1 **The contribution of Urban Food Policies toward food security in developing and developed countries: a**

2 **network analysis approach**

3 **Abstract**

4 Facing the new challenges of food security, Cities around the world are developing urban food

5 policies. Their objective is to integrate the hunger issues with the goals for a food system based on

6 the environmental, economic and social sustainability. The purpose of this study is to carry out a

7 comparative analysis of the urban food policies' actions envisaged by Cities around the world. The

8 methodology is based on the community detection method through network analysis, in which the

9 number of actions Cities have in common defines their adjacency in the network. The Milan Urban

10 Food Policy Pact, the unique worldwide City's platform, was used to select the Cities and to analyse

11 their actions, classified in six main topics: Ensuring and enabling environment for effective action;

12 Sustainable diets and nutrition; Social and economic equity; Food production; Food supply and

13 distribution; food waste. The result was the definition of three clusters: i) Agriculture for food

14 security; ii) Governance and food economy; iii) Sustainable and healthy consumption. This research

15 provides a description of the current policies main focuses, as well their main political gaps. In this

16 way it may also serve to improve future development.

17 **Key-words:** urban food policy, Milan Urban Food Policy Pact, Network analysis, Food security

18 **Highlights**

19 • Food security is an urban issue

20 • Specific local-based policies are in place around the world

21 • A network analysis was performed to detect discourse coalitions of Cities' policies

22 • Agriculture, governance and healthy nutrition are the main political concerns

23

1. Introduction

The continuous increase in population has produced a rapid expansion of urban settlements: the global population in 2050 will be nine billion, with individuals especially concentrated in metropolitan areas (FAO, 2015). People living in cities are net food consumers in comparison to rural population that is totally or partially involved in agricultural production: in other terms, the higher the level of urbanization, the higher the share of the non-agricultural population, and cities depend on food provision from rural areas.

The most common definition of FS "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*" was proposed in 1996 at the World Food Summit (WFS), which the main aim was focusing the international attention on the hunger issue.

Even if at a global level over the last decade there has been a decline of undernourished people of about 167 million (FAO, 2015), about 793 million people still suffer hungry (FAO 2015) and many millions of urban adults regularly fall short of the 2,100 kilocalories recommended for a healthy, active life. Moreover, international organization and scientific literature agree that the issue of food insecurity is and mainly will be an urban problem (Pothukuchi and Kaufman, 1999; Besthorn, 2013) in developing and developed countries (Speak, 2015); UFS has been significantly overlooked, especially because unemployment, overcrowding and decaying infrastructure and other relevant issue in the urban environment catalyse the attention of policy makers and planners (Maxwell, 1999).

In developing countries, food security issues are frequently related to chronicle insufficient access to food (Battersby, 2013). These countries often try to adapt their food production systems to meet the demand of the increasing urban population, both with their rural agro-food system and with the increasing importance of urban agriculture. In fact, urban agriculture, oriented at both subsistence and market, is one of the most effective leverage for enhancing food accessibility and in general UFS, but on the other hand production often takes place in polluted environments with health risks (De Bon et al., 2010) and a legal status lacks (Bryld, 2003). In recent years also peri-urban agriculture has been considered one of the most important actors in feeding the developing cities, with projects aimed at expanding peri-urban agriculture production to address societal shifts due to rapidly changing demographics (WVC, 2013). Another challenge regarding urban areas of developing countries are the adverse climate conditions and natural disasters characterizing regions in the

Global South, exacerbate the problems of food production and food availability. This problem is more severe in the most urbanized areas also suffering lack of land availability, as occurs in the so-called Megacities, quite widespread in the Asian countries.

Moreover, developing countries are severely affected by the volatility in global food prices. After the food crisis of 2007–2008 when the need of fertile lands for food production became evident, the fear of a political instability condition because of dependence on volatile food imports generated a huge part of the immediate demand for land in that period. The so called "rush for land" is caused by investors from all over the world acquiring land for agriculture and resource extraction, much of it in the global South, increasing the food insecurity of these countries (Mazzocchi et al., 2018). Urban residents are also more disadvantaged than rural residents because they are dependent on food markets and net consumers, so more vulnerable to potential price volatility (Szabo, 2016). As a consequence of this dependence, urban dwellers often refer to informal food systems, incurring in low quality food and lack of hygiene during food preparation and sale (Szabo, 2015, Obosu-Mensa, 2002). In particular, in the megacities, mainly in Asia, the demand for food is extremely high and concentrated and urban agriculture not applicable because of the limited or absent agricultural areas.

Lastly, in developing countries, many challenges are related to political instability and corruption (Szabo, 2016), in some cases leading to civil war, with cities that are often the more vulnerable places in which these issues arisen.

In developed countries different forms of urban poverty and food insecurity have been detected. In the US, the number of people affected by limited food supply increased from 33 million in 2001 (Brown and Carter, 2003) to 45 million in 2010 (Besthorn, 2013), reaching the at least 12 % of households (Macias, 2008). Between 2009 and 2012 in Europe, an increase of 75 %the number of people dependent on food assistance was observed (International Federation of Red Cross and Red Crescent Societies 2013). Moreover low-income neighborhoods within cities in the US are becoming 'food desert' where few grocery stores and more fast food restaurants exist (Segal, 2010).

So, also in the North the debate in literature recently comprehends the emerging focus on food access, highlighting spatial inequities in food retail and raising questions of access (Battersby, 2013). In 2013 with a discussed initiative Michelle Obama joined forces with Wal-Mart to promote healthy habits and fighting

children obesity in the USA cities, just to combat the phenomenon of the food deserts, opening outlets also in the suburban districts of big cities.

For all these reasons, scholars agree that including the FS in the urban policy is thus necessary to support a sustainable urban development (Smith, 1995). Moreover, the benefits of public interventions in the urban food security's planning rely both on the capacity network that public institutions may have and the multiplying effects of the positive impacts (Coppo et al., 2017).

1.1 Food policies: how to address the main issues

In several cities the political concerns on food security have led local institutions to develop such urban food policies (UFP) (Marsden and Sonnino, 2012). According to Raja et al. (2008, pp. 25), UFP should be *"comprehensive plans provide a roadmap for the future growth of a community. Inclusion of food issues in a comprehensive plan ensures that, along with ensuring adequate housing, jobs, transportation, etc., a community is positioned to have a well-functioning community food system in the future—one that provides access to healthful and affordable foods for all residents".* This means that the aim of the UFP should be not only to simply provide enough food to everyone, but to combine such provision with the limits of environmental, economic, and social sustainability (Sonnino, 2014), addressing the currents constraints of the urban food system (Coppo et al., 2017).

Authors have begun to point out and address several stakes to properly design and implement UFP, also basing their analysis on the first examples of UFP and have highlighted some critical issues in the UFP implementation.

Analysis on UFP dedicate specific place to reconnect the actual food production to the need of urban food system. Especially, according to authors, the analysis of what exactly is produced nearby the city is the first start to develop a secure and sustainable urban food system (Filippini et al., 2018; Morrison et al., 2011). Zasada et al (2017) point out that especially in metropolitan areas, is necessary to look at the regional context, where beside fostering food production, for its re-connection with urban areas, also organizational innovations towards short food supply chains are fundamental and acknowledged in research and policy. The most recent literature elaborates on this subject, often moving from the contribution of Wiskerke (2009) on the concept of "new food geographies", based on the conceptual framework of the triangle of the Short Food Supply Chains, Revaluation of Public Procurement and Urban Food Strategies issues.

Urban and Periurban agriculture can play a very relevant role in providing food for the cities and contribute to the UFS. According with Siegner et al (2018) studies on urban foodshed have been proposed to provide local institutions with framework to address the production issue of the city (Peter et al., 2008, Horst et al, 2017 McClintock et al., 2013) and have focused on the production potential of urban lands. Moreover, UFP can regulate UA by a) the adoption of enabling ordinances, for example land use designations and zoning ordinances; b) the regulations on urban agriculture productions, for example on backyard animals; c) the implementation of fiscal policy instruments, as tax abatement (Meenar et al., 2017),

Furthermore, one of the priorities of the UFP concerns the debate on how we eat and the modes of consumption (Lang and Barling, 2012), that cannot reduce the urban food question to a narrow nutritional agenda (Morgan, 2015: 2). The causes of the local nutritional lacks in terms of economic equity and social justice should be answered by "urban nutritional interventions", as a precondition for developing specific policies (Dixon et al., 2007). These interventions should be based on a comprehensive and integrated approach that combines infrastructure improvement, health promotion, and community participation (Kjellstrom et al., 2007). Urban design and planning would be greatly aided by routine assessment of the impact on health equity of where food retail outlets are placed and how easy it is to get to them, also through actions that may change the modes of transportations and distributions (Friel et al., 2007). Specific actions should also consider food safety protocols specific to the contexts, a control and better governance of the local activities of multinational supermarkets and food suppliers; initiatives for the food self-reliance. (WHO, 2008). The need for specific UFP in megacities is one of the most challenging goals, but very few efforts have been done at the moment. Concerns are also moved on the need to include the "exchange nodes" of the food supply, such as food platform, distributors, groceries, improving the food transportation (Sonnino, 2014, Feenstra, 2007). The UFP can support the development of innovative distribution systems which can work side by side with the large retail system with the technological innovation as one of the leverages enhancing urban sustainability and thus effective urban food policies (Martin et al., 2018). Being responsibility of local public bodies, public food procurement in schools and health centers is conceived as one of the first arena to drive the distribution of food towards sustainable modes of production and consumption (Viljoen and Wiskerke, 2012; Moragues-Faus and Morgan, 2015). For institutions, the inclusion of local and organic food is usually used to foster the sustainability of public food procurement. Empirical studies have shown that more than that, it is the local

alliance of public bodies, private companies and families that effectively impact the change in the organization of the food supply, improving the sustainability's performances (Filippini et al., 2018).

One of the most relevant issue of the UFP concerns the governance. In fact, the responsibilities for the different components of the urban food system are usually divided between various local authorities who do not work together and may take contradictory decisions. This hampers the food security of urban dwellers and thus the urban sustainable development (Smith, 1995). For this reason, coordinated food policy's actions are needed, taking care of the different steps of the urban food supply (Smith, 1995). Studies have verified that while some cities have tried to implement integrated strategies, more able to include the different dimensions of the agro-food system, others have just implemented disconnected actions towards FS (Doernberg et al., 2016). At the moment, also the issues of whether and how the city government should influence and intervene in the agricultural sector remains unresolved in literature, considering the typology and the amount of resources to be used (Cohen and Reynolds, 2014). UFP may have changing frameworks, looking at the themes and concerns developed in their local areas, and in this lies the innovation of policies (Coppo et al., 2017) and, to better coordinate the disparate elements of the food systems, Food Policy Councils should be established, including private and public actors, to support the effectiveness of private bottom up and institutional top down initiatives (Feenstra, 2007).

The topic of social justice is relevant in the literature of UFP, which should not privilege the needs of certain communities over others or exclude some groups in the policy-making process (Cohen and Reynolds, 2014). Urban agriculture, community gardens are usually proposed as a way to both ensure social inclusion and healthy food production. Especially urban agriculture is employed both as a tool of the entrepreneurial city and as a grassroots response to urban environmental injustice (Walker, 2015). Nevertheless, Horst et al (2017) demonstrate in their robust review the "dangerous relationships" between UFP and food justice: "*Urban agriculture may reinforce and deepen societal inequities by benefitting better resourced organizations and the propertied class and contributing to the displacement of lower-income households. The precariousness of land access for urban agriculture is another limitation, particularly for disadvantaged communities.*" (pp.277).

According to the literature to the best of our knowledge, a worldwide review of urban food policies and plans is missing. The overall purpose of this research is to perform a comparative analysis of the UFP and/or the urban food actions carried out around the world. The unique existing formal platform grouping cities around

the world which share the same values and the same engagements is the Milan Urban Food Policy Pact (MUFPP). On the occasion of a major event during Expo 2015, the MUFPP has gathered cities of the whole world interested in defining urban policies for FS. It is an international protocol, engaging 148 cities in the development of food policy systems, based on the principles of sustainability and social justice. On the base of these cities the sample has been selected.

To highlight the main trends of the urban food policies and actions, the methodology is based on Network Analysis. Network Analysis enables the characterisations of cities' groups on the base of the common policies implemented, using a person-groups approach (Borgatti and Everett, 1997). Section two describes the methodology, including the case study, data and modelling. Section three shows the results which have been discussed in section four. Finally, section five illustrates the conclusions.

2. Methodology

The methodology is based on the community detection through network analysis. Following the person-groups approach (Borgatti and Everett, 1997) the network analysis creates associations between actors based on their similarities. In political analysis, such similarities are based on the ideas actors share, the so-called "discourse coalitions" (Leifeld, 2017). To do so, the qualitative textual analysis of political discourses, needs to be standardized, using a qualitative coding (Saldanha, 2009). In this way, the network analysis also provides a standardized measurement of content coalitions or disagreement between actors. Consequently, clusters in the network are groups of actors with stronger discourse coalition (Fisher et al., 2013).

Such methodology has been already proposed by the Discourse Network analysis (Leifeld, 2017), in analysing political discourses on climate changes (Fisher et al., 2013), or in other policy's analysis contributions (i.e. Leifeld and Haunss, 2012; Rennkamp et al., 2017), where the aim of the network was to put in relationships the actors through the content of their political discourses. According to the authors at the base of the Discourse Network analysis, since "the alignment of actors by common claims is essentially a relational phenomenon" (Leifeld and Haunss, 2012: 389), the use of social network analysis is essential to properly placing their position in the general debate. In this study, the network between the Cities is based on the analysis of the Cities' urban food policies documents, and the network is created considering the actions Cities have in common. In other words, the network resulting from the analysis is based on the similarities between policies, not on the actual links between cities. The clusters created through the community detection are thus groups

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of policies with similar actions planned. Notably, in this study the methodology follows three main steps: firstly, the database was created, by selecting the policies, and by performing the textual analysis and the actions coding; then, the ~~Cities~~ network between Cities' policies was developed; finally, clusters were detected and analysed.

2.1 Sample and database

The Milan Urban Food Policy Pact (MUFPP) is an international protocol, subscribed by the Mayors of 148 Cities around the world (MUFPP, 2017). Initiated during a major event of Expo 2015 in Milan (Italy), the MUFPP engages the Cities in the development of urban food systems that can contribute to improve FS and the sustainable development. The list of the 148 cities which have signed the MUFPP has been chosen as the sample for this analysis. Based on that, a first Cities selection was conducted to consider only the cities that have effectively developed urban food policies, or that have carried out specific actions in the topic of the urban food governance. In this phase among the 148 Cities, only 32 of them were selected (Table 1). The policy's documents were found through an internet search started from the municipalities' websites and using key words such as "urban food strategy", "urban food policy", "food security", "urban food system", translated in the official languages of the City's Countries.

City	UFP or Action/s	References
Almere	Agromere	The RUAF Foundation, 2011
Amsterdam	Food & Amsterdam; Proeftuin Amsterdam	European Commission, 2008; Gemeente Amsterdam, 2013.
Baltimore	Baltimore Food Policy Initiative	Baltimore City, 2014
Belo Horizonte	Secretaria Municipal de Abastecimento's projects	Rocha, 2016
Berlin	Several projects of urban agriculture	Berlin Metropolis, 2015
Bilbao	Several actions of food governance	MUFPP, 2016
Birmingham	Birmingham Food Charter	Birmingham Food Council, 2014
Bogotà	Plan Maestro de Abastecimiento de Alimentos para Bogotá	Alcadia Bogotà, 2008
Chicago	A Recipe for Healthy Places	City of Chicago, 2013
Ghent	Gent en Garde	Ghent Food Policy Council, 2014
Johannesburg	Agriculture and Food Security priority, part of the Joburg 2040 Strategy	City of Johannesburg Metropolitan Municipality, 2011
La Paz	Ley Municipal Autónoma No. 105 de Seguridad Alimentaria de La Paz	Ciudad de Nuestra Señora de La Paz, 2014
London	London Food Strategy - Healthy and Sustainable Food for London	London Development Agency, 2006
Lusaka	Women Groups Economical Empowerment	MUFPP, 2015b
Madrid	Alimentando otro modelo de ciudad	Ajuntamento de Madrid, 2016
Melbourne	Food city: City of Melbourne Food Policy	City of Melbourne, 2014
Mexico City	Aliméntate; Comedores Comunitarios	MUFPP, 2015b
Milano	Food Policy Milano	Città Metropolitana di Milano, 2015

Montreal	Plan de développement Système Alimentaire Montréalais 2025	Cré de Montreal, 2015
Nairobi	Nairoby Urban Food Bill: Nairobi fresh	Nairobi City County, 2014
New York	FoodWorks	The New York City Council, 2013
Paris	Plan alimentation durable	Marie de Paris, 2015
Pittsburgh	Pittsburgh Food policy Council website actions	Pittsburgh Food Policy Council, 2016
Quito	AGRUPAR	MUFPP, 2015b
Rotterdam	Food & The City	City of Rotterdam, 2012
Riga	Getliņi EKO	MUFPP, 2015b
San Francisco	San Francisco Healthy and Sustainable Food Policy	San Francisco Department of Public Health, 2010
Sao Paulo	1° Plano Municipal de segurança alimentar e nutricional 2016-2020	Prefeitura do Município de São Paulo, 2016
Toronto	Toronto Food Strategy	Toronto Public Health, 2010
Torino	Towards the Turin Food Policy. Best Practices and visions	Città di Torino, 2016
Utrecht	Lekker Utregs	Lekker Utregs Website, 2012
Vancouver	What feeds us: Vancouver food strategy	City of Vancouver, 2013

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Table 1 Selected Cities and their UFP or Action

2 All the policy's documents selected are provided with a list of actions Cities engage to apply. In other words,

3 while the policy is the comprehensive plan and political document, the actions are the activities, operations,

4 and practical goals. Each action was analysed and then coded according to the "Framework for Action"

5 provided by the MUFPP (MUFPP, 2015a). In fact, the MUFPP Text provides six main actions' categories to

6 which detailed recommended actions are associated (Table 2). For each city's policy, the main purpose of the

7 actions was identified, and then categorised accordingly to the main purpose of MUFPP actions.

Main topic	Recommended Actions	Code
Ensuring an enabling environment for effective action (governance)	Facilitate collaboration across city agencies and departments	G1
	Enhance stakeholder participation and Food Councils	G2
	Identify, map and evaluate local initiatives	G3
	Develop or revise urban food policies and plans	G4
	Develop or improve multisectoral information systems	G5
	Develop a disaster risk reduction strategy	G6
Sustainable diets and nutrition	Promote sustainable diets	N1
	Address non-communicable diseases associated with poor diets and obesity	N2
	Develop sustainable dietary guidelines	N3
	Adapt standards and regulations to make sustainable diets accessible in public sector	N4
	Explore regulatory and voluntary instruments in private companies	N5
	Encourage joint action by health and food sectors	N6
	Commit to achieving universal access to safe drinking water and	N7
Social and economic equity	Social protection actions to improve food access (i.e. food banks)	S1
	Reorient school feeding programmes	S2
	Promote decent employment for all	S3
	Encourage and support social and solidarity economy activities	S4
	Promote local networks and support grassroots activities	S5
	Promote participatory education, training and research	S6
Food production	Promote and strengthen urban and peri-urban food production	P1
	Seek coherence between the city and nearby rural food production	P2
	Apply an ecosystem approach in land use planning and management	P3
	Protect and enable secure access and tenure to land	P4

	Help provide services to food producers in and around cities	P5
	Support short food chains, producers' organization, producer-to-consumer networks and platforms	P6
	Improve (waste) water management and reuse in agriculture	P7
Food supply and distribution	Assess the flows of food to and through cities (CO2)	D1
	Support improved food storage, processing, transport and distribution technologies and infrastructure linking peri-urban and near rural areas (food flow)	D2
	Assess, review and/or strengthen food control systems	D3
	Review public procurement and trade policy	D4
	Provide policy and program support for municipal public markets, retailers and other space of marketing	D5
	Improve and expand support for infrastructure	D6
	Acknowledge the informal sector's contribution	D7
Food waste	Convene food system actors to assess and monitor food loss and waste reduction	W1
	Raise awareness of food loss and waste	W2
	Research and collaboration on waste management	W3
	Save food by facilitating recovery and redistribution for human consumption of safe and nutritious foods	W4

1   *Table 2 Topic and Recommended Actions (for a complete description of the Actions see MUFPP, 2015a)*

2   The result was a dichotomy matrix where it was indicated whether the City had envisaged or not (1/0) a

3   MUFPP recommended action.

4   The sample has been further analysed. The Shannon Entropy Index *(H)* here is calculated to assess the degree

5   of dispersion of Cities' actions (1).

6      $H = -\sum_{i=1}^{n} P(n_i)\ln(P(n_i))$ (1)

7      $$H = -\sum_{i=1}^{n} p_i \ln p_i$$

8   where *n* is the number of actions, p_i is the probability of the action *i* to appear, calculated on the amount of

9   actions *N* carried by cities, thus

10      $p_i = \frac{n_i}{N}$ (2)

11   When values are proximal to 1 city would have equal proportion of actions and it is well differentiated; when

12   values are proximal to 0 city's food actions are less differentiated.

13   **2.2 Network Analysis**

14   The network between the Cities is built on the coded actions Cities have in common. In this study, the network

15   analysis and the community detection have been performed using "igraph" package of the R software 3.2.3.

16   **2.2.1 Network development**

1   In the graph theory, a network is composed by a set of nodes or vertices connected through lines or edges.

2   When the nodes are of the same kind, network are called "one-mode network"; when network are composed

3   by two kinds of nodes, they are called "two-mode networks" (Borgatti and Everett, 1997). In discourse network

4   analysis, networks are built upon two types of nodes: a first type of nodes, which are usually the actors, and a

5   second type of nodes which are usually the ideas they share (Leifeld, 2017). In the case of our analysis the first

6   type of nodes are the Cities and the second type of nodes are the recommended actions of Table 2. In the case

7   of two mode networks, the network analysis can be performed by transforming the two modes network into

8   one mode network, through the creation of the adjacency matrix. In such matrix the proximity between the

9   first type nodes, and so their tie, is defined by the number of the second types nodes they have in common. In

10   our case the ties between the Cities – first type of nodes – is defined by the number of the recommended actions

11   – second type of node – they have in common. In this process, to each network relation is assigned a weight

12   w, which is a function of the amount of shared recommended actions between the two Cities, and it measures

13   the strength of the link between two Cities: the more actions Cities have in common, the stronger their relations

14   will be. In this way, the network became a one-mode, weighted and undirected network, with 32 nodes and

15   422 connections (Fig.1).
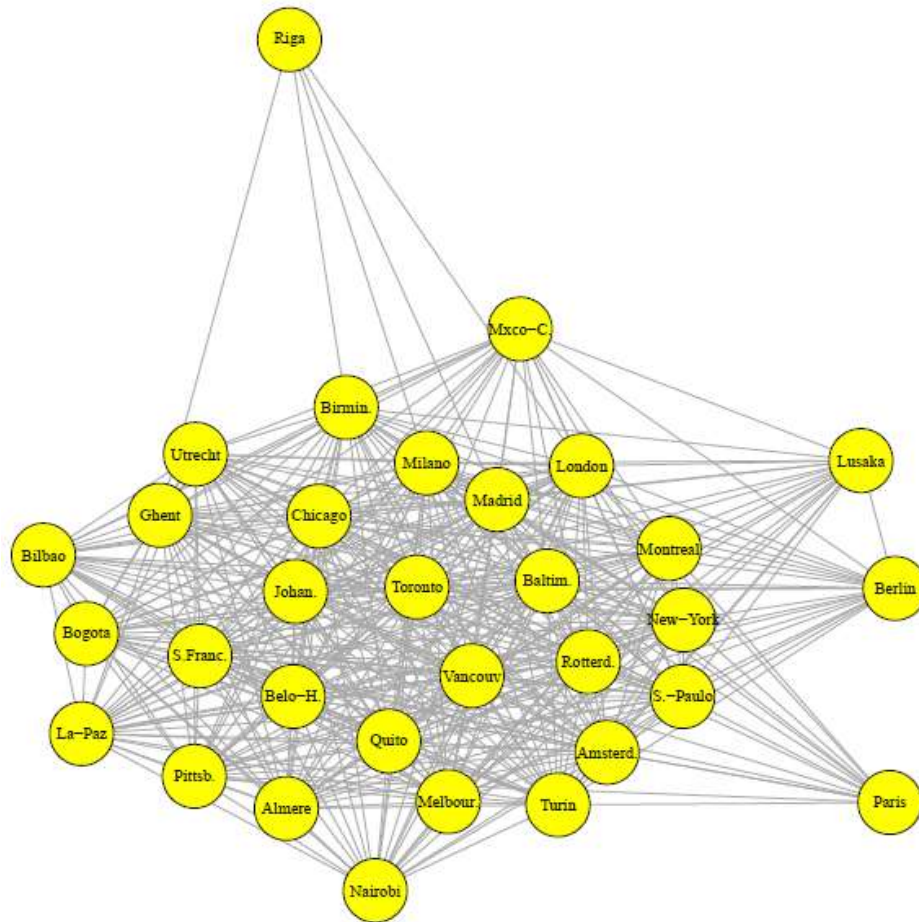
Figure 1 Graph representation of the 32 cities

During the network development, to consider in the analysis only the relevant connection between Cities, a filter has been applied in the network on the weight greater than four ($w > 4$). In other words, all the edges between cities with a weight – number of actions in common between cities – lower than four, have been excluded in the graph construction. This has led to select the outliers.
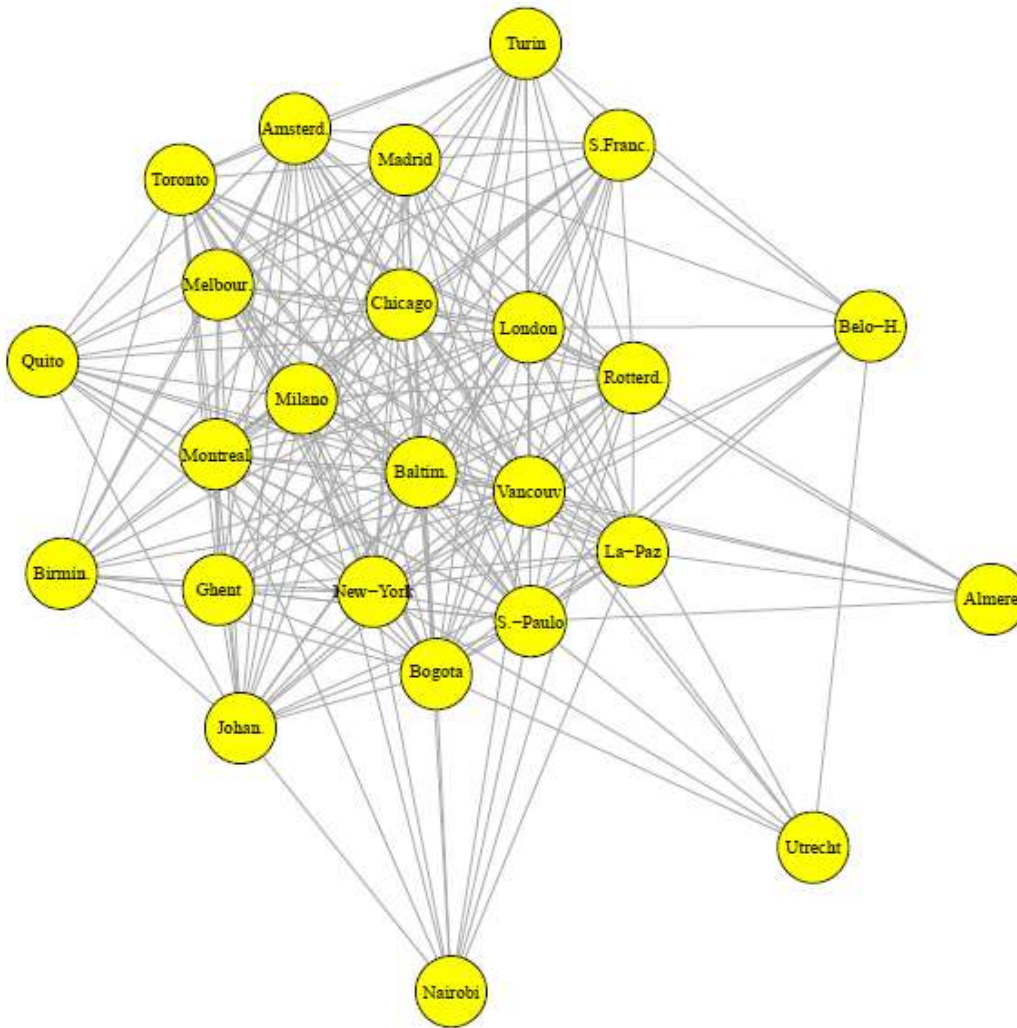
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Figure 2 Graph representation of the 25 cities

3   The final sample is thus composed by 25 Cities/nodes and 204 connections (Fig.2). The Cities excluded are

4   Berlin, Bilbao, Lusaka, Mexico City, Paris, Pittsburgh and Riga. To describe the network structure, we

5   employed the density measure, and the nodes' degree. The density Δ_G provides a measure of the overall

6   connectivity of the network and it is calculated as the ratio between the actual number of edges E between the

7   nodes n in a network, and the maximum number of ties that are possible. For undirected network is calculated

8   as (2)

9      $$\Delta_G = \frac{2E}{n(n-1)} \tag{2}$$

10   It ranges from 0 to 1; completed connected networks have a density score equal to 1, while sparse networks

11   have a density score of 0. In this way, it provides a measure of the probability that two nodes are directly

1   connected. The degree d is just the number of ties connected to each node. In this way it is a measure of the

2   centrality of the nodes in the network (Freeman, 1978).

3   **2.2.2 Community detection**

4   In network analysis, a community is defined as a group of densely connected nodes with fewer connections

5   across groups (Fortunato, 2010). Different methods exist in network analysis to detect communities (for a

6   complete review see Fortunato 2010). The Spinglass Community detection function (Reichardt and Bornholdt,

7   2006) simply calculates iteratively which pair of nodes should be in the same group, considering the weights

8   of nodes, typical of bipartite graph (Fortunato, 2010). Literature has assessed that the method is the most

9   appropriate for small samples (Yang et al., 2016).

10 As done in literature (i.e. Fisher et al., 2013), to validate the goodness of the community division we also

11 compared the "intra-cluster density" and "inter-cluster density" for each cluster, as specified by Fortunato,

12 (2010). Considering a community C of a graph G, with $|C| = n_c$ and $|G| = n$, the "intra-cluster density" Δ_{int} is

13 defined as the ratio between the edge density inside a community and its potential edge density (Fortunato,

14 2010). For weighted networks, it is calculated as the sum of the weights S of all the edges of the group C

15 divided by the number of binary links that are theoretically possible (Fisher et al., 2013) (3).

16 $$\Delta_{int(c)} = \frac{S_{int}}{n_c \, (n_c - 1)/2} \qquad (3)$$

17 Following Fortunato (2010), the "inter-cluster density" $\Delta_{ext(c)}$ is the ratio between the number of edges

18 running from the vertices of a cluster and the maximum number of inter-cluster edges that is possible. For

19 weighted networks, it is thus calculated as the ratio between the sum of the weights of inter-cluster edges of

20 the group nodes S_{ext} by the maximum number of binary links of the group's nodes and the rest of the nodes

21 that are theoretically possible (4).

22 $$\Delta_{ext(c)} = \frac{S_{ext}}{n_c \, (n - n_c)} \qquad (4)$$

23 According to literature, for C to be a community, we expect $\Delta_{int(c)}$ to be greater than the weighed density of

24 the graph G Δ_{Gw}, and $\Delta_{ext(c)}$ to be lower than the average density (Fortunato, 2010).

1 Finally, to verify the relationship between communities, we have calculated the "between group density"

2 (Fisher et al., 2013) $\Delta_{be(c1c2)}$ as the sum of the weights of the links between two communities S_{be}, and the

3 potential number of binary links between the group C_1 and C_2 (5).

4 $$\Delta_{be(c1c2)} = \frac{S_{be}}{n_{c1}n_{c2}} \hspace{6cm} (5)$$

5 If the density is high within a group, its internal coherence is high, indicating discourse coalition. The lower is

6 the density between the communities, the more is their polarization.

7 **3. Results**

8 Results regard both the sample of cities, and the network resulted from the analysis. Table 3~~1~~ shows the values

9 of the Shannon Entropy Index (H), thus identifying the policy's diversification. ~~while~~ Figure 2~~3~~ shows the

10 total percentage of actions Cities are engaged on, considering the six topics: in this way beyond the total

11 percentage Figure ~~1~~3 shows also the importance of the six MUFPP pillars. By comparing the two results, it is

12 possible to observe four scenarios. First, ~~As it is possible to notice, usually~~ the Cities with the higher amount

13 of actions, have also higher scores of Shannon Entropy Index. This is the case for Cities as Milan, which

14 includes in its food policy almost 60% of the MUFPP actions and has the higher H Index ($H = 0.77$), London

15 (54% of actions and $H = 0.77$), New York (51% of actions and $H = 0.73$). These Cities have thus envisaged

16 most of the MUFPP actions in absolute terms and have also a good differentiation of actions. Second, ~~At the~~

17 ~~same time,~~ despite the fact to have envisaged more actions (Figure 3), other Cities have lower Shannon Entropy

18 scores, as Vancouver ($H = 0.68$) or Chicago ($H = 0.63$) (Table 3), thus showing a more specialization. Figure

19 ~~1~~3 shows in fact that Vancouver includes 54% of the MUFPP, but it does not seem to apply the actions in the

20 same proportion, being more focused in governance and production. Chicago is very concerned with nutrition,

21 but it has not envisaged actions on waste management. Third, on the contrary, Cities as Ghent, Melbourne and

22 Madrid show high level of actions' differentiation ($H = 0.74$), even though they did envisage around 35% of

23 actions, showing a more holistic approach in their food policies. In fact, they have planned actions from all the

24 six pillars (Fig. 3). Finally, the Cities with lower percentage of actions have also the lowest Shannon Entropy.

25 This is the case for Berlin, Bilbao, Lusaka, Mexico City, Paris, Pittsburgh and Riga.

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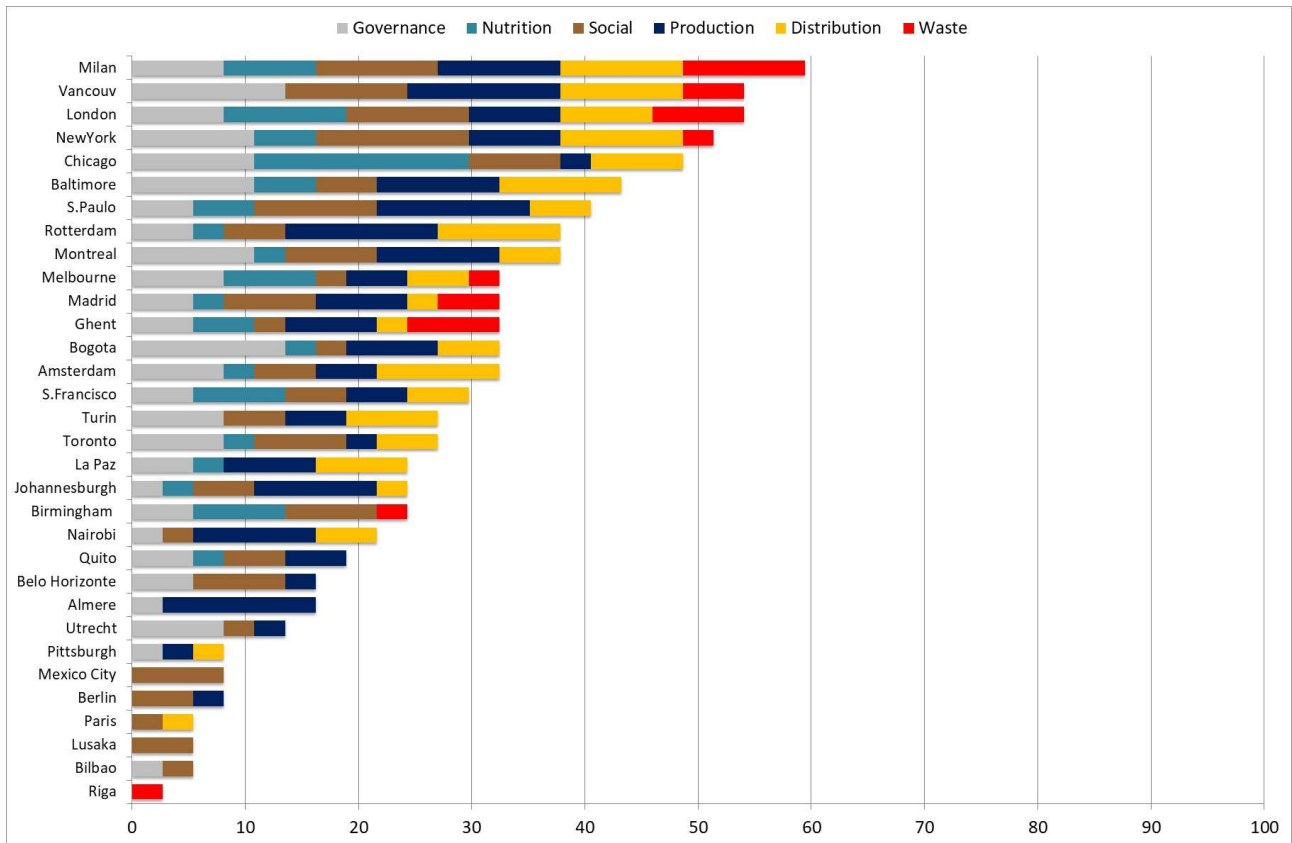
2 *Figure 3 Percentage of actions envisaged in the food policy's documents*

3 *Table 3 Shannon Entropy index (H)*

City	H
Milan	0.77
London	0.77
Ghent	0.74
Melbourne	0.74
Madrid	0.74
New York	0.73
San Francisco	0.69
Vancouver	0.68
Baltimore	0.68
San Paulo	0.66
Amsterdam	0.66
Montreal	0.66
Toronto	0.65
Rotterdam	0.64
Chicago	0.63
Johannesburg	0.62
Bogotà	0.62
Turin	0.59
Quito	0.59

Birmingham	0.57
La Paz	0.57
Nairobi	0.53
Pittsburgh	0.48
Belo Horizonte	0.44
Utrecht	0.41
Bilbao	0.30
Paris	0.30
Berlin	0.28
Almere	0.20
Lusaka	0.00
Mexico City	0.00
Riga	0.00

These are also the Cities excluded during the network analysis from the final sample. Most of these cities excluded seem to have applied just one or few kind of recommended actions (i.e. Berlin, Paris, Riga), or they seem to have just started a process of consultation with private and public bodies (i.e. Bilbao). This result confirms that the network has considered the most relevant Cities.

Considering the actions in the analysis three recommended actions were not associated with food policies actions: "Seek coherence between the city and nearby rural food production" (P2), "Improve and expand support for infrastructure" (D6) and "Acknowledge the informal sector's contribution" (D7).

Most of the actions envisaged by Cities concern governance, especially "G2 – Enhance stakeholder participation and Food Councils" and "G4 – Develop or revise urban food policies and plans", included by more than 50% of Cities, followed by actions of production pillar, as "P1 – Promote and strengthen urban and peri-urban food production" and "P4 – Protect and enable secure access and tenure to land", social equity as "S5 – Promote local networks and support grassroots activities" (46%), distribution action as "D5 – Provide policy and program support for municipal public markets, retailers and other space of marketing" (43%), and "N1 – Promote sustainable diets nutrition", (43%). The most marginal actions in the case of governance are "G6-Develop a disaster risk reduction strategy" (5%), on nutrition "N7-Commit to achieving universal access to safe drinking water" (5%), on production "P7 – Improve (waste) water management and reuse in agriculture" (8%), and in general waste management actions.

1   In Figure ~~4~~3 the line width represents the number of actions in common between the Cities – the weight, while

2   their size is a function of their degree d centrality. Among the cities, Vancouver is the one more related with

3   other cities, with a $d = 23$, followed by New York, San Paulo, London $d = 22$, while ~~Utrecht~~ Almere is the

4   less connected with a $d = 6$.

5
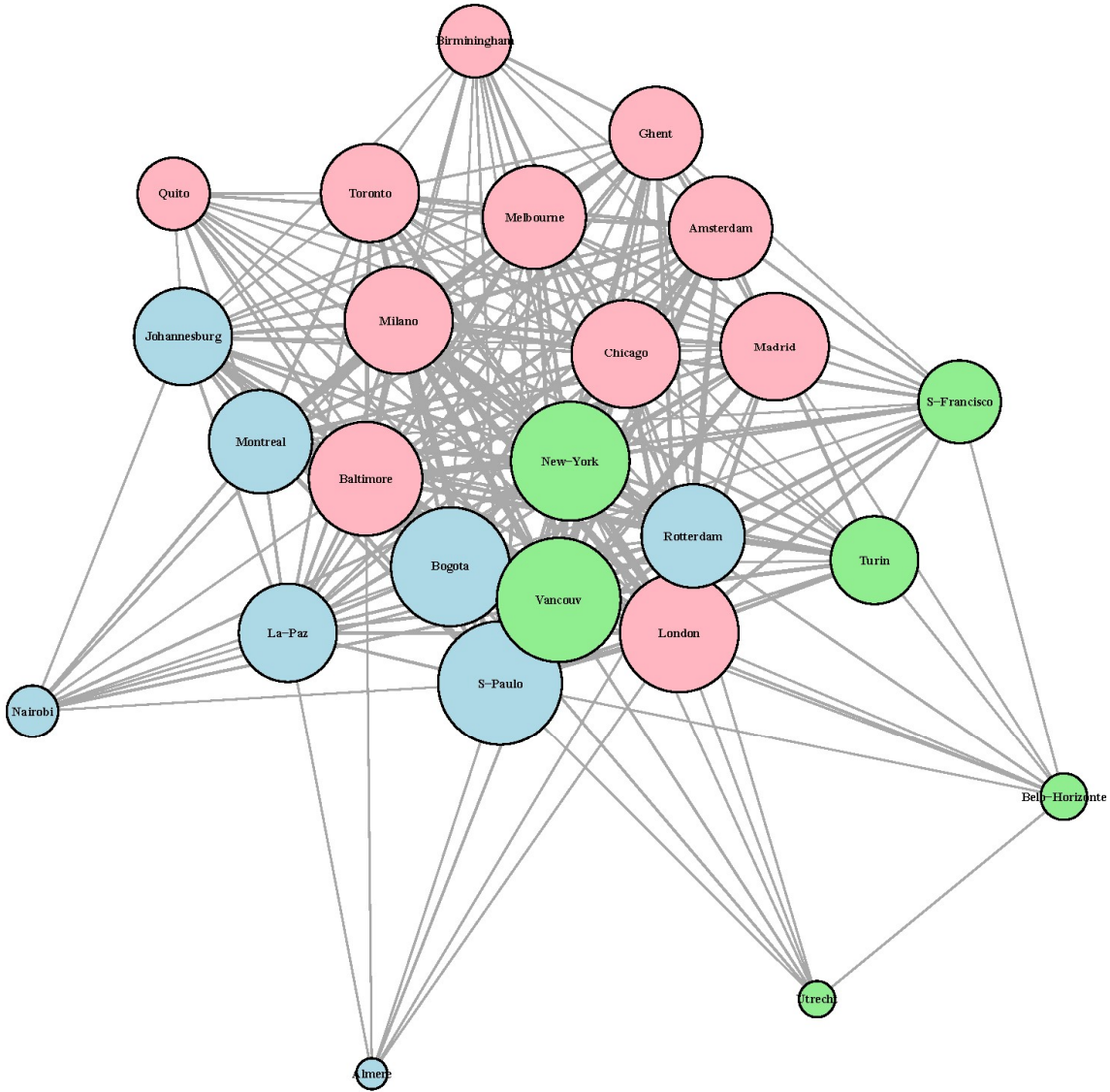
6   *Figure 4 The Clusters resulting from the Spinglass community detection algorithm*

7   The network has a high score of density $\Delta_G = 0.75$, which indicates that the nodes are highly connected in the

8   network. Considering that we have selected edges with a $w < 4$, this means that 75% of the Cities of our sample

9   have at least four actions in common. The assorted colours indicate the different clusters Cities belong to. The

10   community detection algorithm in fact has detected three cities' clusters (Table 4). As it is possible to see, the

11   internal density $\Delta_{int(c)}$ and the external density $\Delta_{ext(c)}$ are always respectively higher and lower than the

1. weighted density of the network Δ_{Gw}, as well as than the density between groups Δbe, confirming the validity

2. of the clusters division (Table 5). Moreover, the "between groups density" indicates a higher density between

3. Group 2 and Group 3, while Group 1 and Group 2 seems to more distant (Table 5).

	G1. Agriculture for food security	G2. Governance and food economy	G3. Sustainable and healthy consumption
Cities	Almere Bogota Johannesburg. La Paz Montreal Nairobi Rotterdam San Paulo	Belo Horizonte New York San Francisco Turin Utrecht Vancouver	Amsterdam Baltimore Birmingham Chicago Ghent London Madrid Melbourne Milan Quito Toronto
$\Delta_{int(c)}$	5.25	6.46	7.78
$\Delta_{ext(c)}$	2.37	2.64	2.18

4. *Table 4 Groups of cities*

Δ	Score
Δ_{Gw}	5.20
$\Delta_{be(c1c2)}$	4.52
$\Delta_{be(c1c3)}$	4.89
$\Delta_{be(c2c3)}$	5.74

5. *Table 5 Values of weighted density*

6. In the following paragraphs, the detail is given about the actions characterising each cluster.

7. **Group 1 –** *Agriculture for food security*

8. In this group, the Cities address urban FS especially through actions which sustain the food production of local

9. agriculture. Notably all the cities are engaged in supporting directly urban and periurban agriculture (P1),

10. which secures the supply of fresh and healthier food. To this action, usually Cities associate the protection and

11. securing of access and tenure to land (P4), the helping in the provision of services to food producers in and

12. around cities (P5), the supporting of short food chains, producer organizations, producer-to-consumer

13. networks (P6); there are also several actions about the support of improved food storage, processing, transport

14. and distribution technologies and infrastructure (D2), and the group is the unique one which groups cities that

15. have actions on local food safety and quality legislation and regulations (D3); such attention of food quality is

16. coherent with a general attention on promoting healthy and sustainable diets (N1).

17. The sustain and promotion of urban and periurban agriculture (P1) is for example done through actions that

18. legally allow urban agriculture. In Nairobi, the City Council has set up a specific bill which legally allow urban

19. agriculture (FAO, 2016; Nairobi City County, 2014). To prevent healthy risks, it has also envisaged several

rules on food safety as hygienic standard, animal welfare and traceability (D3). The sustain of urban and agricultural production is also done through the sustain of the local production, to enrich the local food supply. Montreal has the objective to valorise and diversify the local production of food, by favouring the access to market (CRÉ de Montréal, 2014), both in periurban and urban areas, through dedicated events as the "Cultiver Montréal" or the dedicate website "MontrealAgriculture". The sustain of agricultural production is often associated with policies for the agricultural land preservation (P4), to assure land for local production at disposition of local consumption. The City of Nairobi has included legal means to use vacant private land for agriculture purposes, by contracting with the private owners (Nairobi City County, 2014); through the "Inventario das zonas productivas" (Inventory of productive zones) La Paz aims to monitor what is produced, how and by who, as well as it verifies the potential food capacity of vacant land, distinguishing what is possible to produce in urban, periurban and rural lands (Ciudade de Nuestra Senora de La Paz, 2014). Facing the prevision of the urban areas to grow, in Almere the "Agromere project" wanted "to explore opportunities to re-integrate agriculture into modern Dutch city life" and has designed a city district of 250 ha where 70 hectares are devoted to houses and infrastructure, and 180 ha for agricultural production (The RUAF, 2011). The provision of services to farmers (P5) is done through technical assistance and tools and funds. In Johannesburg to empower urban farmers, seven "Agri-resource centres" have been implemented, which aim "to serve as community based support systems for agricultural activity at an individual/household and communal level" (City of Johannesburg Metropolitan Municipality, 2011: p.47) by organising training workshops, inter-sectoral collaboration forums, information and assistance about the access to land, cooperative registration, and providing productive inputs like seeds and water licenses. Beyond the sustain of the production, the Cities aim also to sustain the link of producers to markets and consumers (P6). In San Paolo, "Do campo para cidade" (From the field to the city) aims to implement markets for family farms in the city (Prefeitura do Município de São Paulo, 2016). In the "Plan Maestro de Abastecimiento y Seguridad Alimentaria" Bogotà has implemented the "Agrored" that are rural production networks among farmers and processors and seeks to organize supply (Alcadia de Bogotà, 2006). The City has also implemented the "Nutrired", which is focused on improving the food distribution (D2) by organising the supply of food among urban actors, integrating the local food processing, the food handling, the commercial management of all economic agents.

Cities belonging to Group 1 are almost all placed in Developing Countries. Except for Montreal and San Paolo, all the cities are under the 35% of actions implemented, and none shows a food strategy including all MUFPP issues (Table 3). For example, no cities have adopted food waste strategies, moreover, also Distribution (D) and Nutrition (N) actions are strongly linked to the core issue of this group, that is the security for the urban productions (Fig.3).

Group 2 – *Urban food system integration process*

The second cluster groups cities more focused on actions concerning governance, social equity and economic development. Cities are engaged in facilitating the collaboration across city agencies and departments (G1), enhancing stakeholder participation (G2). They are also engaged in several aspects of the food system, from the production (sustain of short food supply chains (P6)), to the distribution (support of food flow (D2)), the support different space of sale in the city (D5), the review of public procurement and trade policy (D4)) to waste management (prevention of waste in the public and commercial sector (W3)). On the social dimension, we find actions directly on public food assistance and social protection systems (S1), reorientation of school feeding programs (S2), support of economy activities which have a solidarity meaning (S4).

Before developing a unique food strategy, the governance approach of Belo Horizonte has been firstly focused in centralising all the programs connected to food in a unique municipal department. Created in 1993, the Secretaria Municipal de Abastecimento (SMASAN) "allowed for an integrated thinking of the food system. It no longer was "food for hungry students" in a department of education, or "food for needy people" in a department of social assistance, or "food for consumers" in a department of commerce, or "food from family farmers" in a department of agriculture" (Rocha, 2016: 33). The multiscale approach is applied since "food systems exist at many scales, from household to neighbourhood, to city, to region and beyond" (City of Vancouver, 2013: 47). Among the governance actions, the City of Vancouver has thus envisaged the strengthen of alliances and partnerships with other municipalities in Metro Vancouver and Fraser Valley regions on food policy. All the cities have envisaged the participation of the Food Policy Councils (G2). According to the Vancouver food strategy the "partnerships are an essential aspect of achieving the actions" of food policies (City of Vancouver, 2013: 49). Only by including and coordinating the different local stakeholders it is possible "to make the biggest impact on food system issues", because "that makes the most of the tools and levers available to the City" (City of Vancouver, 2013: 53). In this sense Cities focus their policy on actions of

governance with applications both "inside" the institutions (G1) and outside them, to food system stakeholders (G2), also implementing educational actions in schools and supporting solidarity actions.

Such inclusive approach is also applied in the waste management: Cities are interested in collaborating with the private sector along with research, educational and community-based organisations to prevent waste or safely recover food and packaging (W3). New York has contemplated actions as the discourage bottled water consumption, the establishment of a voluntary household composting program, the encouragement of restaurant grease recycling (The New York City Council, 2013).

In this group, there is a special attention on distribution issues. There are actions aiming at improving the efficiency of distribution passages and food flow to secure food access in the city (D2). New York has planned to "identify optimal distribution routes and modes for food distribution within the region and city" (The New York City Council, 2013: 46), or several actions that maximize the potential of the Hunts Point Food Distribution Centre (The New York City Council, 2013: 46), as well as diversify and improve food transports.

In this group, a specific attention is paid in improving the efficiency of the marketing system through the sustain of different spaces of sale (D5), as farmers markets, retailers and processors. New York has envisaged actions to support food manufacturers such as specific training workshops, the creation of an online resource centre, the development of new industrial space for food manufacture business. These actions beyond the improvement of the food access aim also to generate growth and employment in the food manufacturing sector (The New York City Council, 2013). As actions addressed to public food procurement (D4), San Francisco has established the "Food Procurement Ordinance", by which "to ensure that a percentage of the City's direct food purchases support regional agricultural producers, the Department of the Environment was asked to draft a local and sustainable food procurement ordinance" (San Francisco City, 2010: 18). At the same time attention is paid in reorient feeding programs schools (S2), by improving the quality of meals provided. Turin has implemented the project "Il menu l'ho fatto io" where the families were involved in the definition of a healthy and sustainable schools' menu (Città di Torino, 2016). In the group, a relevant quota of the actions is on social equity issue Several cities have proposed food assistance actions as food banks, community kitchens and others (S1). San Francisco has envisioned to maximize the food stamps enrolment through a public internet interface. Cities have sustained also solidarity economic activities (S4) as Belo Horizonte, where the "Popular Restaurant" is a cafeteria-style restaurant open to all, serving over 20,000 nutritious meals per day at subsidized

prices; with this action, the policy aims also to incentive the purchase of food directly from small-scale family (Rocha, 2016). "Abastecer" is a program where selected grocery stores can sell vegetables at one price below market values (Rocha, 2016). Finally, in this group of cities we find interest in actions of supporting short food supply chains (P6), such as CSA and other forms of farmers direct sale. Turin has developed a label, the "Paniere dei prodotti tipici della Provincia di Torino" (Basket of typical products of the Province of Turin), which aim is to facilitate the sale of local farmers' products in the urban shops (Città di Torino, 2016).

All the cities of this group are metropolitan urban areas.

Group 3 – *Sustainable and healthy consumption*

The third group is represented by cities that are engaged in actions promoting healthy diets and providing access to fresh food. In fact, the cities have developed actions concerning healthy diet promotion (N1), involvement of private and public companies by regulatory and voluntary instruments (N5) and non-communicable diseases (N2). The creation of Food Policy Councils (G2), and the involvement of different departments of cities (G1) are strategic leverages for the UFP implementation. Moreover, community gardens and other social actions in schools (S5), environmental sustainability of food distribution (D1), organization of different spaces of sale in the city (D5) and awareness on food loss and waste (W2) are fundamental issue in the food policies of this cluster.

The actions of healthy diet promotion (N1) are especially addressed to kids in schools through food education activities. In the Mayor Food Strategy, the City of London proposed to sustain the education system in increasing the amount of time spent food education in schools as cooking activities, which also means to support specific measures for individual schools and teachers (London Developement Agency, 2006). To educate kids to the value of agriculture and fresh food, Amsterdam and Chicago promote actions of community food gardens (S5) in schools (City of Chicago, 2013). Educations actions are also addressed to adults: Quito organised the "Points of Healthy Stations" that addresses basic health needs of citizens and give them advices on healthy foods (MUFPP, 2016). With the "Thursday Veggie Day" the city of Ghent encourages the consumption of a tasty vegetarian dish at least once a week. Since the consumption of meat is connected to obesity and climate change, with this action, the city combines the promotion of healthy diets with the environmental sustainability of the food system (Ghent Food Policy Council, 2013).

Chicago is the city more engaged on obesity and other diseases connected to poor diets (N3). Now, it has planned to improve the collection of data on obesity with qualitative interviews and obesity-related indicators, in accordance with researchers, university and other organizations; it has also envisioned to strengthen the collaboration between the public health service and the department of economic development in order to integrate healthy issues into local land planning projects (City of Chicago, 2013).

Beside the direct actions of public bodies, several actions aim to "engage grocery chain as partners" (N5), to share the responsibility of healthy choices with the actors providing food in the urban dwellers' everyday life. In Baltimore the "Get Fresh Kids Menu" action has led nine vendors to create healthy kid's menu, which meet school nutrition requirements and that are proposed to kids in smaller portion size and affordable prices (Baltimore City, 2014). The engagement of the cities in providing healthy option is explained in the efforts in supporting specific food business (D5) engaged in healthy food, with the aim to reach food desert areas. In Baltimore, the Baltimore Food Desert Retail Strategy aims to specific expand the supermarkets, through the "Personal Property Tax Credit for Supermarket" which is a 10-year, 80 percent credit against the personal property tax for supermarkets locating in food desert areas. Among the obligations, the supermarket must have at least 500 square feet dedicated to the sale of fruits and vegetables and at least 500 square feet dedicated to the sale of other perishable goods including meat, seafood and dairy products" (Baltimore City, 2016).

On distribution issues, the analysis of food flows (D1) aim to secure a food access that is healthy and environmentally sustainable. Amsterdam and the neighbouring provinces have started mapping the flow of food to overcome the problems in the delivery of food (European Commission, 2008); the aim of the "Food Environment Map and Report" of Baltimore is to identify areas of greatest need; Melbourne wants to identify opportunities to reduce the greenhouse gas emissions associated with the city's food consumption (City of Melbourne, 2014).

Coherently with these policies, the support of community gardens and other grassroots activities (S5) occurs in the "Huertos Saudable" in Madrid (Ajuntamento de Madrid, 2016). Moreover, urban gardens and urban food production are used to create and improve employment (S3). In Ghent, the project "Heiveld: brownfields get a green touch" is an urban garden project that by the one side promotes social employment, and by the other side allow elderly inhabitants to share their gardening experience (Ghent Food Policy Council, 2013). Another action which aims to improve the wellness of employee, is the "Community Supported Agriculture

(CSA) and Wellness" in Baltimore. Through this action the union Managerial and Professional Society (MAPS) incentivise CSA as part of employee wellness plans, by reimbursing up to 250 $ for employee that buy products from CSA (Baltimore City, 2016). Finally, also the waste management actions, can be an opportunity to address food desert issues (W4). Ghent has promoted the "Ghent CPSW" which aims to redistribute food surplus from retailers and other sources to social organisations, to reach vulnerable people, improving food access, and at the same reduce food waste. London seems to be the most active city in the waste management addressing concerns both to private household, private companies and public agencies (London Development Agency, 2006).

These cities are very diversified in terms of percentage of adopted actions and degree of urban food strategy completeness in relation to MUFPP issues. In fact, this group comprehends Milan, with the highest Shannon index and Quito, with low value of this index (Table 3).

4. Discussion

Our results confirm what already assessed by previous research: differences in the policy frameworks exist (Coppo et al, 2017) and the Shannon Entropy Index show that Cities can be more or less specialized on the sixth topics. We can identify two main groups: Cities which have urgent needs and thus they are forced to focus on priorities, for example with actions on nutrition to fight against obesity, or actions on food production to allow urban dwellers to grow their own food; and Cities that adopt a more holistic approach, and therefore choose to implement a wide range of food policy actions. In the last group Milan is the most representative and the its Urban Food Policy has been recognized as the most innovative at the Guangzhou International Award 2018 (MUFPP, 2018).

In general, production, social equity and governance issues, are the most implemented actions in cities plans and are strictly connected to the social and economic dimension of the food production and consumption. On the contrary, the food waste actions are poorly represented in our sample, suggesting less interest of the Cities in the environmental sphere of the urban food system. Waste management is a very expensive and complex issue and perhaps cities still consider the environmental aspect of the food less urgent than the productive and the social ones. As claimed in literature, less attention is also addressed on environment linked to climate change (Reynolds, 2009). If "the only food system to be secure is that which is sustainable, and the route to

food security is by addressing sustainability" (Lang and Barling, 2012: 322), progress need to be done on better addressing the sustainability of the whole food system.

The high level of density of the network shows that Cities' strategies are highly interconnected. This can be due to the common aims and instruments adopted by the Cities and a "copying process", in factmost of the Cities have relatively young food strategies and they have been developed on the base of the example of other Cities. Future studies should analyse the evolution of policies according to the specific context of the City.

A link exists between food production action thorough urban agriculture and nutrition security, especially in developing countries. Here, the need to assure urban dwellers to grow their own food is combined with the need to implement food safety, coherently with the concerns in literature and case study analysis (De Bon et al., 2010). In Europe urban agriculture is usually proposed as a response to land use change, to protect the original agricultural use (Ruggeri et al., 2017). According to Siegner et al (2018), one of the main benefit urban agriculture provides to society is the local environmental quality improvements, coherently with the idea of a multifunctional agriculture in urban-periurban areas (Zasada et al., 2011). The food production actions encompass also actions to support the farmers in the periurban area, and thus the farmers' economy, especially in Europe and in developing countries; in other words, these actions can benefit both consumers by providing local food and producers by sustaining their activities. This is coherent with findings in literature that assessed the link between farmers and UFS. While in the past farmers were addressed to increase their food production to feed more people, in a global market where they did not have power, now they ask more and more to produce in a more sustainable way, with fairer prices and direct connection with the local markets (Fish et al., 2012). This is also coherent with the literature that assess that rethinking the urban-rural divide to have a sustainable urban development (Gren and Andersson, 2018).

The analysis of the groups suggests that when Cities are more engaged with the governance actions adopt a more holistic approach, considering more topics. Especially distribution issues and social equity relate to more engagement in governance actions.According to the "New York Food Works", this is especially true for metropolis, where the high dimension of the city justifies the holistic approach: "When we buy a salad, we might not think about all the people and places that were involved in its creation" (The New York City Council, 2010: 1). This means that an UFP should consider all the steps between the production and the consumption of food as the distribution, the processing, and the waste management, applying a multisector approach. In this

way, Cities are able to include also the "exchange nodes" of the food system, as wholesale markets, retailers, food hubs, distributors, and others that practically improve the process of availability of food (Sonnino, 2014). Such holistic approach is applied also in a constant dialogue with private and public bodies, local and regional actors, using Food Policy Councils (Feenstra, 2007). This reflects the ambition of Cities not only of designing a sustainable urban development, but also to reorient the food system in a more sustainable way (Coppo et al., 2017; Candel, 2014).

Despite the current literature asks Cities and local institutions to adopt a coordinated policy framework to foster UFS, the debate has been abstracting and generic, leading to a "simplistic view of governance" (Candel, 2014). In this perspective Candel (2014) even claim that also fragmented networks of institutional bodies can have positive impact: depending on the context, instead of applying a unique body of actions, a fragmented network may be more flexible to unexpected circumstances, to apply competences and to create space for variability and learning than mono-centric governance system. In our sample, not all the Cities have implemented a unique food policy. Again, being UFP a relatively young experience for several of the Cities, only further studies should analyse the impact and the adaptation of the governance framework. In our opinion the organization of an UFP is a first step to share an idea towards a shared goal.

Our results suggest a sort of trade-off between actions on food production and governance. Especially it seems that Cities more engaged on production, both on urban and periurban agriculture seem more focused in few but specialized actions, improving the capacity of grow food, the protection of agricultural land, and the connection between production and consumption. Not always these Cities, especially in developing countries, have also adopted a unique food policy, while Cities with more governance actions, have less actions in production, and in general a more comprehensive food plan. In developing countries, agricultural urban systems are historically strictly focused on enhancing FS in terms of availability (Gallaher et al., 2013), while in the developed ones, the Cities are especially moved by the need to govern the food supply in order to have a more sustainable food system. Nevertheless, a more comprehensive vision of the urban food system for a more sustainable urban development it is possible also in developing countries (Smith, 1995).

Nutrition, Governance and Social equity are connected in developed countries and especially in North America. Here we find especially Cities in which a high wealth level has leaded to an increase of food diseases as obesity. Actions addressed to the demand side of food market (Reynolds, 2009), are aimed at raising

awareness among urban dwellers and the more vulnerable part of population about health issues and consequences of food choices, and securing consumer engagement (London Developement Agency, 2006). Especially in US, the theme of food access has been combined with the urban vacant land issue, often proposed to mitigate food desert problem, implementing UA projects (Smith et al., 2017).

Some Cities in facing food insecurity connected to healthy diets have resisted "the temptation to reduce the urban food question to a narrow nutritional agenda" (Morgan, 2015: 2). The strategy is to integrate the healthy food question in the different aspect of social life, in order to prevent competition with other social matters as job, social assistance, and mobilise local resources (Mah and Thang, 2013). In the "Recipe for a Healthy place" the city of Chicago states that "the most effective way to address obesity and related diseases is to change the day-to-day environment so that it supports healthy eating" (City of Chicago, 2013: 1); in other words, to improve the eating habits of citizenships the food policy needs to create a healthy place. A healthy place is a place where there is a new social life linked to community gardens and urban farming, a new economic development connected to more sustainable food system, and the capacity of distributing healthy food in areas where it is less accessible.

Literature has stressed the link between the alignment of local agriculture and healthy diets (Morrison, 2011). While in the policies actions of mapping of food deserts areas exist, it lacks the analysis about the local agriculture and the action to reinforce such alignment.

5. Conclusions

The analysis has allowed to distinguish three main issues in the current UFP' actions: the food production, the governance of food system, the food health and nutrition. This first example of worldwide UFP analysis covered policies both in developed and developing countries, from North America, Latin America, Africa, Europe and Australia. Despite some cities were pioneers on the subject, nowadays UFP appear as a worldwide relevant issue, both in metropolis and middle-sized cities. UFPs encompass very different initiatives both coming "from the bottom" and "from above" by institutions' side. The MUFPP tries to frame UFP, to define the path for adopting them, to systematize actions conveying them into a single formal framework. The Cities signing the MUFPP are constantly growing, confirming the growing interest of Cities believing that the sustainability of the urban development must pass through the care of the urban food system. Although MUFPP

has not been planned for a FS policies assessment and its framework does not shape exclusively food security issues, according to the results it could provide an essential contribution to urban FS policy detection.

To conclude, UFPs are "young" policies that arise from the very recent need for a reorganization of urban strategy in response to the new needs arising from the increasing population in urban areas globally, on the one hand, and by strong globalization due to the liberalization of the market for the last thirty years (FAO, 2015). For this reason, they have the spirit of innovation that often characterizes the initial proposals for dealing with new challenges, but at the same time they lack in organicity and homogeneity: therefore, an instrument such as MUFPP and, more generally, the sharing of practices and knowledge is even more important for the of urban strategies in order to improve FS.

This worldwide analysis of the food plans has revealed that while several cities have developed comprehensive policies including detailed actions, other cities have just developed general ideas on the main topics of FS. Moreover, not always all the actions carried out by a city are included in a comprehensive food strategy, suggesting that such actions are spot actions, or carried out in isolation with respect to other public and private actions. If by the one side this may allow a more flexibility in the public planning, it can also lead to a great dispersion of resources and efforts. The MUFPP can be an important arena for such development.

We argue that our analysis would increase the knowledge and indirectly support the development of the network between cities, by providing another occasion of exchange for the Cities to sustain their future development. The analysis covered only the documents of the UFP and do not enter in the detail of the actual application of the actions, in terms of money and practical engagement; further study could detail more on this, as well as they should assess the short- and long-term impact of the actions envisaged by the Cities.

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