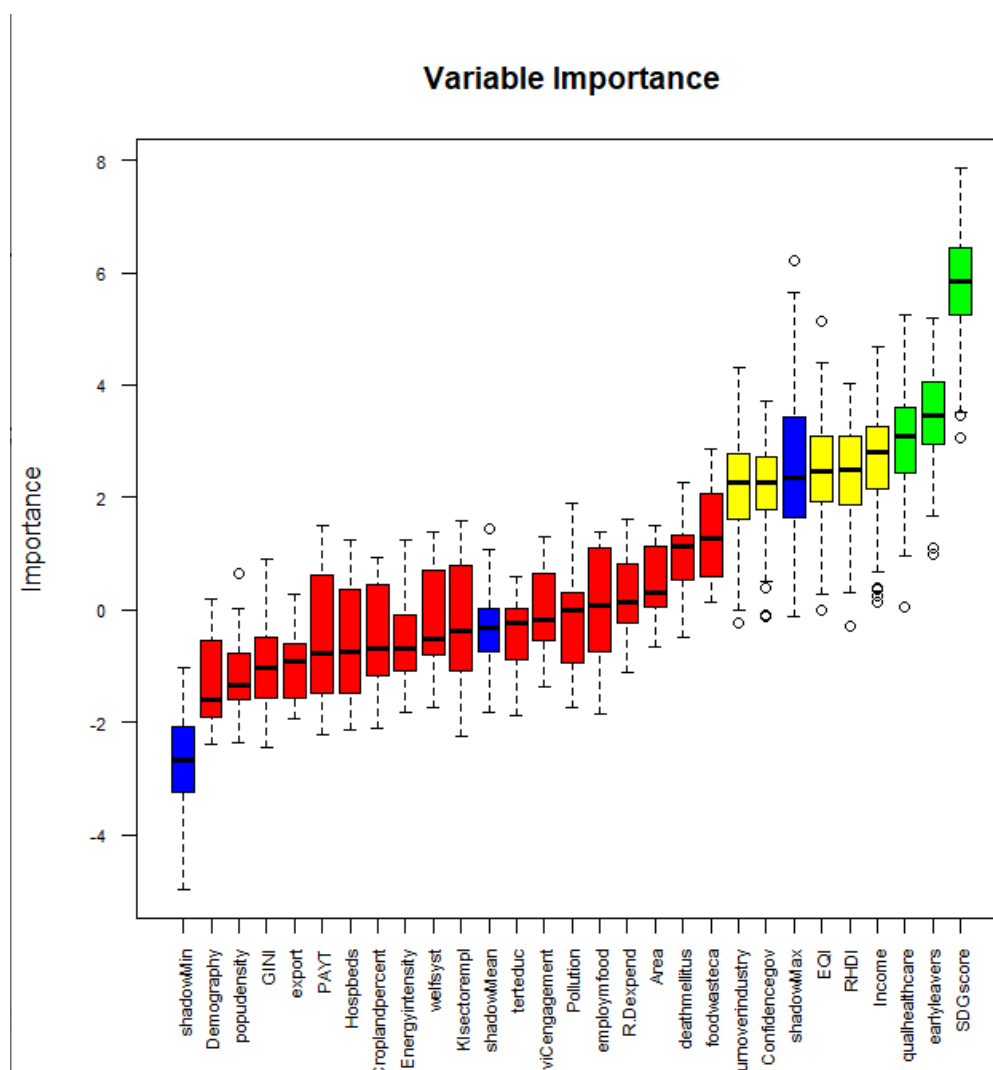


Figure 38: Boruta feature selection Food Production

SDG Analysis

P: Do the SDGs appointed by the MUFPP influence the implementation of particular categories of food smart practices?

R1: Are SDGs 2, 11, 12, 15 scores linked to **Food Production** score?

Hypothesis: SDG 2, SDG 11, SDG 12, SDG 15

	Food Production					
	Model1	Model2	Model3	Model4	Model5	Model6
Intercept (<i>p-value</i>)	0.2257 (0.1630)	0.2197 (0.0362 *)	0.3342 (0.0000***)	0.2884 (0.0016 **)	0.3777 (0.0000***)	0.3961 (0.0000***)
SDG2	0.0008 (0.2970)	0.0007 (0.2550)	0.0005 (0.3760)	-	-	-
SDG11	0.0015 (0.2610)	0.0014 (0.1950)	-	0.0012 (0.274)	-	-
SDG12	0.0000 (0.8990)	-	-	-	-0.0001 (0.929)	-
SDG15	-0.0001 (0.8970)	-	-	-	-	-0.0004 (0.71)
(<i>p-value test</i>)	(0.6867)	(0.2877)	(0.3757)	(0.275)	(0.9289)	(0.7098)
R ²	0.1500	0.1363	0.0438	0.0658	0.001	0.0079
Adjusted R ²	-0.1115	0.0347	-0.0092	0.0139	-0.0619	-0.0472
Breusch-Pagan (<i>p-value test</i>)	2.7004 (0.6091)	1.4279 (0.4897)	1.1064 (0.2929)	0.0074 (0.9316)	0.0316 (0.8589)	1.1119 (0.2917)
AIC	-28.3155	-38.5486	-38.5139	-38.9788	-31.3995	-37.7757
AICc	-20.726	-35.94	-36.97	-37.64	-29.75	-36.31
RMSE	NA	0.07546	0.08	0.078	NA	0.081

P-values are given under brackets in this table. * Significant with an interval of 95%, ** Significant with an interval of 99%

Table 39: Model creation Food Supply and Distribution pillar with related SDGs

No variables in the models we tested combining these SDGs are significative for Food Production. Indeed, we observe for our variables very low multiple R-squared and low adjusted R-squared. We can therefore conclude the absence of link between SDGs 2, 11,12,15 and the implementation of urban food production in cities (cfr. table 39).

Appendix 6: SDG analysis

Descriptive Statistics

The function summary, that can be consulted in table 40, gives a general overview of our variables. In this dataset, there is nine missing data. It can be observed that the mean of our

variables is always above 50, which means that our cities score generally above average on the SDGs. For SDG 13 Climate Action and SDG 15 Life on Land, none of our cities reach the maximum value of 100. For SDG 6 and 12, one city at least obtains a nul score. Concerning SDG 2, as the third quartile lies at 100, we can assume that a quite big proportion of cities has a score of 100 in this SDG. For SDG 15, we can see that compared to other SDGs, less cities obtain very high scores, as the third quartile lies at 77.26.

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
SDG 1	45.38	65.94	88.48	80.23	94.13	100
SDG 2	10.80	44.32	100	75.35	100	100
SDG 3	32.36	65.78	84.28	77.46	95.72	100
SDG 4	28.88	59.97	83.69	77.64	95.67	100
SDG 6	0	57.01	76.99	62.58	79.9	100
SDG 8	10.41	50.75	70.87	67.6	87.55	100
SDG 11	40.40	58.45	70.25	71.9	87.94	100
SDG 12	0	51.46	68.64	62.40	84.49	100
SDG 13	29.2	54.49	64.78	68.12	82.59	98.23
SDG 15	20.14	49.3	63.24	62.86	77.26	97.3
SDG 16	27.22	59.41	82.83	76.5	96.81	100

Table 40: Descriptive Statistics Sustainable Development Goals

Appendix 7: Dataset Variables

Variable name	Demography	Area	Popudensity	GINI	RHDI	CiviCengagement	EQI	Confidencegov	Pollution	foodwasteca
	Total nb of city inhabitants	City area in [km²]	City inhabitants per km²	GINI at disposable income after taxes and transfers on a [0-1] scale in region	Ranking in EU Development Index	Taken per region on a [0-1] scale	European Quality of Government index 2017 per region (quality, impartiality and corruption) [percentage]	Population that has confidence in the national government in region [percentage]	Pollution Index of the city [percentage]	Food waste per Capita per year per country [kg/capita/year]
Barcelona	1620343	98,20	16,5	0,325	149	4,4	40,8	27,32	64,23	55
Bilbao	345821	41,3	8,4	0,302	47	4,8	63,6	25,07	28,17	55
Brugge	118325	138	0,85	0,248	65	10	70,5	49,09	17,09	87
Ghent	260341	156	1,67	0,248	66	10	70,5	49,09	46,33	87
Marseille	862211	241	3,58	0,304	127	7,6	54	38,6	66,89	67
Milan	1378689	182	7,58	0,304	146	7,2	38,9	26,19	66,94	65
Turin	875698	130	6,74	0,286	169	6,9	23,4	29,4	69,61	65
Utrecht	352866	94,3	3,74	0,283	4	8,8	73,4	63,44	30,86	60
Athens	664046	39	17,03	0,355	190	5,7	22,9	21,3583	57,79	58
Bratislava	429564	368	1,167	0,275	107	5,1	28,5	24,955	41,27	62
Ljubljana	292988	275	1,065	0,248	115	2,8	43	25,2035	23,24	57
Riga	632614	304	2,081	0,345	232	5,7	38,2	23,2278	38,65	50
Vienna	1911728	415	4,61	0,337	122	7	68,1	43,71	18,38	74
Munich	1471508	311	4,736	0,294	6	7,5	78,6	51,22	24,77	57
Luxembourg	122273	51,5	2,376	0,281	8	10	75,5	72,57	22,22	56
Stockholm	974073	187	5,204	0,314	2	9	80,2	59,75	19,64	61
Warsaw	1700612	517	3,28	0,321	177	3,5	38	24,99	64,22	57
Tallinn	437619	159	2,746	0,361	180	5,6	54,4	33,12	22,13	61
Prague	1324277	496	2,67	0,3	51	5,2	45,8	37,66	35,11	53
Lisbon	547733	84,9	6,452	0,311	187	3,8	51,7	27,56	34,91	59
Sources	citypopulation.de	citypopulation.de	citypopulation.de	http://stats.oecd.org/version%20a4.pdf	https://ec.europa.eu	https://www.numbstaibility_index/				
	City Population	City Population	City Population	OECD	European Commission	OECD	European Commis	OECD	Numbco	BCFN
Retrieval date	12 October 2019	12 October 2019	12 October 2019	22 December 2020	22 December 2020	14 January 2020	14 January 2020	14 January 2020	14 January 2020	8 March 2020

Table 41 : Dataset variables

[illegible]

[illegible]

Appendix 8 : Alternative Framework- Final Scores - Detailed computations

MUFPP pillar	Indicator	MUFPP indicator name	Alternative indicator	Measurement unit
Food governance	1	Presence of an active municipal interdepartmental government body for advisory and decision making of food policies and programmes	/	Binary
Food governance	2	Presence of an active multi-stakeholder food policy and planning structure (e.g. food policy councils; food partnerships; food coalitions)	/	Binary
Food governance	3	Presence of a municipal urban food policy or strategy and/or action plans	/	Binary
Food governance	4	Presence of an inventory of local food initiatives and practices to guide development and expansion of municipal urban food policy and programmes	/	Binary
Food governance	5	Presence of a mechanism for assembling and analysing urban food system data to monitor/evaluate and inform municipal policy making on urban food policies	/	Binary
Food governance	6	Existence of a food supply emergency/food resilience management plan for the municipality (in response to disasters; vulnerabilities in food production, transport, access; socio economic shocks, etc.) based on vulnerability assessment	/	Binary
Sustainable diets and nutrition	7	Minimum dietary diversity for women of reproductive age	Prevalence of anaemia in women of reproductive age	Percentage
Sustainable diets and nutrition	8	Number of households living in “food deserts”	Percentage of people with access to at least one food within 15 minutes of walking	Percentage
Sustainable diets and nutrition	9	Costs of a nutritious food basket at city/community level	Daily recommended minimum amount of money for food per person in city	Price
Sustainable diets and nutrition	10	Individual average daily consumption of meat	Average total meat supply per person per country	kg/year
Sustainable diets and nutrition	11	Number of adults with type 2 diabetes	Prevalence of diabete and related risk factors among country population	Percentage
Sustainable diets and nutrition	12	Prevalence of stunting for children under 5 years	/	Percentage
Sustainable diets and nutrition	13	Prevalence of overweight or obesity among adults, youth and children	(BMI<30) %	Percentage
Sustainable diets and nutrition	14	Number of city-led or supported activities to promote sustainable diets	Public health is part of the top three priorities by city	Binary
Sustainable diets and nutrition	15	Existence of policies/programmes that address sugar, salt and fat consumption in relation to specific target groups (e.g. general public, in hospitals & schools)	Presence of Salt/fat/sugar programs in national schools policy	Binary
			SSBs taxes	Binary
			Legal mandatory act on marketing of food and non-alcoholic beverages to protect health	Binary
Sustainable diets and nutrition	16	Presence of programmes/policies that promote the availability of nutritious and diversified foods in public facilities	Variety of products is a Criteria for the choice of products distributed under the school scheme and any priorities for the choice of those products	Binary
			Presence of a municipal policy	Binary
			Nutrition based standards in school food schemes	Score
			Availability of alternative food systems in European prisons per country	Score
Sustainable diets and nutrition	17	Percentage of population with access to safe drinking water and adequate sanitation	Percentage of population satisfied with quality of water per region	Percentage
Social and economic Equity	18	Percentage of food insecure households based on the Food Insecurity Experience Scale (FIES)	Number of moderately or severely food insecure people in country (million)	Number
Social and economic Equity	19	Percentage of people supported by food and/or social assistance programmes	Beneficiaries of food aid services (percentage or total nb people in city/region)	Number/percentage
Social and economic Equity	20	Percentage of children and youth (under 18 years) benefitting from school feeding programmes	School food policy objectives are: to tackle health inequalities, prevent malnutrition, support parents and local communities?	Score
Social and economic Equity	21	Number of formal jobs related to urban food system that pay at least the national minimum or living wage	Number of jobs in the agrisector in the industry (region or municipality)	Number
Social and economic Equity	22	Number of community-based food assets in the city	Presence of community gardens	Binary
			Presence of community/soup kitchens	Binary
			Presence of a Food hub	Binary
Social and economic Equity	23	Presence of food-related policies and targets with a specific focus on socially vulnerably groups	/	Binary
Social and economic Equity	24	Number of opportunities for food system-related learning and skill development in i) food and nutrition literacy, ii) employment training and iii) leadership	Is food and nutrition a mandatory part of the national educational curriculum?	Binary
Food Production	25	Number of city residents within the municipal boundary with access to an (urban) agriculture garden	Percentage of population with access to at least one hectar of urban green areas	Percentage
Food Production	26	Presence of municipal policies and regulations that allow and promote agriculture production and processing in the municipal area	/	Binary
Food Production	27	Surface area of (potential) agricultural spaces within the municipal boundary	Urban green Area	Percentage
Food Production	28	Proportion of total agricultural population –within the municipal boundaries-with ownership or secure rights over agricultural land for food production, by sex	Land ownership	Percentage
			Participation of woman in farming	Percentage
Food Production	29	Proportion of agricultural land in the municipal area under sustainable agriculture	Proportion of agricultural land in the municipal area under sustainable agriculture	Percentage
Food Production	30	Number of urban and peri-urban food producers that benefitted from technical training and assistance in the past 12 months	Knowledge transfer and innovation in agriculture, forestry and rural area: number of trained person in region	Number
Food Production	31	Number of municipal food processing and distribution infrastructures available to food producers in the municipal area	Number of food and agriculture related clusters in the region	Number
Food Production	32	Proportion of local/regional food producers that sell their products to public markets in the city	Percentage of producers that directly sell their food for regional market	Percentage
Food Production	33	Annual proportion of urban organic waste collected that is re-used in agricultural production taking place within municipal boundaries	NA	NA
Food Supply and Distribution	34	Existence of policies/programmes that address the reduction of GHG emissions in different parts of the food supply chain	/	Binary
Food Supply and Distribution	35	Presence of a development plan to strengthen resilience and efficiency of local food supply chains logistics	/	Binary
Food Supply and Distribution	36	Number of fresh fruit and vegetable outlets per 1000 inhabitants (markets and shops) supported by the municipality	Number of food and farmers markets in the municipality	Number
Food Supply and Distribution	37	Annual municipal investment in food markets or retail outlets providing fresh food to city residents, as a proportion of total (investment) budget	Percentage of 2014-2020 Budget EU Rural Development Programme for Food chain organisation, including processing and marketing of agricultural products, animal welfare and risk management	€
Food Supply and Distribution	38	Proportion of food procurement expenditure by public institutions on food from sustainable, ethical sources and shorter (local/regional) supply chains	Percentage of agricultural holdings receiving support for participating in quality schemes, local markets and short supply circuits, and producer groups/organisation	%
Food Supply and Distribution	39	Presence of food safety legislation and implementation and enforcement procedures	National Food safety laws en regulations	Binary
Food Supply and Distribution	40	Existence of support services for the informal food sector providing business planning, finance and development advice	NA	NA
Food Waste	41	Total annual volume of food losses & waste	Food waste generation per inhabitant	kg/inhabitant
Food Waste	42	Annual number of events and campaigns aimed at decreasing food loss and waste	Food wastage and recovery is included in the school food policy standards and guidelines	Binary
			Presence of a municipal campaign on food waste	Binary
Food Waste	43	Presence of policies or regulations that address food waste prevention, recovery or redistribution	/	Binary
Food Waste	44	Total annual volume of surplus food recovered and redistributed for direct human consumption	/	Tons

Table 42 : Alternative Framework

Food Governance		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
1		1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0
2		1	1	1	1	1	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0
3		1	1	1	1	1	1	1	0	0	0	0	1	0	1	1	0.5	0	0.5	0	0
4		0	0	0	1	1	1	0	0.5	0	0	0	1	0	0	0	0	0	0	0	0
5		0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6		1	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0
Total		0.67	0.50	0.67	0.83	0.67	0.67	0.67	0.08	0	0.17	0.666666667	0.166666667	0.5	0.666666667	0.083	0.5	0.08333333333	0	0	0.333
Diet and Nutrition		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
7		0.8342	0.8342	0.8275	0.8275	0.8378	0.8378	0.8194	0.836	0.84	0.73	0.76	0.75	0.8267	0.837	0.8388	0.8456	0.7426	0.7439	0.7427	0.8249
8		0.973861	0.9595	0.9717	0.9657	0.9239	0.9099	0.8973	0.8973	0.8976	0.7021	0.7516	0.8068	0.8754	0.9119	0.7546	0.8307	0.7942	0.7811	0.7942	0.9421
9		0.700	0.590	0.480	0.6	0.510	0.475	0.475	0.565	0.564	0.782	0.713	0.964	0.57	0.6	0.46	0.5	0.713	0.9	0.84	0.91
10		1	1	0.807	0.807	0.656	0.656	0.828	0.756	0.7151	0.5919	0.762	0.685	0.87	0.877	0.92	0.77	0.885	0.6347	0.83	0.94
11		0.906	0.906	0.915	0.915	0.936	0.936	0.92	0.939	0.909	0.914	0.905	0.906	0.94	0.926	0.932	0.931	0.905	0.907	0.904	0.908
12		0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765	0.765
13		0.833	0.833	0.92	0.92	0.814	0.814	0.847	0.864	0.795	0.774	0.774	0.764	0.848	0.86	0.774	0.89	0.77	0.788	0.74	0.709
14		0	0	1	1	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	0
15		1	0.66	0.33	0.33	0.33	0.33	0.66	0	0.33	0.33	0.33	0.66	0.33	0	0.33	0	0.33	0	0.33	0
16		0.65	0.65	0.58	0.58	0.56	0.56	0.25	0.64	0.57	0.464	0.5625	0.794	0.25	0.5	0.5	0.554	0.67	0.5625	0.76	0.625
17		0.6541	0.8684	0.7427	0.7789	0.8647	0.8647	0.8187	0.9111	0.7555	0.8146	0.9587	0.7	0.9419	0.9338	0.8643	0.9587	0.7489	0.7908	0.9007	0.8456
Total		0.76	0.82	0.67	0.77	0.65	0.66	0.66	0.74	0.67	0.63	0.66	0.80	0.75	0.77	0.70	0.76	0.76	0.75	0.73	0.71
Economic Equity		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
18		0.924	0.924	0.93	0.93	0.891	0.891	0.938	0.959	0.8227	0.945	0.88	0.9	0.955	0.964	0.837	0.9511	0.925	0.947	0.96	0.883
19		0.07	0.03	0.01	0.025	0.012	0.007	0.05	0.007	0.0081	0.131	0.04	0.002	0.014	0.014	0.019	0.02	0.021	0.36	0.0168	0.033
20		1	1	0.66	0.66	0	0	0.33	0.33	0.33	1	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0	0.66
21		0.008	0.002	0.005	0.002	0.003	0.003	0.005	0.005	0.033	0.03	0.006	0.08	0.004	0.016	0.014	0.01	0.007	0.03	0.0275	0.004
22		0.66	0.66	0.66	0.66	0.33	0.33	0.66	0.66	1	0.33	0.66	1	0.33	0.66	0.66	0.66	0.66	0.66	1	0.66
23		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24		1	1	0	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1
Total		0.53	0.53	0.33	0.34	0.19	0.19	0.43	0.29	0.60	0.63	0.66	0.66	0.57	0.47	0.36	0.61	0.61	0.61	0.66	0.52
Food Production		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
25		0.973	0.981465	0.820478	0.976644	0.966058	0.930874	0.982373	0.844903	0.9586	0.9761	0.9925	0.699	0.9726	0.9839	0.9825	0.996	0.9976	0.9976	0.95	0.8466
26		1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0.5	1	0	1	1
27		0.2456	0.578	0.0483	0.15	0.286	0.24	2.001202261	0.43	0.069	0.275	0.424	0.209	0.2375	0.1627	0.3033	0.2414	0.2059	0.2522	0.3248	0.1468
28		0.413	0.413	0.254	0.254	0.454	0.454	0.487	0.553	0.26	0.398	0.46	0.43	0.53	0.532	0.42	0.695	0.362	0.43	0.436	0.423
29		0.12	0.0001	0.06	0.0316	0	0.006	0.258	1	0	0.0378	0.025	0.1	0.25	0.033	0.046	0.1916	0.0341	0.196	0.1409	0.0704
30		0.0025	0.01	0.0005	0.008	0.15	0.15	0.0001	0.00104	0.0063	0.0012	0.048	0.0073	0.068	0	0	0.013	0.007	0.003	0.0047	0.00613
31		1	0.143	0.143	0.143	0.143	0.57	0.143	0	0	0	0.143	0.143	0	0	0	0	0.143	0	0	0
32		0.083	0.0673	0.6	0.2	0.0451	0.0422	0.26	0.06	0.104	0.07	0.042	0.103	0.27	0.032	0.15	0.15	0.301	0.18	0.05	0.064
33		0.48	0.40	0.37	0.35	0.38	0.42	0.64	0.36	0.30	0.34	0.39	0.27	0.42	0.34	0.36	0.41	0.25	0.38	0.30	0.32
Total		0.48	0.40	0.37	0.35	0.38	0.42	0.64	0.36	0.30	0.34	0.39	0.27	0.42	0.34	0.36	0.41	0.25	0.38	0.30	0.32
Food Distribution		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
34		1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
35		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36		0.024	0.02	0.1	0.073	0.068	0.027	0.02	0.014	0.066	0.007	0.014	0.026	0.0115	0.0326	0.04	0.004	0.0053	0.009	0.00377	0.038
37		0.11	0.18	0.14	0.14	0.02	0.02	0.04	0.04	0.0654	0.191	0.113	0.0702	0.0688	0	0	0.0476	0.1115	0.106	0.111	0.0328
38		0.0403	0.0642	0.0068	0.0185	0.048	0.048	0.0356	0.039	0.0126	0.0041	0.0029	0.0506	0.3063	0	0	0.0093	0.0412	0.018	0.034	0.0322
39		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total		0.53	0.38	0.37	0.54	0.36	0.35	0.18	0.35	0.52	0.53	0.52	0.52	0.40	0.34	0.34	0.51	0.36	0.36	0.35	0.52
Food Waste		Baredona	Bilbao	Milan	Turin	Bruges	Ghent	Marseille	Utrecht	Athens	Bratislava	Ljubljana	Riga	Vienna	Munich	Luxembourg City	Stockholm	Warsaw	Tallinn	Prague	Lisbon
41		0.5714	0.25	0.222	0.333	0.377	0.77	1	0.583	0.455	0.18	0.278	0.1818	0.5	0.4	0.1613	0.27	0.37	0.37	0.29	0.2066
42		1	1	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	1	1	0.5	0.5	0.5	1	0.5	0.5	0	0
43		1	1	1	1	1	1	0	1	0	0	0	1	0.5	0.5	1	1	0.5	0.5	0	1
44		0.01	0.0018	0.0019	0.0078	0.0016	0.001	0.002	0	0.003	0.00186	0.00013	0	0.0032	0.0008	0.000455	0.0006	0.0016	0.0018	0.0085	0.004
Total		0.64535	0.56295	0.430975	0.4602	0.5679	0.56775	0.3755	0.52075	0.368825	0.170465	0.5695325	0.29545	0.3758	0.22302	0.415	0.568	0.0016	0.0018	0.0085	0.004
Total score		Baredona	Bilbao	Milan	Turin																

Indicator	Alternative indicator	Cities	Value	Name source	Source	Additional computation for final
1	Presence of an active municipal interdepartmental government body for advisory and decision making of food policies and programmes	Barcelona	1	Ajuntament de Barcelona	https://ajuntament.barcelona.cat/	
		Bilbao	1	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	
		Milan	1	Comune di Milano	http://www.foodpolicy.milano/	
		Turin	1	Città di Torino	https://www.academia.edu/24/	
		Brugge	1	Karine De Batselier (Klimaatcoördinator Stad Brugge)	Personal Contact	/
		Ghent	1	Katrien Verbeke (Coordinator of local food policy at City of Ghent)	Personal Contact	/
		Marseille	1	Laure Gaillard (Chief of the sustainable food, agricultural economy and food security)	Personal contact	/
		Utrecht	0	Anne-Marie Gout (Senior Beleidsadviseur Gezondheid / Thema)	Personal Contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public Relations)	Personal Contact	/
		Bratislava	0	/	/	/
		Ljubljana	0	Zala Strojín Božić (Circular economy manager)	Personal contact	/
		Riga	0	SupurbFood	http://providus.lv/article_file/	/
		Vienna	1	ESMAP	https://www.esmap.org/sites/	/
		Munich	1	Georg Sedlmeir (City Of Munich, Department Of Health And Environment)	Personal contact	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	1	Stockholm University	https://www.diva-portal.org/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townhall)	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Programme)	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relations)	Personal Contact	/
		Lisbon	0	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
2	Presence of an active multi-stakeholder food policy and planning structure (e.g. food policy councils; food partnerships; food coalitions)	Barcelona	1	Ajuntament de Barcelona	https://ajuntament.barcelona.cat/	
		Bilbao	1	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	
		Milan	1	Comune di Milano	http://www.foodpolicy.milano/	
		Turin	1	Città di Torino	https://www.academia.edu/24/	
		Brugge	1	Karine De Batselier	Personal contact	/
		Ghent	1	Katrien Verbeke	Personal contact	/
		Marseille	1	Laure Gaillard (Chief of the sustainable food, agricultural economy and food security)	Personal contact	/
		Utrecht	0	Anne-Marie Gout	Personal contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public Relations)	Personal contact	/
		Vienna	1	Adelheid Sagmeister (Coordinator for the Milan Urban Food Policy Hub)	Personal contact	/
		Munich	1	Food Policy Networks	http://www.foodpolicy.network/	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	1	Food Policy Networks	http://www.foodpolicy.network/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townhall)	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Programme)	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relations)	Personal Contact	/
		Lisbon	0	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
		Bratislava	0	/	/	/
		Ljubljana	1	Zala Strojín Božić (circular economy manager, city administration)	Personal contact	/
		Riga	0	SupurbFood	http://providus.lv/article_file/	/
3	Presence of a municipal urban food policy or strategy and/or action plans	Barcelona	1	Ajuntament de Barcelona	https://ajuntament.barcelona.cat/	
		Bilbao	1	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	
		Milan	1	Comune di Milano	http://www.foodpolicy.milano/	
		Turin	1	Città di Torino	https://www.academia.edu/24/	
		Brugge	1	Karine De Batselier	Personal contact	/
		Ghent	1	Katrien Verbeke	Personal contact	/
		Marseille	1	Laure Gaillard (Chief of the sustainable food, agricultural economy and food security)	Personal contact	/
		Utrecht	0	Anne-Marie Gout	Personal contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public Relations)	Personal contact	/
		Bratislava	0	/	/	/
		Ljubljana	1	Zala Strojín Božić (circular economy manager, city administration)	Personal contact	/
		Riga	0	SupurbFood	http://providus.lv/article_file/	/
		Vienna	1	Wien Government	https://www.wien.gv.at/engli	/
		Munich	1	Georg Sedlmeir (City Of Munich, Department Of Health And Environment)	Personal contact	/
		Luxembourg	0,5	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	0	Stockholm University	https://www.diva-portal.org/	/
		Warsaw	0,5	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townhall)	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Programme)	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relations)	Personal Contact	/
		Lisbon	0	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
4	Presence of an inventory of local food initiatives and practices to guide development and expansion of municipal urban food policy and programmes	Barcelona	0	Ajuntament de Barcelona	https://ajuntament.barcelona.cat/	
		Bilbao	0	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	
		Milan	0	Comune di Milano	http://www.foodpolicy.milano/	
		Turin	0	Città di Torino	https://www.academia.edu/24/	
		Brugge	1	Karine De Batselier	Personal contact	/
		Ghent	1	Katrien Verbeke	Personal contact	/
		Marseille	0	Laure Gaillard (Chief of the sustainable food, agricultural economy and food security)	Personal contact	/
		Utrecht	0,5	Anne-Marie Gout	Personal contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public Relations)	Personal contact	/
		Bratislava	0	/	/	/
		Ljubljana	1	Zala Strojín Božić (circular economy manager, city administration)	Personal contact	/
		Riga	0	SupurbFood	http://providus.lv/article_file/	/
		Vienna	0	/	/	/

Table 44 : Detailed computations

		Munich	1	Georg Sedlmeir (City Of Munich, Department Of Health And Er	Personal contact	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	0	/	/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townh	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Progi	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relatio	Personal Contact	/
		Lisbon	0	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
5	Presence of a mechanism for assembling and analysing urban food system data to monitor/evaluate and inform municipal policy making on urban food policies	Barcelona	0	Ajuntament de Barcelona	https://ajuntament.barcelona/	/
		Bilbao	0	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	/
		Milan	1	Comune di Milano	http://www.foodpolicymilano/	/
		Turin	1	Città di Torino	https://www.academia.edu/24/	/
		Brugge	0	Karine De Batselier	Personal contact	/
		Ghent	0	Katrien Verbeke	Personal contact	/
		Marseille	0	Laure Gaillard (Chief of the sustainable food, agricultural econo	Personal contact	/
		Utrecht	0	Anne-Marie Gout	Personal contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public R	Personal contact	/
		Bratislava	0	/	/	/
		Ljubljana	0	Zala Strojín Božić (circular economy manager, city administrati	Personal contact	/
		Riga	0	SupurbFood	http://providus.lv/article_file/	/
		Vienna	0	/	/	/
		Munich	0	Georg Sedlmeir (City Of Munich, Department Of Health And Er	Personal contact	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	0	Stockholm resilience center	https://www.stockholmresilience.org/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townh	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Progi	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relatio	Personal Contact	/
		Lisbon	1	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
6	Existence of a food supply emergency/food resilience management plan for the municipality (in response to disasters, vulnerabilities in food production, transport, access; socio economic shocks, etc.) based on vulnerability assessment	Barcelona	1	Ajuntament de Barcelona	https://ajuntament.barcelona/	/
		Bilbao	0	Bilbao Ekintza Bizkaia	https://info.beaz.bizkaia.eus/	/
		Milan	0	Comune di Milano	http://www.foodpolicymilano/	/
		Turin	1	Città di Torino	https://www.academia.edu/24/	/
		Brugge	0	Karine De Batselier	Personal contact	/
		Ghent	0	Katrien Verbeke	Personal contact	/
		Marseille	1	Laure Gaillard (Chief of the sustainable food, agricultural econo	Personal contact	/
		Utrecht	0	Anne-Marie Gout	Personal contact	/
		Athens	0	Dimitris Konstantopoulos (International Cooperation & Public R	Personal contact	/
		Bratislava	1	Resin	https://resin-cities.eu/fileadmin/	/
		Ljubljana	1	Zala Strojín Božić (circular economy manager, city administrati	Personal contact	/
		Riga	1	Fit4Food2030	https://fit4food2030.eu/wp-content/	/
		Vienna	0	/	/	/
		Munich	0	Georg Sedlmeir (City Of Munich, Department Of Health And Er	Personal contact	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal Contact	/
		Stockholm	1	Stockholm Resilience center	https://www.stockholmresilience.org/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townh	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Progi	Personal Contact	/
		Prague	0	Alena Hrdličková (Mayor's Office Prague, International Relatio	Personal Contact	/
		Lisbon	1	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
		Additional sources for Food Governance		MUFPP (2019)		
				De Cunto et al. (2017)		
				Magarini, de Cunto, et Porreca (2018)		
				Candel (2019)		
7	Prevalence of anaemia in women of reproductive age in	Barcelona	16,58	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Bilbao	16,58	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Milan	17,25	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Turin	17,25	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Brugge	16,22	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Ghent	16,22	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Marseille	18	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Utrecht	16,4	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Athens	15,88	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Bratislava	26,61	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Ljubljana	24,41	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Riga	25,13	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Vienna	17,33	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Munich	16,3	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Luxembourg	16,12	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Stockholm	15,44	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Warsaw	25,74	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Tallinn	25,61	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Prague	25,73	World Health Organisation	https://www.who.int/data/ghis/	1-...
		Lisbon	17,51	World Health Organisation	https://www.who.int/data/ghis/	1-...
8	Percentage of people with access to at least one food within 15 minutes of walking	Barcelona	97,3861	OECD	http://www.oecd.org/regional/	/

		Bilbao	95,960	OECD	http://www.oecd.org/regional/	
		Milan	97,1708	OECD	http://www.oecd.org/regional/	
		Turin	96,5722	OECD	http://www.oecd.org/regional/	
		Brugge	92,3923	OECD	http://www.oecd.org/regional/	
		Ghent	90,9988	OECD	http://www.oecd.org/regional/	
		Marseille	92,8311	OECD	http://www.oecd.org/regional/	
		Utrecht	89,7318	OECD	http://www.oecd.org/regional/	
		Athens	89,76	OECD	http://www.oecd.org/regional/	
		Bratislava	70,21	OECD	http://www.oecd.org/regional/	
		Ljubljana	75,16	OECD	http://www.oecd.org/regional/	
		Riga	80,68	OECD	http://www.oecd.org/regional/	
		Vienna	87,54	OECD	http://www.oecd.org/regional/	
		Munich	91,19	OECD	http://www.oecd.org/regional/	
		Luxembourg	75,46	OECD	http://www.oecd.org/regional/	
		Stockholm	83,07	OECD	http://www.oecd.org/regional/	
		Warsaw	87,23	OECD	http://www.oecd.org/regional/	
		Tallinn	79,42	OECD	http://www.oecd.org/regional/	
		Prague	78,11	OECD	http://www.oecd.org/regional/	
		Lisbon	94,21	OECD	http://www.oecd.org/regional/	
9	Daily recommended minimum amount of money for food per person in city	Barcelona	7,21	NUMBEO	https://www.numbeo.com/foi/	
		Bilbao	8,5	NUMBEO	https://www.numbeo.com/foi/	
		Milan	10,46	NUMBEO	https://www.numbeo.com/foi/	
		Turin	8,33	NUMBEO	https://www.numbeo.com/foi/	
		Brugge	9,83	NUMBEO	https://www.numbeo.com/foi/	
		Ghent	8,9	NUMBEO	https://www.numbeo.com/foi/	
		Marseille	10,56	NUMBEO	https://www.numbeo.com/foi/	
		Utrecht	8,89	NUMBEO	https://www.numbeo.com/foi/	
		Athens	6,42	NUMBEO	https://www.numbeo.com/foi/	
		Bratislava	6,21	NUMBEO	https://www.numbeo.com/foi/	
		Ljubljana	7,04	NUMBEO	https://www.numbeo.com/foi/	
		Riga	5,35	NUMBEO	https://www.numbeo.com/foi/	
		Vienna	8,77	NUMBEO	https://www.numbeo.com/foi/	
		Munich	8,41	NUMBEO	https://www.numbeo.com/foi/	
		Luxembourg	10,92	NUMBEO	https://www.numbeo.com/foi/	
		Stockholm	9,96	NUMBEO	https://www.numbeo.com/foi/	
		Warsaw	5,02	NUMBEO	https://www.numbeo.com/foi/	taken as reference value=1
		Tallinn	5,58	NUMBEO	https://www.numbeo.com/foi/	
		Prague	6	NUMBEO	https://www.numbeo.com/foi/	
		Lisbon	5,49	NUMBEO	https://www.numbeo.com/foi/	
10	Average total meat supply per person per country	Barcelona	100,25	Our World in data	https://ourworldindata.org/meat-production	taken as reference value=1
		Bilbao	100,25	Our World in data	https://ourworldindata.org/meat-production	
		Milan	80,95	Our World in data	https://ourworldindata.org/meat-production	
		Turin	80,95	Our World in data	https://ourworldindata.org/meat-production	
		Brugge	65,77	Our World in data	https://ourworldindata.org/meat-production	
		Ghent	65,77	Our World in data	https://ourworldindata.org/meat-production	
		Marseille	83,04	Our World in data	https://ourworldindata.org/meat-production	
		Utrecht	75,81	Our World in data	https://ourworldindata.org/meat-production	
		Athens	71,69	Our World in data	https://ourworldindata.org/meat-production	
		Bratislava	59,34	Our World in data	https://ourworldindata.org/meat-production	
		Ljubljana	76,39	Our World in data	https://ourworldindata.org/meat-production	
		Riga	68,72	Our World in data	https://ourworldindata.org/meat-production	
		Vienna	87,22	Our World in data	https://ourworldindata.org/meat-production	
		Munich	87,78	Our World in data	https://ourworldindata.org/meat-production	
		Luxembourg	80,07	Our World in data	https://ourworldindata.org/meat-production	
		Stockholm	77,06	Our World in data	https://ourworldindata.org/meat-production	
		Warsaw	88,7	Our World in data	https://ourworldindata.org/meat-production	
		Tallinn	63,63	Our World in data	https://ourworldindata.org/meat-production	
		Prague	82,78	Our World in data	https://ourworldindata.org/meat-production	
		Lisbon	94,06	Our World in data	https://ourworldindata.org/meat-production	
11	Prevalence of diabete and related risk factors among co	Barcelona	9,4	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Bilbao	9,4	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Milan	8,5	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...

		Turin	8,5	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Brugge	6,4	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Ghent	6,4	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Marseille	8	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Utrecht	6,1	World Health Organisation	https://www.who.int/diabetes/country-profiles/fr/	1-...
		Athens	9,1	World Health Organisation	https://www.who.int/diabetes	1-...
		Bratislava	8,6	World Health Organisation	https://www.who.int/diabetes	1-...
		Ljubljana	9,5	World Health Organisation	https://www.who.int/diabetes	1-...
		Riga	9,4	World Health Organisation	https://www.who.int/diabetes	1-...
		Vienna	6	World Health Organisation	https://www.who.int/diabetes	1-...
		Munich	7,4	World Health Organisation	https://www.who.int/diabetes	1-...
		Luxembourg	6,8	World Health Organisation	https://www.who.int/diabetes	1-...
		Stockholm	6,9	World Health Organisation	https://www.who.int/diabetes	1-...
		Warsaw	9,5	World Health Organisation	https://www.who.int/diabetes	1-...
		Tallinn	9,3	World Health Organisation	https://www.who.int/diabetes	1-...
		Prague	9,6	World Health Organisation	https://www.who.int/diabetes	1-...
		Lisbon	9,2	World Health Organisation	https://www.who.int/diabetes	1-...
12	Prevalence of stunting for children under 5 years	Barcelona	1,7	Index Mundi	https://www.indexmundi.com	mean = 1,7
		Bilbao	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Milan	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Turin	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Brugge	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Ghent	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Marseille	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Utrecht	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Athens	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Bratislava	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Ljubljana	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Riga	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Vienna	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Munich	1,3	Index Mundi	https://www.indexmundi.com	taken as reference value=1
		Luxembourg	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Stockholm	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Warsaw	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Tallinn	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
		Prague	2,6	Index Mundi	https://www.indexmundi.com	1,3/2,6= 0,5
		Lisbon	1,7	Index Mundi	https://www.indexmundi.com	1,3/1,7= 0,765
13	(BMI<30) %	Barcelona	16,7	SDG	https://www.sdindex.org/en/	1-...
		Bilbao	16,7	SDG	https://www.sdindex.org/reports/sdg-index-and-dashboards-report-for-european-cities/	1-...
		Milan	9,8	SDG	https://www.sdindex.org/reports/sdg-index-and-dashboards-report-for-european-cities/	1-...
		Turin	9,8	SDG	https://www.sdindex.org/en/	1-...
		Brugge	18,6	SDG	https://www.sdindex.org/en/	1-...
		Ghent	18,6	SDG	https://www.sdindex.org/en/	1-...
		Marseille	15,3	SDG	https://www.sdindex.org/en/	1-...
		Utrecht	13,6	SDG	https://www.sdindex.org/en/	1-...
		Athens	24,9	SDG	https://www.sdindex.org/en/	1-...
		Bratislava	20,5	SDG	https://www.sdindex.org/en/	1-...
		Ljubljana	20,2	SDG	https://www.sdindex.org/en/	1-...
		Riga	23,6	SDG	https://www.sdindex.org/en/	1-...
		Vienna	15,2	SDG	https://www.sdindex.org/en/	1-...
		Munich	14	SDG	https://www.sdindex.org/en/	1-...
		Luxembourg	22,6	SDG	https://www.sdindex.org/en/	1-...
		Stockholm	11	SDG	https://www.sdindex.org/en/	1-...
		Warsaw	23,1	SDG	https://www.sdindex.org/en/	1-...
		Tallinn	21,2	SDG	https://www.sdindex.org/en/	1-...
		Prague	26	SDG	https://www.sdindex.org/en/	1-...
		Lisbon	29,1	SDG	https://www.sdindex.org/en/	1-...
14	Public health is part of the top three priorities by city	Barcelona	0	De Cunto et al.	https://ec.europa.eu/research/	/
		Bilbao	1	MUFPP	http://www.milanurbanfoodp/	/
		Milan	0	FAO	http://www.fao.org/3/ca0901/	/
		Turin	1	MUFPP	http://www.milanurbanfoodp/	/
		Brugge	0	Karine De Batselier	Personal Contact	/
		Ghent	0	Katrien Verbeke	Personal Contact	/
		Marseille	0	Laure Gaillard (Chief of the sustainable food, agricultural economi	Personal Contact	/
		Utrecht	1	Anne-Marie Gout	Personal Contact	/
		Athens	0	100 Resilient Cities	https://www.100resilientcities/	/
		Bratislava	0	/	/	/
		Ljubljana	0	Zala Strojin Bozic (circular economy manager, city administrati	Personal Contact	/
		Riga	1	FAO	http://www.milanurbanfoodp/	/

		Vienna	1	FAO	http://www.fao.org/3/CA065/	
		Munich	1	Ifsa	http://ifsa.boku.ac.at/cms/file/	
		Luxembourg	1	Nicole Isaac (Assistante déléguée à l'environnement ville de Luxembourg)	Personal Contact	/
		Stockholm	1	NCBI	https://www.ncbi.nlm.nih.gov/	
		Warsaw	1	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townhouse)	Personal Contact	/
		Tallinn	1	Evelin Piirsalu (Senior expert Environmental Management Programme)	Personal Contact	/
		Prague	1	World Obesity	https://s3.eu-central-1.amazonaws.com/obesityworld/obesityworld.com	/
		Lisbon	0	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
15	A. Presence of Salt/fat/sugar programs in national schools policy: max sugar/fat/salt criteria	Barcelona	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Bilbao	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Milan	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Turin	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Brugge	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	Regional school scheme
		Ghent	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	Regional school scheme
		Marseille	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Utrecht	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Athens	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Bratislava	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Ljubljana	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Riga	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Vienna	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Munich	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	Regional school scheme
		Luxembourg	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Stockholm	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Warsaw	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Tallinn	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Prague	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Lisbon	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
	B. SSBs taxes	Barcelona	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Bilbao	0	World Health Organisation	https://iris.paho.org/bitstream/	
		Milan	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Turin	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Brugge	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Ghent	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Marseille	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Utrecht	0	World Health Organisation	https://iris.paho.org/bitstream/	
		Athens	1	World Health Organisation	https://iris.paho.org/bitstream/	
		Bratislava	0	Tax Foundation	https://taxfoundation.org/sod/	
		Ljubljana	0	Tax Foundation	https://taxfoundation.org/sod/	
		Riga	1	Tax Foundation	https://taxfoundation.org/sod/	
		Vienna	0	Tax Foundation	https://taxfoundation.org/sod/	
		Munich	0	Tax Foundation	https://taxfoundation.org/sod/	
		Luxembourg	0	Tax Foundation	https://taxfoundation.org/sod/	
		Stockholm	0	Tax Foundation	https://taxfoundation.org/sod/	
		Warsaw	0	Tax Foundation	https://taxfoundation.org/sod/	
		Tallinn	0	Tax Foundation	https://taxfoundation.org/sod/	
		Prague	0	Tax Foundation	https://taxfoundation.org/sod/	
		Lisbon	1	Tax Foundation	https://taxfoundation.org/sod/	
	C. Legal mandatory act on marketing of food and non-alcoholic beverages to protect health	Barcelona	1	European Commission	https://data.jrc.ec.europa.eu/	
		Bilbao	1	European Commission	https://data.jrc.ec.europa.eu/	
		Milan	0	European Commission	https://data.jrc.ec.europa.eu/	
		Turin	0	European Commission	https://data.jrc.ec.europa.eu/	
		Brugge	0	European Commission	https://data.jrc.ec.europa.eu/	
		Ghent	0	European Commission	https://data.jrc.ec.europa.eu/	
		Marseille	1	European Commission	https://data.jrc.ec.europa.eu/	
		Utrecht	0	European Commission	https://data.jrc.ec.europa.eu/	
		Athens	0	European Commission	https://data.jrc.ec.europa.eu/	
		Bratislava	0	European Commission	https://data.jrc.ec.europa.eu/	
		Ljubljana	0	European Commission	https://data.jrc.ec.europa.eu/	
		Riga	1	European Commission	https://data.jrc.ec.europa.eu/	
		Vienna	0	European Commission	https://data.jrc.ec.europa.eu/	
		Munich	0	European Commission	https://data.jrc.ec.europa.eu/	
		Luxembourg	0	European Commission	https://data.jrc.ec.europa.eu/	
		Stockholm	1	European Commission	https://data.jrc.ec.europa.eu/	
		Warsaw	0	European Commission	https://data.jrc.ec.europa.eu/	
		Tallinn	1	European Commission	https://data.jrc.ec.europa.eu/	
		Prague	0	European Commission	https://data.jrc.ec.europa.eu/	
		Lisbon	0	European Commission	https://data.jrc.ec.europa.eu/	as an addition of the 3 criterias/3
16	A. Variety of products is a Criteria for the choice of products distributed under the school scheme and any priorities for the choice of those products	Barcelona	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Bilbao	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Milan	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Turin	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Brugge	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	Regional school scheme
		Ghent	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	Regional school scheme
		Marseille	0	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	
		Utrecht	1	European Commission	https://ec.europa.eu/info/food/nutrition-and-food-safety/food-safety/food-safety-and-food-quality	

		Athens	1	European Commission	https://ec.europa.eu/info/foog/	
		Bratislava	1	European Commission	https://ec.europa.eu/info/sites/	
		Ljubljana	1	European Commission	https://ec.europa.eu/info/sites/	
		Riga	1	European Commission	https://ec.europa.eu/info/sites/	
		Vienna	0	European Commission	https://ec.europa.eu/info/sites/	
		Munich	0	European Commission	https://ec.europa.eu/info/sites/	
		Luxembourg	1	European Commission	https://ec.europa.eu/info/sites/	Regional school scheme
		Stockholm	0	European Commission	https://ec.europa.eu/info/sites/	
		Warsaw	1	European Commission	https://ec.europa.eu/info/sites/	
		Tallinn	0	European Commission	https://ec.europa.eu/info/sites/	
		Prague	1	European Commission	https://ec.europa.eu/info/sites/	
		Lisbon	1	European Commission	https://ec.europa.eu/info/sites/	
	B. Presence of a municipal policy on nutritious and div	Barcelona	1	De Cunto et al.	https://ec.europa.eu/research/	
		Bilbao	1	De Cunto et al.	https://ec.europa.eu/research/	
		Milan	1	MUFPP	http://www.milanurbanfoodp/	
		Turin	1	De Cunto et al.	https://ec.europa.eu/research/	
		Brugge	1	De Cunto et al.	https://ec.europa.eu/research/	
		Ghent	1	De Cunto et al.	https://ec.europa.eu/research/	
		Marseille	1	De Cunto et al.	https://ec.europa.eu/research/	
		Utrecht	1	FAO	http://www.fao.org/3/CA111/	
		Athens	1	Urbact	https://urbact.eu/sites/default/	
		Bratislava	0	/	/	/
		Ljubljana	0	Zala Strojín Božić (circular economy manager, city administrati	Personal Contact	/
		Riga	1	World health Organization	http://www.euro.who.int/en/c/	
		Vienna	1	MUFPP	http://www.fao.org/3/CA065/	
		Munich	1	City of Munich	http://www.ilo.org/dyn/migm/	
		Luxembourg	1	Nicole Isaac (Assistante déléguée ville de Luxembourg)	Personal contact	/
		Stockholm	1	NCBI	https://www.ncbi.nlm.nih.gov/	
	C. Nutrition based standards in school food schemes, score	Warsaw	0	World health organization	http://www.euro.who.int/_d/	
		Tallinn	1	Evelin Piirsalu (Senior expert Environmental Management Progr	Personal contact	/
		Prague	1	World Obesity	https://s3.eu-central-1.amazonaws.com/	
		Lisbon	1	European Commission	https://ec.europa.eu/research/	
		Barcelona	5/14	European Commission	https://ec.europa.eu/jrc/sites/j/	score as an addition of criterias/r
		Bilbao	5/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Milan	8/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Turin	8/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Brugge	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Ghent	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Marseille	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Utrecht	1/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Athens	4/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Bratislava	12/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Ljubljana	14/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Riga	6/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
	D. Availability of alternative food systems in European prisons per country, score	Vienna	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Munich	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Luxembourg	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Stockholm	10/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Warsaw	13/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Tallinn	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Prague	4/14	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Lisbon	0	European Union	https://ec.europa.eu/jrc/sites/j/	
		Barcelona	0,25	World Health Organization	https://apps.who.int/gho/data/	score as an addition of criterias/r
		Bilbao	0,25	World Health Organization	https://apps.who.int/gho/data/	
		Milan	0,75	World Health Organization	https://apps.who.int/gho/data/	
		Turin	0,75	World Health Organization	https://apps.who.int/gho/data/	
		Brugge	0,25	World Health Organization	https://apps.who.int/gho/data/	
		Ghent	0,25	World Health Organization	https://apps.who.int/gho/data/	
		Marseille	0	World Health Organization	https://apps.who.int/gho/data/	
		Utrecht	0,5	World Health Organization	https://apps.who.int/gho/data/	
		Athens	0	World Health Organization	https://apps.who.int/gho/data/	
		Bratislava	0	World Health Organization	https://apps.who.int/gho/data/	
		Ljubljana	0,25	World Health Organization	https://apps.who.int/gho/data/	
		Riga	0,75	World Health Organization	https://apps.who.int/gho/data/	
		Vienna	NA	World Health Organization	https://apps.who.int/gho/data/	
		Munich	NA	World Health Organization	https://apps.who.int/gho/data/	
		Luxembourg	NA	World Health Organization	https://apps.who.int/gho/data/	
		Stockholm	0,5	World Health Organization	https://apps.who.int/gho/data/	
		Warsaw	0,75	World Health Organization	https://apps.who.int/gho/data/	
		Tallinn	0,25	World Health Organization	https://apps.who.int/gho/data/	
		Prague	0,75	World Health Organization	https://apps.who.int/gho/data/	
		Lisbon	0,5	World Health Organization	https://apps.who.int/gho/data/	Total score indicator 16 is an addition of 4 criteria, divided by 4
17	Percentage of population satisfied with quality of water per region	Barcelona	65,41	OECD	http://www.oecd.org/regional/	
		Bilbao	86,8	OECD	http://www.oecd.org/regional/	
		Milan	74,2	OECD	http://www.oecd.org/regional/	
		Turin	77,9	OECD	http://www.oecd.org/regional/	

		Brugge	86,5	OECD	http://www.oecd.org/regional/	
		Ghent	86,5	OECD	http://www.oecd.org/regional/	
		Marseille	81,9	OECD	http://www.oecd.org/regional/	
		Utrecht	91,1	OECD	http://www.oecd.org/regional/	
		Athens	75,55	OECD	http://www.oecd.org/regional/	
		Bratislava	81,46	OECD	http://www.oecd.org/regional/	
		Ljubljana	91	OECD	http://www.oecd.org/regional/	
		Riga	70	OECD	http://www.oecd.org/regional/	
		Vienna	94,19	OECD	http://www.oecd.org/regional/	
		Munich	93,38	OECD	http://www.oecd.org/regional/	
		Luxembourg	86,43	OECD	http://www.oecd.org/regional/	
		Stockholm	95,87	OECD	http://www.oecd.org/regional/	
		Warsaw	74,89	OECD	http://www.oecd.org/regional/	
		Tallinn	79,08	OECD	http://www.oecd.org/regional/	
		Prague	90,07	OECD	http://www.oecd.org/regional/	
		Lisbon	84,56	OECD	http://www.oecd.org/regional/	
18	Number of moderately or severely food insecure people per country (million) (3-year average)	Barcelona	3,5	FAO	http://www.fao.org/faostat/fitr	1- (3,5 /populationcountry)
		Bilbao	3,5	FAO	http://www.fao.org/faostat/fitr	1- (3,5 /populationcountry)
		Milan	4,2	FAO	http://www.fao.org/faostat/fitr	1- (4,2 /populationcountry)
		Turin	4,2	FAO	http://www.fao.org/faostat/fitr	1- (4,2 /populationcountry)
		Brugge	1,2	FAO	http://www.fao.org/faostat/fitr	1- (1,2 /populationcountry)
		Ghent	1,2	FAO	http://www.fao.org/faostat/fitr	1- (1,2 /populationcountry)
		Marseille	4,1	FAO	http://www.fao.org/faostat/fitr	1- (4,1 /populationcountry)
		Utrecht	0,7	FAO	http://www.fao.org/faostat/fitr	1- (0,7 /populationcountry)
		Athens	1,9	FAO	http://www.fao.org/faostat/fitr	1-(1,9/populationcountry)
		Bratislava	0,3	FAO	http://www.fao.org/faostat/fitr	1-(0,3/populationcountry)
		Ljubljana	0,25	FAO	http://www.fao.org/3/a-17695	1-(0,25/populationcountry)
		Riga	0,2	FAO	http://www.fao.org/faostat/fitr	1-(0,2/populationcountry)
		Vienna	0,4	FAO	http://www.fao.org/faostat/fitr	1- (0,4 /populationcountry)
		Munich	3	FAO	http://www.fao.org/faostat/fitr	1- (3 /populationcountry)
		Luxembourg	0,1	FAO	http://www.fao.org/faostat/fitr	1- (0,1 /populationcountry)
		Stockholm	0,5	FAO	http://www.fao.org/faostat/fitr	1-(0,5/populationcountry)
		Warsaw	2	FAO	http://www.fao.org/faostat/fitr	1-(2/populationcountry)
		Tallinn	0,1	FAO	http://www.fao.org/faostat/fitr	1-(0,1/populationcountry)
		Prague	0,4	FAO	http://www.fao.org/3/a-17695	1-(0,4/populationcountry)
		Lisbon	1,2	FAO	http://www.fao.org/faostat/fitr	1-(1,2/populationcountry)
19	Beneficiaries of food aid services (percentage total city	Barcelona	112994	Banc del aliments Barcelona	https://www.bancdelaliment	/popucity= 0,07%
		Bilbao	29106	Bancali Bizkaia	https://www.bancali-biz.org/	/popucity
		Milan	105000	Banco Alimentare Lombardia	https://www.bancoalimentare	/popu city
		Turin	107469	Banco Alimentare Torino	https://www.bancoalimentare	/popuregion x popucity
		Brugge	14592	Ignace Bosteels (administrateur délégué voedselbank west vlaan	Personal contact	/popuregion x popucity
		Ghent	10795	Denys Vyncke voorzitter voedselbank oost-vlaanderen	Personal contact	/popucity
		Marseille	100000	Banques Alimentaires Bouches du Rhone	https://ba13.banquealimentai	/popuregion x popucity
		Utrecht	1100 households	FAO	http://www.fao.org/3/CA111	x average household size/ citypo
		Athens	30448	Foodbank Greece	https://foodbank.gr/en/	/ popucity
		Bratislava	13,10%	SAGE Encyclopedia	https://books.google.be/book/	
		Ljubljana	11569	Tadeja Kvas Mayer (Ministry of Agriculture, Forestry and Food	Personal contact	/ popucity
		Riga	1270	Agita Kraukle (foodbank manager Latvijas Samariešu apvieniba	Personal contact	1270/popucity
		Vienna	19000	Smart City Wiener	https://smartcity.wien.gv.at/s	/populationVienna
		Munich	20000	<u>Munich kaleidoscope</u>	https://sylviaboltan.weebly.eu/	/ popucity
		Luxembourg	11728	European Commission	https://www.buttek.lu/spende	/popucountry
		Stockholm	19408	Johan Rindevall (Business Area Manager at Matcentralen)	Personal contact	1497 social bank, estimation for
		Warsaw	36 000	Joanna Galek (Director food bank Warsaw)	Personal contact	/ popucity
		Tallinn	155606	Claudia Vihma (Project Manager Estonian Food bank	Personal contact	/ popucity
		Prague	22000	Rostislav Racek (Project Manager Foodbank Prague)	Personal contact	/ popucity
		Lisbon	66215	Ana Vara (Comissao de Voluntarios Banco Alimentar)	Personal contact	/ popucity
20	School food policy objectives are: to tackle health inequalities, prevent malnutrition, support parents and local communities?	Barcelona	1	European Commission	https://ec.europa.eu/jrc/sites/	Score: addition of 3 criteria / 3
		Bilbao	1	European Commission	https://ec.europa.eu/jrc/sites/	
		Milan	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Turin	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Brugge	0	European Commission	https://ec.europa.eu/jrc/sites/	
		Ghent	0	European Commission	https://ec.europa.eu/jrc/sites/	
		Marseille	0,33	European Commission	https://ec.europa.eu/jrc/sites/	
		Utrecht	0,33	European Commission	https://ec.europa.eu/jrc/sites/	
		Athens	0,33	European Commission	https://ec.europa.eu/jrc/sites/	
		Bratislava	1	European Commission	https://ec.europa.eu/jrc/sites/	
		Ljubljana	1	European Commission	https://ec.europa.eu/jrc/sites/	
		Riga	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Vienna	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Munich	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Luxembourg	0	European Commission	https://ec.europa.eu/jrc/sites/	
		Stockholm	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Warsaw	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Tallinn	0,66	European Commission	https://ec.europa.eu/jrc/sites/	
		Prague	0	European Commission	https://ec.europa.eu/jrc/sites/	
		Lisbon	0,66	European Commission	https://ec.europa.eu/jrc/sites/	

21	Number of jobs in the agrisector in the industry	Barcelona	3393900 0,018	European Commission	https://ec.europa.eu/eures/ma	employed populationx ratio labor in agriculture x barcelona population/catalonia population
		Bilbao	721	Beaz Bizkaia	https://info.beaz.bizkaia.eus/	/ popucity
		Milan	6853	Comune di Milano	http://www.foodpolicymilan.it/	/ popucity
		Turin	2128	Citego	http://base.citego.org/docs/fit/	/ popucity
						proportion agriculture in flandersx jobs in agriculture in belgium x flandersx proportion city/province
		Brugge	22.424	RTBF Info	https://www.rtbf.be/info/ecor	proportion agriculture in flandersx jobs in agriculture in belgium x flandersx proportion city/province
		Ghent	22.424	RTBF info	https://www.rtbf.be/info/ecor	proportion agriculture in flandersx jobs in agriculture in belgium x flandersx proportion city/province
		Marseille	0,50%	Metropole Aix Marseille Provence	https://storage.sbg.cloud.ovh	popu utrecht percentage agriculture jobsx working population utrecht / (popucity)
		Utrecht	1571	FAO	http://www.fao.org/3/CA111	21959/populationsAthens=0.033
		Athens	21959	Hellenic Statistical Authority	https://www.statistics.gr/en/s	21959/populationsAthens=0.033
		Bratislava	3%	Némethová J., Civián M.,	https://www.statistics.gr/en/s	21959/populationsAthens=0.033
		Ljubljana	0,60%	FAO	http://www.fao.org/3/CA087/	/
		Riga	8%	Baltis Studies Center	https://www.sufisa.eu/wp-co	Country average taken
		Vienna	0,40%	Eurostat	https://ec.europa.eu/growth/t/	/
		Munich	1,60%	Eurostat	https://ec.europa.eu/growth/t/	/
		Luxembourg	1,40%	Gouvernement du Grand Duché de Luxembourg	https://agriculture.public.lu/c/	/
22	A. Presence of Community gardens	Stockholm	1%	Chamber	https://www.chamber.se/	/
		Warsaw	0,70%	European Commission	https://ec.europa.eu/growth/t/	/
		Tallinn	3%	The World Bank	https://data.worldbank.org/in	Country average taken
		Prague	2,75%	The World Bank	https://tradingeconomics.com	Country average taken
		Lisbon	0,40%	European Commission	https://ec.europa.eu/growth/t/	/
		Barcelona	1	Ajuntament Barcelona	https://ajuntament.barcelona	/
		Bilbao	1	De Cunto et al.	https://ec.europa.eu/research/	/
		Milan	1	Senes et al.	https://ec.europa.eu/research/	/
		Turin	1	ProGireg	https://progireg.eu/turin/	/
		Brugge	1	Candel	https://ec.europa.eu/research/	/
		Ghent	1	De Cunto et al.	https://ec.europa.eu/research/	/
		Marseille	1	MadeinMarseille	https://madeinmarseille.net/3/	/
		Utrecht	1	De Cunto et al.	https://ec.europa.eu/research/	/
		Athens	1	Community Food Initiatives	https://communityfoodinitiati	/
		Bratislava	1	CityFarmers	https://cityfarmer.info/bratisl	/
		Ljubljana	1	FAO	http://www.fao.org/documen	/
		Riga	1	European Union	https://www.urbanallotments/	/
		Vienna	1	European Union	https://www.urbanallotments/	/
		Munich	1	City farmer	https://cityfarmer.info/report/	/
		Luxembourg	1	Gouvernement du Grand Duché de Luxembourg	https://fr.calameo.com/read/0	/
		Stockholm	1	Daily Scandinavian	https://www.dailyscandinavia	/
		Warsaw	1	GeoInfo	http://geoinfo.amu.edu.pl/qg/	/
		Tallinn	1	Baltic Urban Lab	https://www.balticurbanlab.e	/
		Prague	1	Ceska Pozice	https://ceskapozice.lidovsky.c	/
		Lisbon	1	European Commission	https://ec.europa.eu/research/	/
					.	/
	B. Presence of community/soup kitchens	Barcelona	1	Info Barcelona	https://www.barcelona.cat/in	/
		Bilbao	1	Power& Bruce	https://books.google.be/book	/
		Milan	1	Food for Soul	https://www.foodforsoul.it/w	/
		Turin	1	Fit4Food	https://fit4food2030.eu/wp-cs	/
		Brugge	0	/	/	/
		Ghent	0	/	/	/
		Marseille	1	Discosoupe	http://discosoupe.org/event/d	/
		Utrecht	1	NLCares	https://www.nlcares.nl/en/utr	/
		Athens	1	European Union	https://www.urbanallotments/	/
		Bratislava	0	/	/	/
		Ljubljana	0	/	/	/
		Riga	1	Caritas	https://www.caritas.org/wher	/
		Vienna	0	/	/	/
		Munich	1	Der Spiegel	https://www.spiegel.de/conse	/
		Luxembourg	1	Serve the City	http://servethecity.lu/	/
	C. Presence of a food hub: EIT food hub 2019-2020	Stockholm	1	Windber area Community Kitchen	https://www.windberkitchen	/
		Warsaw	1	Warsaw Volunteer mission	https://wym.org.pl/soup-kitc	/
		Tallinn	1	European Commission	https://epale.ec.europa.eu/en/	/
		Prague	0	/	/	/
		Lisbon	1	Culinary Backstreets	https://culinarybackstreets.co	/
		Barcelona	0	/	/	/
		Bilbao	0	/	/	/
		Milan	0	/	/	/
		Turin	0	/	/	/
		Brugge	0	/	/	/
		Ghent	0	/	/	/
		Marseille	0	/	/	/
		Utrecht	0	/	/	/
		Athens	1	European Institution of Innovation and Technology	https://eit.europa.eu/news-evi	/

		Bratislava	0	/	/	/
		Ljubljana	1	European Institution of Innovation and Technology	https://eit.europa.eu/news-ev/	/
		Riga	1	European Institution of Innovation and Technology	https://eit.europa.eu/news-ev/	/
		Vienna	0	/	/	/
		Munich	0	/	/	/
		Luxembourg	0	/	/	/
		Stockholm	0	/	/	/
		Warsaw	0	/	/	/
		Tallinn	0	/	/	Final score is addition of 3 score
		Prague	1	European Institution of Innovation and Technology	https://eit.europa.eu/news-ev/	
		Lisbon	1	European Institution of Innovation and Technology	https://eit.europa.eu/news-ev/	
23	Presence of food-related policies and targets with a specific focus on socially vulnerably groups	Barcelona	1	Ajuntament Barcelona	https://ajuntament.barcelona/	/
		Bilbao	1	Beaz Bizkaia	https://info.beaz.bizkaia.eus/	/
		Milan	1	Comune Di Milano	http://www.foodpolicy.milano/	/
		Turin	1	Citego	http://www.citego.org/bdf_fv/	/
		Brugge	1	RREUSE	http://www.rreuse.org/wp-co/	/
		Ghent	1	De Cunto et al.	https://ec.europa.eu/research/	/
		Marseille	1	Banque alimentaire france Urbaine	https://ba13.banquealimentaire/	/
		Utrecht	1	FAO	http://www.fao.org/fileadmin/	/
		Athens	1	European Commission	https://ec.europa.eu/research/	/
		Bratislava	1	European Commission	https://www.google.be/url?sa/	/
		Ljubljana	1	European Commission	https://www.google.be/url?sa/	/
		Riga	1	European Commission	https://www.google.be/url?sa/	/
		Vienna	1	Cooperative city	https://cooperativecity.org/20/	/
		Munich	1	City of Munich	http://www.ilo.org/dyn/migpi/	/
		Luxembourg	1	Food Assistance Covention	https://www.foodassistance.eu/	/
		Stockholm	1	Eurocities	http://nws.eurocities.eu/Medi/	/
		Warsaw	1	Eurocities	http://nws.eurocities.eu/Medi/	/
		Tallinn	1	World Health Organization	http://www.euro.who.int/_d/	/
		Prague	1	European Development agency	https://euda.eu/centre-of-soci/	/
		Lisbon	1	European Commission	https://ec.europa.eu/research/	/
24	Is food and nutrition a mandatory part of the national ex	Barcelona	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Bilbao	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Milan	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Turin	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Brugge	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Ghent	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Marseille	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Utrecht	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Athens	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Bratislava	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Ljubljana	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Riga	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Vienna	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Munich	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Luxembourg	0	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Stockholm	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Warsaw	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Tallinn	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Prague	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
		Lisbon	1	European Commission	https://ec.europa.eu/jrc/sites/j/	/
25	Percentage of population with access to at least 1 hectare of green urban areas (parks) and forests within 15 minutes of walking	Barcelona	97,3	OECD	http://www.oecd.org/regional/	/
		Bilbao	98,15	OECD	http://www.oecd.org/regional/	/
		Milan	82,05	OECD	http://www.oecd.org/regional/	/
		Turin	97,66	OECD	http://www.oecd.org/regional/	/
		Brugge	96,61	OECD	http://www.oecd.org/regional/	/
		Ghent	93,09	OECD	http://www.oecd.org/regional/	/
		Marseille	98,24	OECD	http://www.oecd.org/regional/	/
		Utrecht	84,49	OECD	http://www.oecd.org/regional/	/
		Athens	95,86	OECD	http://www.oecd.org/regional/	/
		Bratislava	97,61	OECD	http://www.oecd.org/regional/	/
		Ljubljana	99,25	OECD	http://www.oecd.org/regional/	/
		Riga	69,9	OECD	http://www.oecd.org/regional/	/
		Vienna	97,26	OECD	http://www.oecd.org/regional/	/
		Munich	98,39	OECD	http://www.oecd.org/regional/	/
		Luxembourg	98,25	OECD	http://www.oecd.org/regional/	/
		Stockholm	99,6	European Commission	https://ec.europa.eu/regional/	/
		Warsaw	95,33	OECD	http://www.oecd.org/regional/	/
		Tallinn	99,76	OECD	http://www.oecd.org/regional/	/
		Prague	95	OECD	http://www.oecd.org/regional/	/
		Lisbon	84,66	OECD	http://www.oecd.org/regional/	/
26	Presence of municipal policies and regulations that allow and promote agriculture production and processing in the municipal area	Barcelona	1	European Parliament	https://www.europarl.europa/	/
		Bilbao	1	Agrocities European Network	http://www.agroecocities.eu/	/
		Milan	1	Magarini& Porrecca, 2018	http://www.refreshcoe.eu/wp/	/
		Turin	1	Magarini& Porrecca, 2018	http://www.refreshcoe.eu/wp/	/
		Brugge	1	Purple EU	https://www.purple-eu.org/at/	/

		Ghent	1	European Parliament	https://www.europarl.europa/	
		Marseille	1	Medicities	http://www.medicities.org/doi/	
		Utrecht	0	Anne Marie Gout	Personal Contact	/
		Athens	1	100 Resilient Cities	https://www.100resilientcities.org/	
		Bratislava	1	SARIO	https://www.sario.sk/sites/de/	
		Ljubljana	1	FAO	http://www.fao.org/3/CA087/	
		Riga	0,5	Supurbfood	http://www.supurbfood.eu/ci/	
		Vienna	1	Urban Allotment Gardens in European Cities	https://www.urbanallotments.org/	
		Munich	1	City of Munich	http://www.ilo.org/dyn/migp/	
		Luxembourg	1	Nicole Isaac (Assistante déléguée à l'environnement ville de luxemb)	Personal contact	/
		Stockholm	1	Renewable Agriculture and Food systems	https://www.researchgate.net/	
		Warsaw	0	European Parliament	https://www.europarl.europa/	
		Tallinn	1	Baltic Urban Lab	https://www.balticurbanlab.eu/	
		Prague	0,5	Interreg	http://www.interreg-danube.eu/	
27	Urban green Area	Lisbon	1	Lisboa	https://www.lisboa.pt/cidade/	
		Barcelona	24,65	SDG	https://www.sdgindex.org/req/	
		Bilbao	57,8	Bilbao Turismo	https://www.bilbaoturismo.ni/	
		Milan	4,83	SDG	https://www.sdgindex.org/req/	
		Turin	15	SDG	https://www.sdgindex.org/req/	
		Brugge	28,6	Karine De Batselier	Personal Contact	/
		Ghent	24	Katrien Verbeke	Personal Contact	/
		Marseille	55,18	SDG	https://www.sdgindex.org/req/	
		Utrecht	43	OPPLA	https://oppla.eu/casestudy/19/	
		Athens	6,9	SDG	https://www.sdgindex.org/req/	
		Bratislava	27,526	SDG	https://www.sdgindex.org/req/	
		Ljubljana	42,43	SDG	https://www.sdgindex.org/req/	
		Riga	20,95	SDG	https://www.sdgindex.org/req/	
		Vienna	23,75	SDG	https://www.sdgindex.org/req/	
		Munich	16,27	SDG	https://www.sdgindex.org/req/	
		Luxembourg	30,33	SDG	https://www.sdgindex.org/req/	
		Stockholm	24,14	SDG	https://www.sdgindex.org/req/	
		Warsaw	20,59	SDG	https://www.sdgindex.org/req/	
		Tallinn	25,22	SDG	https://www.sdgindex.org/req/	
		Prague	32,48	SDG	https://www.sdgindex.org/req/	
		Lisbon	14,68	SDG	https://www.sdgindex.org/req/	
28	A. Land ownership	Barcelona	100	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Bilbao	100	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Milan	91,1	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Turin	91,1	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Brugge	99,8	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Ghent	99,8	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Marseille	100	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Utrecht	99	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Athens	86	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Bratislava	91,2	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Ljubljana	93,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Riga	93,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Vienna	99,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Munich	100	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Luxembourg	84,1	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Stockholm	99,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Warsaw	91,2	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Tallinn	93,7	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Prague	100	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Lisbon	99,6	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
	B. Participation of woman in farming	Barcelona	41,3	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	final computation is the multiplication of both factors
		Bilbao	41,3	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Milan	27,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Turin	27,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Brugge	45,5	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Ghent	45,5	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Marseille	48,7	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/

		Utrecht	55,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Athens	30,2	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Bratislava	43,7	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Ljubljana	48,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Riga	45,8	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Vienna	53,2	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Munich	53,2	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Luxembourg	50,1	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Stockholm	69,6	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Warsaw	39,7	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Tallinn	45,9	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Prague	43,6	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
		Lisbon	43,1	Barilla Center for Food and Nutrition	https://foodsustainability.eiu.com/heat-map/	/
29	Proportion of agricultural land in the municipal area under sustainable/organic agriculture	Barcelona	12	The Ingredient bio	http://theingredient.bio/en/20	/
		Bilbao	0,01	Statista	https://www.statista.com/stat	354 farmers xcitypopulation/pro
		Milan	6	Comune di Milano	http://www.foodpolicy.milano/	/
		Turin	3,16	Osservatorio Europeo del Paesaggio	https://www.ecoregion.info/v/	/
		Brugge	0	Katherine Verbeke	/	/
		Ghent	0,6	De Cock, Dessein et de Krom (2016)	https://www.sciencedirect.co/	/
		Marseille	25,8	PACA	https://paca.chambres-agricul/	/
		Utrecht	100	Gout, Anne Marie	/	/
		Athens	0	URBACT	https://urbact.eu/sites/default/	/
		Bratislava	3,78	Palsova, Schwarczova, et Schwarcz	https://www.sciencedirect.co/	/
		Ljubljana	2,5	Ljubljana	https://www.ruralur.si/sites/de/	/
		Riga	10	Supurbfood	http://www.supurbfood.eu/cii/	/
		Vienna	25	IFOAM EU organic group	https://euorganic2030.bio/en/	/
		Munich	3,3	Federal Ministry of food and agriculture	https://www.bmel.de/Shared/	Bavaria organic land average
		Luxembourg	4,6	Lux Times	https://luxtimes.lu/luxembourg/	Country average taken
		Stockholm	19,16	Eurostat	https://rea.apambiente.pt/com	Country average taken
		Warsaw	3,41	Eurostat	https://rea.apambiente.pt/com	Country average taken
		Tallinn	19,6	Eurostat	https://rea.apambiente.pt/com	Country average taken
		Prague	14,09	Eurostat	https://rea.apambiente.pt/com	Country average taken
		Lisbon	7,04	Eurostat	https://rea.apambiente.pt/com	Country average taken
30	Knowledge transfer and innovation in agriculture, fores	Barcelona	18900	European Commission	http://agricultura.gencat.cat/v/	((18900/popucatalunia)
		Bilbao	22055	European Commission	https://ec.europa.eu/info/sites/	((22055/popubasquecountry)
		Milan	4730	European Commission	https://ec.europa.eu/info/sites/	((4730/populombardy)x popucity)
		Turin	36000	European Commission	https://ec.europa.eu/info/sites/	((36000/popupiedmont)
		Brugge	981850	European Commission	https://ec.europa.eu/info/sites/	((981850/popuflanders)x popucity)
		Ghent	981850	European Commission	https://ec.europa.eu/info/sites/	((981850/popuflanders)x popucity)
		Marseille	626	European Commission	https://ec.europa.eu/info/sites/	((626/popuprovincealpes)
		Utrecht	18000	European Commission	https://ec.europa.eu/info/sites/	((18000/popunetherlands)x popu)
		Athens	67500	European Commission	https://ec.europa.eu/info/sites/	((67500/popugreece)
		Bratislava	6425	European Commission	https://ec.europa.eu/info/sites/	((6425/popuslovakia)
		Ljubljana	100600	European Commission	https://ec.europa.eu/info/sites/	((100600/popuslovenia)
		Riga	14000	European Commission	https://ec.europa.eu/info/sites/	((14000/popul Latvia)
		Vienna	609000	European Commission	https://ec.europa.eu/info/sites/	((609000/popuustria)
		Munich	0	European Commission	https://ec.europa.eu/info/sites/	/
		Luxembourg	0	European Commission	https://ec.europa.eu/info/sites/	/
		Stockholm	135000	European Commission	https://ec.europa.eu/info/sites/	((135000/popusweden)
		Warsaw	261811	European Commission	https://ec.europa.eu/info/sites/	((261811/popupoland)
		Tallinn	4000	European Commission	https://ec.europa.eu/info/sites/	((4000/popuestonia)
		Prague	50442	European Commission	https://ec.europa.eu/info/sites/	((50442/popuczechia)
		Lisbon	6303	European Commission	https://ec.europa.eu/info/sites/	((6303/popuportugal)
31	Number of food and agriculture related clusters in the r	Barcelona	7	European Cluster Collaboration Platform	https://www.clustercollaborai	is reference value =1
		Bilbao	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Milan	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Turin	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Brugge	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Ghent	4	European Cluster Collaboration Platform	https://www.clustercollaborai	4 as a proportion of 7
		Marseille	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Utrecht	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Athens	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Bratislava	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Ljubljana	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Riga	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7
		Vienna	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Munich	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Luxembourg	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Stockholm	0	European Cluster Collaboration Platform	https://www.clustercollaborai	0 as a proportion of 7
		Warsaw	1	European Cluster Collaboration Platform	https://www.clustercollaborai	1 as a proportion of 7

[illegible]

		Riga	1	Fit4Food2030	https://fit4food2030.eu/wp-cs/	
		Vienna	0	/	/	/
		Munich	0	Georg Sedlmeir (City Of Munich, Department Of Health And En	Personal contact	/
		Luxembourg	0	Maud LORANG (Assistante Scientifique Ville de Luxembourg)	Personal contact	/
		Stockholm	1	/	/	/
		Warsaw	0	Natalia Boitot (Vice Chair Eurocities, Inspector Warsaw Townh	Personal Contact	/
		Tallinn	0	Evelin Piirsalu (Senior expert Environmental Management Progr	Personal Contact	/
		Prague	0	Judita Eisenberger (EU and International Affairs Specialist Prag	Personal Contact	/
		Lisbon	1	Francisco Sarmento (FAO office in Lisbon)	Personal contact	/
36	Number of food and famers markets in the municipality	Barcelona	39	Ajuntament Barcelona	https://ajuntament.barcelona.nbmarkets/	(popu city/1000)
		Bilbao	7	Bilbao EUS	https://www.bilbao.eus/cs/Sa.nbmarkets/	(popu city/1000)
		Milan	137	Comune di Milano	http://www.foodpolicymilan.nbmarkets/	(popu city/1000)
		Turin	64	Wine and Food traveller	https://www.wineandfoodtrav.nbmarkets/	(popu city/1000)
		Brugge	8	Korte Keten Kaart	https://www.korteketenkaart.nbmarkets/	(popu city/1000)
		Ghent	7	Stad Gent	https://stad.gent/sites/default.nbmarkets/	(popu city/1000)
		Marseille	17	My Provence	https://www.myprovence.fr/g.nbmarkets/	(popu city/1000)
		Utrecht	5	FAO	http://www.fao.org/3/CA111.nbmarkets/	(popu city/1000)
		Athens	44	ThisisAthens	https://www.thisisathens.org.nbmarkets/	(popu city/1000)
		Bratislava	3	Bratislava info	http://www.bratislava.info/sh.nbmarkets/	(popu city/1000)
		Ljubljana	4	New York City Food Policy Center	https://www.nycfoodpolicy.o.nbmarkets/	(popu city/1000)
		Riga	16	European think and do thank	http://www.transition-europe.nbmarkets/	(popu city/1000)
		Vienna	22	Wien government	https://www.wien.gv.at/engli.nbmarkets/	(popu city/1000)
		Munich	48	Technical University of Munic	https://pdfs.semanticscholar.c48forfood:15farmersmarket.c	
		Luxembourg	5	Justarrived.lu	https://www.justarrived.lu/en.nbmarkets/	(popu city/1000)
		Stockholm	4	Real Scandinavia	https://askan.biz/2015/02/22.nbmarkets/	(popu city/1000)
		Warsaw	9	Warsawtour.pl	https://warsawtour.pl/en/mar.nbmarkets/	(popu city/1000)
		Tallinn	4	VisitEstonia	https://www.visitestonia.com.nbmarkets/	(popu city/1000)
		Prague	5	Prague Tv	https://prague.tv/en/s72/Dire.nbmarkets/	(popu city/1000)
		Lisbon	21	Lisbon city guide	https://www.lisbon-city-guide.nbmarkets/	(popu city/1000)
37	Percentage of 2014-2020 Budget EU Rural Developme	Barcelona	11,24	European Commission	http://agricultura.gencat.cat/v	
		Bilbao	18,2	European Commission	https://ec.europa.eu/info/sites/	
		Milan	14,01	European Commission	https://ec.europa.eu/info/sites/	
		Turin	14,34	European Commission	https://ec.europa.eu/info/sites/	
		Brugge	1,69	European Commission	https://ec.europa.eu/info/sites/	
		Ghent	1,69	European Commission	https://ec.europa.eu/info/sites/	
		Marseille	3,56	European Commission	https://ec.europa.eu/info/sites/	
		Utrecht	4,39	European Commission	https://ec.europa.eu/info/sites/	
		Athens	6,54	European Commission	https://ec.europa.eu/info/sites/	
		Bratislava	19,1	European Commission	https://ec.europa.eu/info/sites/	
		Ljubljana	11,3	European Commission	https://ec.europa.eu/info/sites/	
		Riga	7,02	European Commission	https://ec.europa.eu/info/sites/	
		Vienna	6,88	European Commission	https://ec.europa.eu/info/sites/	
		Munich	0	European Commission	https://ec.europa.eu/info/sites/	
		Luxembourg	0	European Commission	https://ec.europa.eu/info/sites/	
		Stockholm	4,76	European Commission	https://ec.europa.eu/info/sites/	
		Warsaw	11,15	European Commission	https://ec.europa.eu/info/sites/	
		Tallinn	10,6	European Commission	https://ec.europa.eu/info/sites/	
		Prague	11,11	European Commission	https://ec.europa.eu/info/sites/	
		Lisbon	3,28	European Commission	https://ec.europa.eu/info/sites/	
38	Percentage of agricultural holdings receiving support fr	Barcelona	4,03	European Commission	http://agricultura.gencat.cat/v	
		Bilbao	6,42	European Commission	https://ec.europa.eu/info/sites/	
		Milan	0,68	European Commission	https://ec.europa.eu/info/sites/	
		Turin	1,85	European Commission	https://ec.europa.eu/info/sites/	
		Brugge	4,8	European Commission	https://enrd.ec.europa.eu/site/	
		Ghent	4,8	European Commission	https://enrd.ec.europa.eu/site/	
		Marseille	3,56	European Commission	https://ec.europa.eu/info/sites/	
		Utrecht	3,9	European Commission	https://enrd.ec.europa.eu/site/	
		Athens	1,26	European Commission	https://ec.europa.eu/info/sites/	
		Bratislava	0,41	European Commission	https://ec.europa.eu/info/sites/	
		Ljubljana	2,9	European Commission	https://ec.europa.eu/info/sites/	
		Riga	5,06	European Commission	https://ec.europa.eu/info/sites/	
		Vienna	30,63	European Commission	https://ec.europa.eu/info/sites/	
		Munich	0	European Commission	https://ec.europa.eu/info/sites/	
		Luxembourg	0	European Commission	https://ec.europa.eu/info/sites/	
		Stockholm	0,93	European Commission	https://ec.europa.eu/info/sites/	
		Warsaw	4,12	European Commission	https://ec.europa.eu/info/sites/	
		Tallinn	1,8	European Commission	https://ec.europa.eu/info/sites/	
		Prague	0,34	European Commission	https://ec.europa.eu/info/sites/	
		Lisbon	3,22	European Commission	https://ec.europa.eu/info/sites/	
39	National Food safety laws and regulations	Barcelona	1	Agencia Española de Consumo, Seguridad Alimentaria y Nutrici	http://www.aecosan.mssi.go	
		Bilbao	1	Agencia Española de Consumo, Seguridad Alimentaria y Nutrici	http://www.aecosan.mssi.go	
		Milan	1	FAO	http://www.fao.org/food/fooc/	
		Turin	1	FAO	http://www.fao.org/food/fooc/	
		Brugge	1	Karine de Bastelier FASFC	https://www.fasfc.be/food/legislation	/
		Ghent	1	Katrien Verbeke FASFC	https://www.fasfc.be/food/legislation	/
		Marseille	1	Ministère de l'agriculture et l'alimentation	https://agriculture.gouv.fr/ali/	/
		Utrecht	1	Anne-Marie Gout Netherlands food and Consumer Product Safety Authority	https://english.nvwa.nl/	/

		Athens	1	European Commission	http://ec.europa.eu/food/audit/	
		Bratislava	1	European Commission	http://ec.europa.eu/food/audit/	
		Ljubljana	1	SEERural	http://www.seerural.org/wp-content/	
		Riga	1	Supurbfood	http://www.supurbfood.eu/ci/	
		Vienna	1	European Centre for Disease Prevention and Control	https://www.ecdc.europa.eu/en/	
		Munich	1	European Centre for Disease Prevention and Control	https://www.ecdc.europa.eu/en/	
		Luxembourg	1	Gouvernement du Grand Duché de Luxembourg	https://guichet.public.lu/fr/en/	
		Stockholm	1	Swedish National Food Agency	https://www.government.se/en/	
		Warsaw	1	Almanac	https://www.focus-on-food.eu/	
		Tallinn	1	Ministry of rural affairs Estonia	https://www.agri.ee/en/object/	
		Prague	1	Ministry of agriculture of the Czech Republic	https://www.bezpecnostpotravy.cz/	
		Lisbon	1	Economic and food safety Authority	http://www.asae.gov.pt/welc/	
40	Existence of support services for the informal food sector providing business planning, finance and development advice	Barcelona	NA	/	/	/
		Bilbao	NA	/	/	/
		Milan	NA	/	/	/
		Turin	NA	/	/	/
		Brugge	NA	/	/	/
		Ghent	NA	/	/	/
		Marseille	NA	/	/	/
		Utrecht	NA	/	/	/
		Athens	NA	/	/	/
		Bratislava	NA	/	/	/
		Ljubljana	NA	/	/	/
		Riga	NA	/	/	/
41	Food waste generation per inhabitant	Barcelona	35	Catalan News	https://www.catalannews.com/	
		Bilbao	80	Iswa.(2013). Food waste paper.	https://iswa2019.org/wp-content/	
		Milan	90	Comune di Milano	https://issuu.com/giorgioghini/	
		Turin	60	Citego	http://www.citego.org/bdf_fi/	
		Brugge	26	Brugge	http://www.reuse.org/wp-content/	
		Ghent	26	Brugge	http://www.reuse.org/wp-content/	
		Marseille	20	Comité régionale d'éducation pour la santé	http://www.cres-paca.org/_d/	taken as reference value=1
		Utrecht	34,3	Voedingscentrum	https://mobiel.voedingscentrum.nl/	
		Athens	44	Statista	https://www.statista.com/stat/	
		Bratislava	111	Ministry of agriculture Slovakia	https://spectator.sme.sk/c/208/	
		Ljubljana	72	Resource.co	https://resource.co/article/1jul/	
		Riga	110	European Parliament	https://www.europarl.europa.eu/	
		Vienna	40	Vienna shares	http://www.viennashares.org/	
		Munich	50	The Local	https://www.thelocal.de/2017/	
		Luxembourg	124	RTL today	https://today.rtl.lu/news/lux/	
		Stockholm	74	MDPI	https://www.google.be/ur/?sa/	
		Warsaw	54	Ministerie van landbouw, natuur en voedselkwaliteit	https://www.agroberichtenbu.nl/	
		Tallinn	54	Foundation for European Progressive Studies	https://www.feps-europe.eu/en/	
		Prague	69	University of economics Prague	https://www.researchgate.net/	
		Lisbon	96.8	Ministry ofAgriculture, Forestry and Rural Development, Lisbon	https://www.cncda.gov.pt/im/	
42	A. Food wastage and recovery is included in the school food policy standards and guidelines	Barcelona	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Bilbao	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Milan	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Turin	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Brugge	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Ghent	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Marseille	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Utrecht	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Athens	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Bratislava	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Ljubljana	1	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Riga	0	European Commission	https://ec.europa.eu/jrc/sites/j/	
		Vienna	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Munich	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Luxembourg	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Stockholm	1	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Warsaw	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Tallinn	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Prague	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
		Lisbon	0	European Commission	https://ec.europa.eu/jrc/en/pu/	
	B. Presence of a municipal campaign on food waste	Barcelona	1	Magarini& Porrecca, 2018	http://www.refreshcoe.eu/wp-content/	
		Bilbao	1	MUFPP	http://www.milanurbanfoodp.org/	
		Milan	1	De Cunto et al.	https://ec.europa.eu/research/	
		Turin	1	De Cunto et al.	https://ec.europa.eu/research/	
		Brugge	1	FoodLab	https://foodlab.brugge.be/brochure/	
		Ghent	1	Foodsavers	https://foodsavers.be/2017/ge/	
		Marseille	1	Ademe	https://serd.ademe.fr/program/	
		Utrecht	1	Magarini& Porrecca	http://www.refreshcoe.eu/wp-content/	
		Athens	1	European Commission	https://ec.europa.eu/environment/	
		Bratislava	0	European Environment Agency	Municipal waste management	
		Ljubljana	1	European Commission	https://ec.europa.eu/transpare/	
		Riga	0	Magarini& Porrecca, 2018	http://www.refreshcoe.eu/wp-content/	
		Vienna	1	Trifocal	http://resources.trifocal.eu/co/	
		Munich	1	European Union	https://www.acrplus.org/imag/	

		Luxembourg	1	Gouvernement du Grand Duché de Luxembourg	https://www.vdl.lu/en/city/pn/	
		Stockholm	1	Stockholm vatten och avfall	http://webbplatsarkivet.stockholm.se/	
		Warsaw	1	European Commission	https://www.municipalwaste.eu/	
		Tallinn	1	SIANI	https://www.siani.se/news-stories/	
		Prague	0	MUFPP	http://www.refreshcoe.eu/wp-content/uploads/2016/05/refreshcoe-report-2016.pdf	
		Lisbon	1	European Commission	https://ec.europa.eu/research/eu-research-projects/	
43	Presence of policies or regulations in the municipality/region that address food waste prevention, recovery or redistribution	Barcelona	1	Ajuntament Barcelona	https://ajuntament.barcelona.cat/	
		Bilbao	1	IHOBE	https://www.ihobe.eus/waste/	
		Milan	1	Comune di Milano	http://www.foodpolicymilan.eu/	
		Turin	1	Città di Torino	http://ojs.francoangeli.it/om/	
		Brugge	1	European Commission	https://ec.europa.eu/environn/	
		Ghent	1	European Commission	https://ec.europa.eu/environn/	
		Marseille	0	/	/	/
		Utrecht	1	FAO	http://www.fao.org/3/CA111/	
		Athens	0	Urbact	https://urbact.eu/athens-urbact/	
		Bratislava	0	OECD	https://www.oecd.org/enviro/	
		Ljubljana	1	TRiFocal	http://resources.trifocal.eu/co/	
		Riga	1	MUFPP	http://www.milanurbanfoodp/	
		Vienna	0,5	European Union	http://www.reducefoodwaste.eu/	
		Munich	0	/	/	/
		Luxembourg	1	Nicole Isaac (Assistante déléguée à l'environnement Ville de Luxembourg)	Personal Contact	/
		Stockholm	1	Stockholm Vatten och avfall	http://webbplatsarkivet.stockholm.se/	
		Warsaw	0,5	European Commission	https://www.municipalwaste.eu/	
		Tallinn	0,5	European Commission	https://www.municipalwaste.eu/	
		Prague	0,5	Interreg	https://www.interreg-central.eu/	
		Lisbon	1	European Commission	https://ec.europa.eu/research/eu-research-projects/	
44	Total annual volume of surplus food recovered and redistributed for direct human consumption per year (city or region)	Barcelona	16623	Banc del aliments Barcelona	https://www.bancdelsaliments.org/	/popucity
		Bilbao	3987	Bancali Bizkaia	https://www.bancali-biz.org/	/popucity
		Milan	19170	Banco Alimentare della Lombardia	https://www.bancoalimentare.org/	/popucity
		Turin	6811	Banco Alimentare Torino	https://www.bancoalimentare.org/	/popucity
		Brugge	1891,089	Ignace Bosteels (administrateur délégué voedselbank west vlaanderen)	Personal Contact	/popucity
		Ghent	1464,167	Denys Vyncke (voorzitter voedselbank oost-vlaanderen)	Personal Contact	/popucity
		Marseille	3700	Banques Alimentaires Bouche du Rhone	https://ba13.banquealimentaire.org/	/popucity
		Utrecht	NA	Voedselbank Utrecht	Personal Contact	/popucity
		Athens	1112	Food bank Greece	Personal Contact	/popucity
		Bratislava	800	Marko Urdzik (President of FoodBank Slovakia)	Personal Contact	/popucity
		Ljubljana	37,5	Alen Novit (Director of SIBAHE, Slovenian Food Bank)	Personal Contact	/popucity
		Riga	3,9	Agita Kraukle (foodbank manager Latvijas Samariešu apvienība)	Personal Contact	/popucity
		Vienna	615,24	Smart City Wiener	https://smartcity.wien.gv.at/s/	/popucity
		Munich	120	Munich kaleidoscope	https://sylviabolton.weebly.co.uk/	/popucity
		Luxembourg	55,62	Banque alimentaire Luxembourg	https://banquealimentaire.lu/	/popucity
		Stockholm	582,24	Johan Rindevall (Business area manager at Matcentralen)	Personal Contact	/popucity
		Warsaw	2 766	Joanna Galek	Personal Contact	/popucity
		Tallinn	77,8	Claudia Vihma (Estonian Food Bank Project Manager)	Personal Contact	155606 x 0.0005t
		Prague	1118	Rostislav Racek (Project Manager Foodbank Prague)	Personal Contact	/popucity
		Lisbon	7352	Ana Vara (Comissao de Voluntarios Banco Alimentar)	Personal Contact	/popucity

