

## Perception of Microgardens in Dakar, Senegal

PIETRO DE MARINIS<sup>1</sup>, CHIARA MAZZOCCHI<sup>1</sup>, GUIDO SALI<sup>1</sup>

<sup>1</sup> *Department of Agricultural and Environmental Science, Production, Territory, Agroenergy, University of Milan, Italy*

\*Correspondence details: [pietro.demarinis@unimi.it](mailto:pietro.demarinis@unimi.it)

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**Abstract:** Promoting sustainable urban food systems through edible urban landscape promotion is a matter of policy and planning. Development Cooperation (DC) providers and local institutions all around the world are now converging on urban food and greening strategies. The role of urban greening and more precisely of Urban and Periurban Agriculture (UPA) in implementing sustainable food systems in developing countries is widely recognized. Microgardens (MGs), which are a specific typology of UPA, are small-scale urban gardens using different techniques, adapted to the local context, such as organic vegetable gardening, etc. The peculiar characteristic of MGs approach is the focus on sustainable recycling materials as productive inputs such as containers or growth mediums. The present study aims to investigate the consumers' perception of the MGs' supply chain, to better analyse MGs in the city and to give suggestions to urban policy makers and DC providers. The analysis was carried on by direct survey on 671 respondents, in the city of Dakar in Senegal. The study is based on a Multiple Correspondence Analysis (MCA) followed by a Hierarchical Cluster Analysis (HCA). Results suggest that UPA's direct experience, meaning in this case the fact of knowing MGs, leads to greater degree of approval, a positive perception of MGs' market and may lead to greater DC intervention impact.

*Keywords: Microgardens; Urban and Periurban Agriculture; Dwellers' perception; Development Cooperation.*

### Introduction

Worldwide fast population growth, especially in urban areas, is rapidly changing the way food systems work. By 2050 more than 67 % of the population will be living in cities and this is why urban food issues are nowadays seen as a keystone of the sustainable development agenda (European Commission, 2017; FAO, 2017; Kay *et al.*, 2018). Development cooperation is, among others, a potential driver of the needed changes in developing economies and, consequently, several international organizations are nowadays focusing on sustainable urban food systems (FAO, 2012; IPES-Food, 2017). From a bottom-up perspective also local authorities have started to collaborate in promoting local and healthy food (Sonnino, 2016) in order to increase food security and food safety, but

also to reach more sustainable food systems in terms of environmental protection, social welfare and economic resilience (Mazzocchi *et al.*, 2018).

Promoting sustainable urban food systems (UFSs) is a matter of policy and planning and all around the world in several cities the political concerns on food nutrition have led local institutions to develop urban food strategies (Marsden and Sonnino, 2012). Most part of these initiatives come out to work at the border between Agricultural, Environmental and Urban Planning strategies. This happens because in fact, spontaneous urban gardening is practiced by the informal community in marginalized urban spaces, which are created by lack of community management, where public spaces and infrastructure are missing or neglected and people feel disregarded by institutional care in terms of living needs such as social activity, food quality and saving expenses. Several studies confirm that, especially in African cities, urban agriculture is often neglected by official urban management strategies (Hampwaye *et al.*, 2007; Simatele *et al.*, 2008).

In recent years, luckily, Urban Food Policies (UFPs) linked to the issue of Urban and Periurban Agriculture (UPA) are continuously growing (Ruggeri *et al.*, 2016; Gore, 2018). While there is not yet a universally agreed-upon definition, UPA is perceived as agriculture practices within and around cities which integrates urban resources (land, water, energy, labour) that could otherwise serve other purposes in order to satisfy the requirements of the urban population (Corsi *et al.*, 2015; FAO, 2017a). From this point of view UPA is seen as a part of the urban green infrastructure (African Research Institute, 2016; Municipality of Dakar, 2018) and it is so interesting because, under the direct control of the local authority, it bridges food production and consumption locally, dealing with food security and sustainability of urban food systems. Historically urban agricultural systems in developing countries aim at contributing to food security and food safety in terms of accessibility (Gallaher *et al.*, 2013; He and Zhu, 2018; Karg *et al.*, 2018): here, UPA is traditionally a subsistence agriculture, but also, more recently, it has assumed a market-oriented character. One of the major problems is the polluted environments in which UPA is practiced, with health risks (Opitz *et al.*, 2015); moreover, in developing countries UPA often lacks a legal status and keep staying in an accepted-but-not-registered limbo of existence (He and Zhu, 2018). In developed countries, although the aims of UPA vary between countries, for example between Eastern and Western European cities (Ruggeri *et al.*, 2016), its principal role is about leisure or recreational activities (Guitart *et al.*, 2012). Nevertheless, the role of UPA in enhancing food security and food safety in developing countries and especially in metropolitan areas, is widely recognized (De Bon *et al.*, 2010; Kahane *et al.*, 2013; Zasada *et al.*, 2017).

According to Battersby (2013), in developing countries the drivers of the lack of food security may vary: while in rural areas the lack of food security often depends on times of famine, in urban areas food security issues are more frequently related chronicle insufficient access to food. This is why urban food policies can contribute specifically to fix this last issue of food insecurity (Mwakiwa *et al.*, 2018).

Concerning UPA characteristics in developing countries, today it is characterized by small traditional family plots to medium size farms. Since the '90s CIRAD has attested the UPA provision of food by direct survey in several case studies conducted in Central Africa (Mbaye *et al.*, 2000; Moustier *et al.*, 2006; De Bon *et al.*, 2010). According to Thebo *et al.* (2014), UPA accounts for 15 % of the total agricultural land in the world.

Focusing the African continent, in sub-Saharan Africa rain-fed systems are prevalent, and irrigated productions characterized the North African more densely populated or water-scarce areas. Tefft *et al.* (2017) affirm that “*in West Africa 95 % of the food consumed is domestically produced, and 2/3 to 3/4 of this demand is driven by urban needs*”. Related to the concept of UPA and really important in terms of development initiatives' impact is

the behaviour of urban consumers: some studies confirm that in several cases a part of urban consumers may prefer to purchase local food through shorter supply chains (Marumo and Mabuza, 2018; De Marinis, 2013). From the farmers' perspective, the possibility to access a diversity of supply chains constitutes a core asset in contributing to the overall urban food system resilience because this translates into improved response to an evolving context setting mad for example by consumer preferences and behaviours (Tefft *et al.*, 2017). Moreover, the various forms of UPA could allow significant opportunities in a diversity of contexts, as displaced people or humanitarian emergencies. The present study has the aim to investigate the consumers' acceptance and perception of the Microgardens's Short Supply Chain (MSSC), a specific typology of UPA, in order to better analyse Microgardens (MGs') experience and give suggestions to urban policy makers and other relevant development cooperation providers for further MGs' future development. As it will be described in detail hereafter, MGs are small-scale urban gardens that use different cropping techniques in urban environment. The peculiar characteristic of MGs approach is the focus on recycling materials as productive inputs such as containers, growth mediums and so on. This technique is particularly useful in developing countries, where inputs are very expensive for small producers and have an impact on final prices paid by consumers (Sposito, 2010). Although literature is very abundant in terms of UPA, at our knowledge few research focuses on the consumers' perception of UPA in African countries (Sawio J., 1993; Obosu-Mensah, 2002; Bouraoui, 2005, Hampwaye *et al.*, 2007; Ba and Moustier, 2010; Marumo and Mabuza, 2018) and none investigates the issue of MSSC. Moreover, UPA support programs such as the MGs' one, are prone to criticisms in terms of their impact, after the end of the funding period (Nordhagen, 2019). The present study aims at assessing the perception by urban dwellers about MGs, which are seen as a specific type of urban agriculture in the wider scene of UPA. The analysis was carried on by direct survey, in the city of Dakar, the capital of Senegal, in the Western Africa. The study is based on a two-step approach, composed by a Multiple Correspondence Analysis (MCA) followed by a Hierarchical Cluster Analysis (HCA), which is a novelty for this specific subject.

### ***Literature on UPA Consumers' Perception in Africa***

Already in 1993, Sawio (Sawio, 1993) wrote that "*As the world becomes increasingly urbanized, the pressures of rapid urbanization are undermining rural resource bases. Several problems intensify as a result. Feeding these people and maintaining liveable environments are a challenge of immense proportions to governments, researchers, planners, decision makers and funding agents the world over. However, recent research shows that Urban Agriculture is being perceived as a potential partial solution to this problem.*" UPA's perception has been deeply studied in several regions of the world, such as the USA (Kathryn *et al.*, 2012; Reynolds, 2015), Mediterranean basin (Sanyé-Mengual *et al.*, 2016) or Australia (Ives and Kendal, 2013), both as a symptom of and an answer to the need for evidence-based urban food policies planning and implementation. Despite this trend, the UPA's perception among local stakeholders remains somehow unexplored in the sub-Saharan African continent. Nevertheless, in a recent report (FAO, 2012) FAO suggest that the 40% of Africa's urban residents are engaged in some sort of agricultural activity, and that horticulture is the main component of urban agriculture. Within the FAO sample, Senegal is one of the leading countries in terms of specific efforts on UPA development. Concerning the study on the consumers' perception of UPA in Africa, we have already

highlighted they are few, and with different scopes. Bouroaoui (2005) conducted a survey on different actors of the UPA's chain, reported a dichotomy of visions between the "food security" and "environmental" perception dominating the producer side, and the "opportunistic economic perception" dominating the consumers' and authorities' sides. This means that, while producers are generally aware of their multifunctional role towards environment, food security and social protection, authorities, and secondly consumers, focused on the value of lands used for agriculture, suggesting "the most economically viable use of these lands" and therefore preferring a mere patrimonial criterion to perceive and evaluate UPA.

Obosu-Mensah (2002) focuses his study on the differences in the agriculture functions' perception by various categories of actors, namely producers, consumers and authority's officials. Even if all actors cited the food supply function of UPA, this is particularly recognized by producers. Obosu-Mensah reports that even if both consumers and intermediaries recognize the function of feeding, they are not aware of the external consequences of proximity in the supply function (short circuits, direct purchase from producers, freshness, etc.), although they profit of these advantages. This conclusion is particularly important because it seems to hinder the full understanding and implication of the population in the framework of initiatives that are based on the promotion of these advantages. The lack of linkage between research and local authorities which are planning some food strategy is witnessed by other recent studies which state the need for closing the gap "between research, practice and policy" (De Cunto *et al.*, 2017).

Another study (Hampwaye *et al.*, 2007) carries on a set of structured interviews on 100 informal urban farmers in Lusaka, in 2004-2005, selecting the respondents from four sites of the city, with the aim to profile urban cultivators and their activities. The study underlines a particular role played by UPA in terms of urban food security and its importance as an activity strongly implemented by women. The authors explain at what extent this result confirms several other cases related to African cities and reported by literature.

Focusing on our specific target, in their studies in Dakar, Ba and Moustier (2010) interviewed a total of around 240 actors of the UPA chain, including urban farmers, consumers, institutional actors, traders. The aim of the study is to define the typology of agro-food systems located in urban and peri-urban area of the city and the perception of UPA functions. The chosen methodology was an open-answer questionnaire, and the results show the UPA's functions perception by the various categories of respondents. One of the main outcomes of Ba and Moustier research is the recognition of the UPA multifunctionality in Dakar, mainly among the decision makers, attesting the awareness of the key role that agriculture also has in the social and environmental perspective. In this perspective, it is worth mentioning that in 2015 the Municipality of Dakar signed the Milan Urban Food Policy Pact and entered the group of cities that are now working in order to systematize an enabling policy environment for further UPA development (C40, 2017; FAO, 2017b; Municipality of Milan, 2015). In Dakar, Microgardens (MGs, better described in the following section) are one of the best practices integrated in the municipality planning for fostering UPA. Consequently, UPA is well represented in Dakar, also thanks to both to the traditional attitude of the inhabitants migrating from the rural areas and to the existence of several development programs funded by international cooperation.

As concern other examples in Western Africa, a recent study by Marumo and Mabuza (2018) examines the urban dwellers' perception towards participating in informal vegetable markets in Mahikeng, South Africa, and determine by a PCA the underlying factors leading purchasing decisions. A questionnaire submitted to 230 households has been used to gather

data. Results show that the fundamental variables are the perception of safety/quality and the economical convenience that informal traders could guarantee. Moreover, the results suggest that low-income households have difficulty in accessing the formal market and so they prefer buying in informal market, both for economic and practical convenience.

## Materials and Methods

### *Case study: Dakar and the MGs' program*

The population of Dakar has grown since 1970 at an annual rate of almost 4 percent and reached 3 million in 2011. In the period 2010-2025, it is expected to grow by a further 2.1 million people. Studies over the past decade have documented distinct horticultural production systems in and around Dakar (Ba A., Sakho and Aubry, 2014). Indeed, the international agenda is pushing UPA in Senegal and in several other countries in Africa because of its potential effects on local food systems sustainability. Previous studies found that 70 % of the urban agricultural area was occupied by 200 enterprises producing French beans, cherry tomatoes and mangoes, mainly for export. Alongside those capital-intensive ventures were more than 2,700 holdings, generally of less than 0.5 ha, cultivated mainly by migrants from rural areas. The principal crops – tomatoes, onions, cabbages, potatoes and watermelons – were sold through local informal markets and provided growers with their main source of income. Unlike export-oriented producers, these growers were highly vulnerable to land use changes: only 3 percent had title deeds. Horticulture extends deeply into urban Dakar, where gardeners produce lettuce and tomatoes on small plots, patios and in backyards, with extraordinary productivity: in less than two months, 3 m<sup>2</sup> of MGs yield 11 kg of lettuce or 4.5 kg of carrots, providing food for the household and a surplus for sale (FAO, 2012).

The framework for this work is offered by the MGs urban agriculture chain in Dakar. MGs are small scale urban gardens that use different techniques, adapted to the local context, such as organic vegetable gardening, soil-less cultivation, simplified hydroponics, aquaponics, bio-intensive method, etc. Two of the most common MGs system in Dakar are shown in figure 1. The peculiar characteristic of MGs approach is the focus on recycling materials as productive inputs such as containers, growth mediums and so on. By using recycled materials, small and residual vertical spaces and employed people's free time, MGs approach integrate deeply with the city's specific resources.

West African MGs program started in 1999 when FAO proposed this approach in Senegal. Dakar, the one and half million-population capital of the country, became the theatre of the first diffusion of MGs in the region. During the following 15 years MGs program went through a series of interconnected phases with slightly different objectives ranging from the adaptation of MGs techniques to local environment and resources to the sub-regional diffusion through international training. From 2004 to 2007 and again between 2009 and 2013 the MGs programme in Dakar was cofounded by the Italy - FAO Decentralized Cooperation Programme (IFDCP GDCP/SEN/002/ITA). Common goals of all phases are: 1) improve the nutrition and food security of the disadvantaged population by facilitating the access and daily consumption of a wide range of vegetables; 2) increasing the income of the disadvantaged population.

Nowadays, active microgardeners are more than 7000 in Dakar, mostly organized in more than 130 Community Production Centers (CPCs). Some of these community centres are in turn gathered in 5 Production Poles. 12 Training and Demonstration Centers (TDCs),

shown in figure 2, constitute the backbone of this network while in the final phase (2015-2016) of the programme a strategic MGs Central has been activated with the aim of managing the input supply for the whole production chain. This central hosts the headquarters of the Microgardeners's association (A2MJ – Association des Acteurs Microjardins) and is led by its representatives in collaboration with the Municipality of Dakar, which has created a specific Department for MGs integration in urban planning.

In fact, the present paper focuses on some of the “reason why” the population in Dakar should choose to rely on UPA and specifically on MGs. Several assumptions about the choice of UPA have been proposed through interviews conducted in May 2013 in several districts of Dakar using a survey structured form.

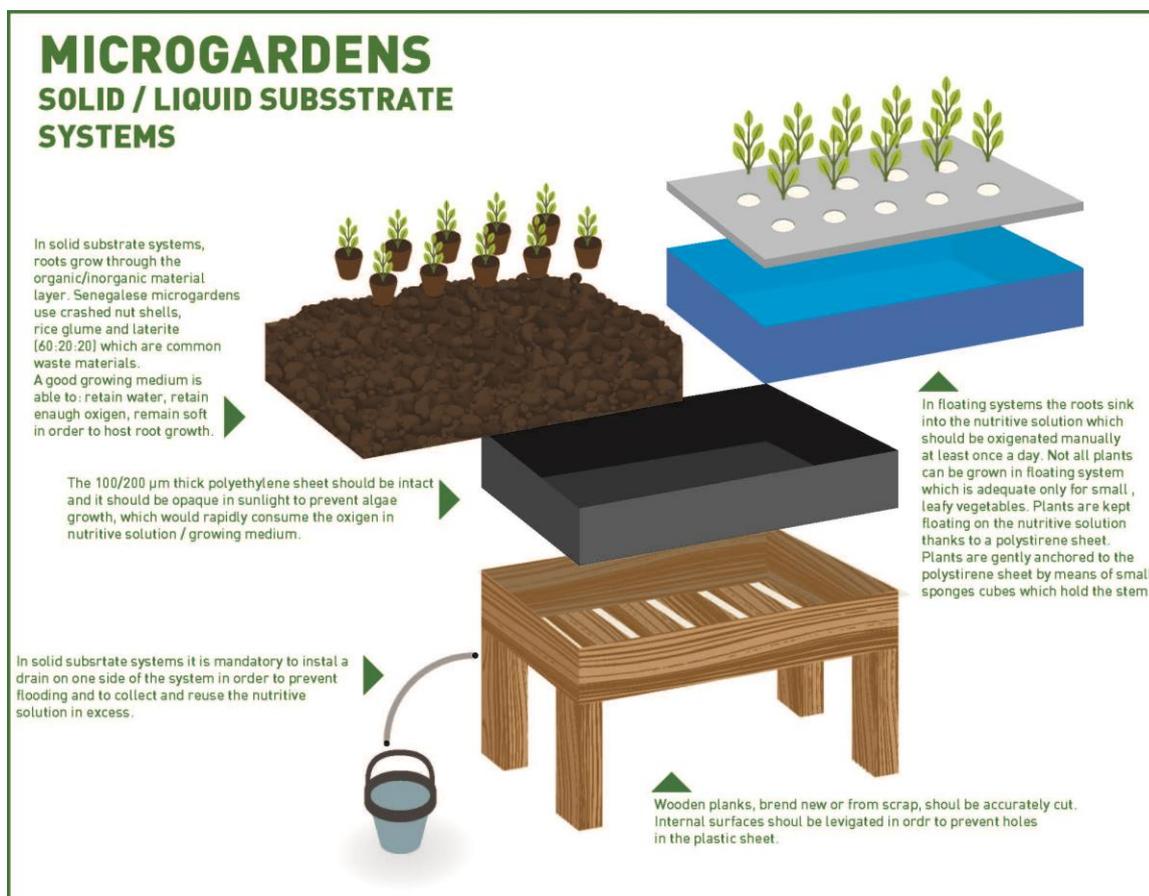


Figure 1 - Microgardens official info graphic used for project dissemination in EXPO2015 Milan. While the wood and plastic container remain the same (bottom of the image), two different Microgarden techniques are illustrated: the floating system on the top-right and the solid-substrate system on the top-left.

### Database and Survey Structure

The perception of urban dwellers of the specific form of UPA in Dakar, that is the MGs value chain, was investigated through direct survey. In May 2013, 671 people were interviewed in three districts of Dakar by 7 operators and by using a structured survey form. Respondents individually filled in the questionnaires, and any further that doubt emerged during compilation was clarified. The three target districts were chosen on the base of two socio-economic parameters: population density (ANSD, 2015) and average income (De

Marinis, 2013). Three districts were selected, as it is shown in figure 3: Camberene was chosen as a mostly residential, low income, district with low and steady population density; Grand Dakar was chosen as middle income, both residential and commercial district with average, unstable population density; Plateau was chosen as high-income, residential-business district with low and stable population density.

Since the total population of the three districts is composed by 133,765 inhabitants (ANSD, 2015), having applied the Krejcie and Morgan (1970) procedure, a sample size of almost 383 respondents is recommended; for our analysis was selected a sample size of 700 respondents, for 671 collected questionnaires. The survey form included 10 core questions (table 1), preceded by some informative question (date, home district, professional occupation and number of family members).



Figure 2 - Microgardens Training and Demonstration Centers in Dakar.

### ***Conceptual and Methodological Framework***

Since the prevalence of categorical variables in the questionnaire, a MCA was performed to conduct a HCA. This approach is a novelty for the dwellers' perception of UPA in African Countries, but it is a well-established technique in drawing classifications (Gore, 2000).

MCA is an extension of CA with more than two variables and a generalization of the principal component analysis with categorical instead of quantitative variables (Abdi and Valentin, 2007), MCA searches for the relationships pattern of several categorical variables

that revealed concealed patterning in complex datasets. Particularly, MCA enables the representation and modelling of complex datasets as clouds of points in a multidimensional Euclidean space. The results are interpreted based on the relative positions of the points and their distributions along the dimensions, and more category frequencies show similar distributions, the closer they are represented in space (Greenacre and Hastie, 1987; Johnson and Wichern, 2007). Studies on the proximity between points are meaningful only between points from comparable sets, i.e., rows with rows and columns with columns (Abdi and Valentin, 2007). In the present study, MCA was performed as a pre-process for hierarchical clustering analysis to retrieve all the information that this type of analysis can provide. Because MCA transforms categorical variables into continuous variables and enables the characterization of groups of individuals based on categories using a smaller number of variables, while retaining as much information as possible, it is widespread practice to use this statistical technique in combination with cluster analysis (Costa *et al.*, 2013; Husson *et al.*, 2010). Cluster analysis following MCA is often used to classify individuals into homogeneous groups; in this case the clusters are derived from the MCA dimension object

Table 1 - Structure of the survey.

QUESTION	VARIABLES NAME	DEFINITION	MODALITY	MEASURE UNIT
1	A1	Sex	Alternative	1: M2: F
2	A2	Who is the one who normally buy vegetables for the family?	Alternative	From 1 to 4 (1=me; 2=parents; 3=housekeeper; 4= others)
3	A3	Does the consumption of vegetables change seasonally?	Alternative	1: no 2: yes
4	A4	Are MGs known to the respondents?	Alternative	1: no 2: yes
5	A5	Where did the respondent hear about MGs?	Alternative	From 1 to 4 (1=word-to-mouth; 2=media; 3=civil society; 4=others)
6	A6	Propensity of the respondent to pay more for buying better quality vegetables.	Alternative	1: no 2: yes
7	A7	Propensity of the respondent to move more for buying better quality vegetables.	Alternative	1: no 2: yes
8	A8	Relative importance of knowing the producer (social value)	Alternative	From low to high importance (1= low importance; 3= high importance)
9	A9	Relative importance of having access to the production site (environmental value)	Alternative	From low to high importance (1= low importance; 3= high importance)
10	A10	Propensity of the respondent to self-organize to have alternative marketing solution for purchases (self-organized purchase group)	Alternative	1: no 2: yes

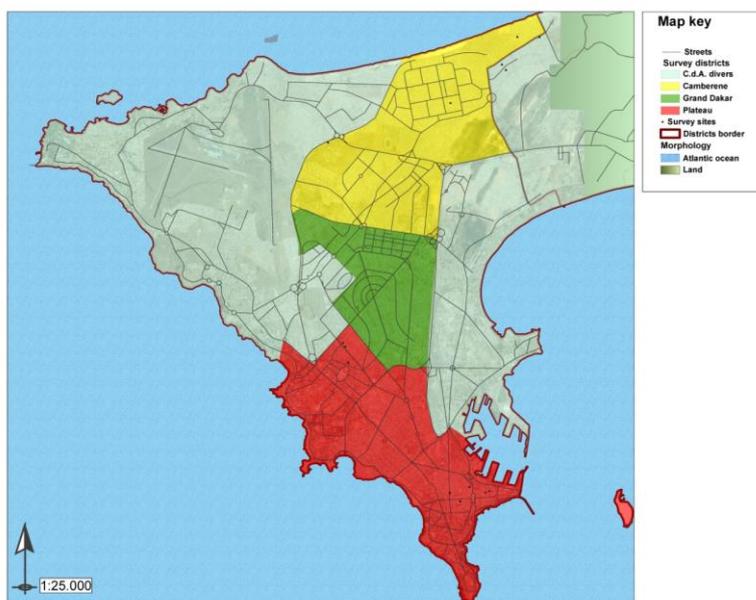


Figure 3 - Survey target districts.

scores, which are based on the quantification of the qualitative variables that define the individual profile. Hierarchical classification was performed using Ward's aggregation, a hierarchical classification algorithm. Ward's minimum variance criterion minimizes the total within-cluster variance, while maximizing the variance between classes, and groups are formed to minimize the pooled within-group sum of squares. That is, the two clusters are fused at each step, resulting in the smallest increase in the pooled within-group sum of squares. These inertias are calculated from the coordinates of the elements on the factorial plane of the MCA.

The Hierarchical Cluster Analysis (HCA) function aggregates clusters so that “*the growth of within-inertia is minimum*” (Husson *et al.*, 2010), i.e., to minimize the reduction of the between-inertia. Thus, hierarchical clustering identifies individuals who belong together, subsequently separating these individuals from the other data, resulting in several clusters. HCA is performed using the principal components of the factorial analysis, and the hierarchy is represented using a dendrogram. The vertical axis of the dendrogram represents the distance or dissimilarity between clusters, and the horizontal axis represents the objects and clusters.

## Results

### *Statistical analysis of the sample*

Our sample is composed of 671 respondents who were interviewed in the three selected districts, in Dakar. Due to the survey structure and methodology, the three districts where the interviews took place are not necessarily the home districts of the respondents as confirmed by the statistical analysis of the sample (table 2): 33.8% from Grand Dakar, 24.7% from Camberene, 12.1% from Dakar-Plateau and 28.2% from other districts. The goal of the interview, in the framework of the MG program was to meet the people responsible for the purchase of food for their household, resulting in a higher percentage of female respondents (95.1% are female, 4.9% are male).

Table 2 - Descriptive statistics of the sample divided per districts.

DISCRICT		NO ANSWER				OTHER DISTRICT				CAMBERENE				DAKAR-PLATEAU				GRAND DAKAR				WHOLE SAMPLE			
SEX	F	5	71,4%			174	93,6%			163	98,2%			71	83,5%			224	98,7%			638	95,1%		
	M	2	28,6%			12	6,5%			3	1,8%			14	16,5%			3	1,3%			33	4,9%		
TOT. SEX		7	100,0%			186	100,0%			166	100,0%			85	100,0%			227	100,0%			671	100,0%		
NUMBER OF PEOPLE IN HOUSEHOLD		min	max	average	st.dev.	min	max	average	st.dev.	min	max	average	st.dev.	min	max	average	st.dev.	min	max	average	st.dev.	min	max	average	st.dev.
		2,0	12,0	6,0	4,1	1,0	22,0	7,4	4,2	2,0	22,0	8,3	4,0	2,0	25,0	5,6	2,9	2,0	25,0	9,6	4,7	1,0	25,0	8,1	4,4
JOBS																									
(Small) Business owners		2 (1%)				52 (24%)				55 (26%)				37 (17%)				68 (32%)				214 (100%)			
Senior officials		3 (1%)				61 (25%)				45 (19%)				7 (3%)				124 (52%)				240 (100%)			
Worker class, Salesmen		0 (0%)				55 (39%)				41 (29%)				31 (22%)				15 (11%)				142 (100%)			
Intellectual/Scientific professionals		1 (2%)				16 (30%)				20 (37%)				6 (11%)				11 (20%)				54 (100%)			
Other professions (retired, unemployed)		0 (0%)				3 (14%)				5 (24%)				4 (19%)				9 (43%)				21 (100%)			
TOTAL		6 (1%)				187 (28%)				166 (25%)				85 (13%)				227 (34%)				671 (100%)			

The average number of family members, as declared by the respondents, approximates the institutional statistics in Dakar which is equal to 7.8 members per household (ANSD, 2015), as shown in table 2. The number of family components changes slightly among the districts, possibly matching their different urban typology: in Grand Dakar, which is the average revenue, mixed residential/commercial district, families are wider, followed by Camberene and Plateau, this last being one of the richest business districts in Dakar.

We could collect information about respondents' professional occupation resulting in slightly different jobs among districts: Camberene is confirmed as a residential district inhabited by people with low-income jobs while Grand Dakar hosts people with medium/high-revenue jobs. Dakar-Plateau is confirmed to be mainly a business district, as shown in table 2.

As it is clear in table 3, the sample shows a high percentage of female respondents (A1) who are also traditionally responsible for purchasing food for their household (A2). It is not clear from the sample if seasonal consumption of vegetables varies across the year (A3). MGs are averagely known among the respondents (A4) and the main informational channels are the word-to-mouth and the media (A5). Variables A6 and A7 resume the propensity to pay more or to displace more to have better quality vegetables in the basket.

The sample shows a slightly negative answer to these questions (A6; A7). Variables A8 and A9 resume the propensity of respondents in attributing value to environmental and social implications of MGs: both variables show a positive behaviour of respondents (A8; A9).

The last variable is about the propensity of the respondent to self-organize with friends or neighbours to activate alternative purchasing systems. Variable A10 averagely shows an affirmative behaviour of the sample (A10).

*Table 3 - Descriptive statistics of the variables.*

VARIABLES	MEDIA	STANDARD DEVIATION	MIN	MAX
A1	1.951	0.216	1	2
A2	1.477	0.932	1	4
A3	1.553	0.498	1	2
A4	1.465	0.500	1	2
A5	1.687	0.878	1	4
A6	1.307	0.462	1	2
A7	1.097	0.300	1	2
A8	1.793	0.832	1	3
A9	1.823	0.845	1	3
A10	1.818	0.386	1	2

### **Selected variables for MCA/CA**

The variables have been selected to maximize the explained variance while retaining the main relevant issues evaluated in the questionnaire.

Variables with low component loadings were sequentially excluded from the analysis. A solution with eight variables was selected as a fair compromise between the readability of the results and the maximization of the explained variance based on the first two axes (Table 4). The results of the MCA are shown in Figure 4.

As shown in figure 4, the first two components reflect 90% of the explained variance, particularly, the first component is approximately 67% and the second component 23% after Benzecri correction. The variables that primarily contributed, in terms of quality, to the construction of the first axis are A8. with 82.88% and A9. with 82.48% of the accumulated contribution. Then, A6 with 38.14%, and A4, with 26.62% of the accumulated contribution. Moreover, A10 showed a relevant contribution (21.12%) to the first component building (Table 5).

*Table 4 - MCA variables description.*

VARIABLE NAME	MODALITIES	DESCRIPTION
A2	A2i	I buy food
	A2p	Parents buy food for me
	A2d	Housekeeper buys food for me
A3	A3si	My fresh vegetable consumption varies throughout the year
	A3no	My fresh vegetables consumption does not vary throughout the year
A4	A4si	I know MGs
	A4no	I do not know MGs
A6	A6si	I could pay more for better quality vegetables
	A6no	I could not pay more for better quality vegetables
A7	A7si	I could travel to buy better quality vegetables at the same price
	A7no	I do not want travel to buy better quality vegetables at the same price
A8	A8l	I'm not interested in knowing the farmer cultivating vegetables that I acquire.
	A8m	I'm quite interested in knowing the farmer cultivating vegetables that I acquire
	A8h	I'm very interested in knowing the farmer cultivating vegetables that I acquire
A9	A9l	I'm not interested in seeing the place where vegetables that I acquire grow
	A9m	I'm quite interested in seeing the place where vegetables that I acquire grow
	A9h	I'm very interested in seeing the place where vegetables that I acquire grow
A10	A10si	I'm very interested in buying by self-organizing purchasing groups.
	A10no	I'm very interested in buying vegetables directly from MGs

Table 5 - Contribution of the variables to the MCA first and second components.

VARIABLE NAME	MODALITIES	COMPONENTS 1 (%)	COMPONENTS 2 (%)	TOTAL (%)
A2	A2i	-	-	
	A2p	-	5.39	5.39
	A2d	-	-	
A3	A3yes	-	4.27	4.27
	A3no	-	-	
A4	A4yes	13.23	-	13.23
	A4no	13.39	-	13.39
A6	A6yes	10.19	8.75	18.94
	A6no	10.34	8.86	19.20
A7	A7yes	-	-	
	A7no	-	-	
A8	A8l	19.7	12.75	32.45
	A8m	-	22.58	22.58
	A8h	19.81	8.04	27.85
A9	A9l	20.2	13.16	33.36
	A9m	-	22.48	22.48
	A9h	19.52	7.12	26.64
A10	A10yes	10.46	-	10.46
	A10no	10.66	-	10.66

To define the profiles of MGs' potential consumers based on MCA results, a cluster analysis has been performed. Clustering identified the best solution as a classification of the respondents into three clusters (Figure 5, Table 6).

Table 6 - Characterization of clusters by variables.

CLUSTER	OBSERVATIONS (N°)	MODALITIES	T-VALUE
1	301 (44.86%)	A9l	28.02
		A8l	26.47
		A4no	6.33
		A10no	4.14
		A7no	3.50
		A2i	2.69
2	206 (30.70%)	A9m	22.95
		A8m	22.58
		A6no	3.28
3	164 (20.44%)	A8h	24.68
		A9h	23.84
		A10si	5.48
		A4si	5.44
		A6si	4.63
		A7si	2.36

The first cluster includes the 44.86% of the sample, with 301 respondents. It groups those who are not interested in knowing the farmer<sup>1</sup> (A8) nor the production place of vegetables (A9), and they declare not to be aware of the MGs networks (A4). Moreover, although being responsible (A2) for their own food purchases, they are not available to move more to get their vegetables (A7) or to self-organize a purchase group in order to buy collectively from MGs (A10). This cluster is called “*The negatives*”, because it groups people with no relation with MGs’ network, although there is not a net rejection of MGs projects but only a lack of knowledge of it. This group of people remains negatively oriented in terms of purchasing in MGs’ network because they don’t give any value to social and environmental issues when choosing where to buy their vegetables, but the evidence that they do not know MG network could suggest they are a good group to be sensitized in order to engage in MGs, by communicating with them and involving them in MGs’ initiatives.

The second cluster includes the 30.70% of the sample (206 respondents). The variables describing this cluster show a medium interest for knowing the farmer (A8) and the production place of vegetables (A9) and the scarce availability in paying more for quality vegetables, mainly for economic reason. This cluster is called “*The inactives*”, because they seem quite interested in alternative food networks, but they haven’t money for acquiring from MGs’ production centres. They can’t be active in terms of purchase choices.

Cluster 3 is composed by 164 interviewees, the 20.44% of the sample. It is called “*The positives*”, including MGs’ consumers, that acquire vegetables from MGs, available to spend more for quality vegetables (A6), very interested in knowing farmers and place of production (A8; A9), they know well MGs (A10). They are already MGs’ consumers and they love this experience. “*The positives*” give high value to social and environmental issues in their consumer choice and they are interested in alternative distribution circuit, such as purchase groups. They know MGs network and are available to move more and pay more to get MG quality vegetables. For this reason, this group can be considered an example of the impact of UPA support activities such as the MG program and they could be a resource in expanding and advertising the MG activities.

More considerations come from the analysis of the distribution of individuals among the clusters and of the clusters among the districts, as it is shown in the tables 7 and 8. Short premises to be taken into account concern the relatively high proportion of respondents coming from “other districts” which somehow prevents direct attribution of the clusters to the three target districts that have been chosen to be representatives of some of the differences in the socio-economic tissue in Dakar.

The distribution shows that the most represented cluster is the first one but the entity of clusters 2 and 3 makes it possible to claim that the survey revealed a heterogeneous perception of MGs among the population. The three target districts are represented disproportionately in the sample where Grand Dakar is the most represented followed by “other districts” group, Camberene, Dakar-Plateau and finally the “no answer” group. Looking at the distribution among districts, results show that people from Grand Dakar and Dakar-Plateau districts place themselves mostly in cluster 1 and cluster 2, while cluster the subjects from Camberene district are more represented in cluster 3. It is interesting to remark that the more residential and poorer district seems to host mostly “positives”, while the mixed and the business districts seem to share a majority of “inactives” and “negatives”.

<sup>1</sup> “*knowing the farmer*” is a proxy of the consumer’s interest to the direct relationship between producer and consumer that usually occurs in a short supply chain (Mazzocchi *et. al.*, 2018).

Table 7 - Analysis of the distribution of individuals among the clusters and of the clusters among the districts.

	NO ANSWER		OTHER DISTRICT		CAMBERENE		DAKAR-PLATEAU		GRAND DAKAR		TOTAL	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
CLUSTER 1 "the negatives"	5	71.43%	82	44.09%	66	39.76%	48	56.47%	100	44.05%	301	44.86%
CLUSTER 2 "the inactives"	1	14.29%	67	36.02%	28	16.87%	20	23.53%	90	39.65%	206	30.70%
CLUSTER 3 "the positives"	1	14.29%	37	19.89%	72	43.37%	17	20.00%	37	16.30%	164	24.44%
TOTAL	7	100.00 %	186	100.00 %	166	100.00 %	85	100.00 %	227	100.00 %	671	100.00 %

Table 8 - Distribution of jobs in the three clusters.

JOBS	CLUSTERS			
	1	2	3	TOTAL
Senior officials	97 (40,42%)	43 (17,92%)	100 (41,67%)	240 (100,00%)
Intellectual/Scientific professionals	12 (22,22%)	30 (55,56%)	12 (22,22%)	54 (100,00%)
(Small) Business owners	55 (25,70%)	50 (23,36%)	109 (50,93%)	214 (100,00%)
Worker class, Salesmen	39 (27,46%)	31 (21,83%)	72 (50,70%)	142 (100,00%)
Other professions (retired, unemployed)	10 (47,62%)	9 (42,86%)	2 (9,52%)	21 (100,00%)
TOTAL	213 (31,74%)	163 (24,29%)	295 (43,96%)	671 (100,00%)

A hypothetical explanation of the shown distribution may be drawn on both socio-economic differences between the districts and professional occupations' distribution among clusters, as shown in table 8.

In fact, in a relatively poor and residential district such as Camberene, people are more used to rely on UPA products and therefore are more sensitive to UPA related social and environmental values, as also reported by other studies (Marumo and Mabuza, 2018). Moreover, Camberene is a densely inhabited residential district with a dense social tissue and it is not unexpected to find here more individuals appertaining to "the positives" cluster, which also groups the majority of low and middle-income workers, as shown in table 8. The same approach could explain the strongest presence of "the negatives" and "the inactives" groups in Grand Dakar and Dakar-Plateau, the mixed residential/commercial district and the most business-oriented district. In this perspective, wealthy individuals may be less concerned with UPA and MGs because they can afford to buy expensive imported products on the large retail market. This interpretation could be confirmed by the strong presence of "the negatives" both in Grand Dakar and Dakar-Plateau districts and by the high number of wealthy workers in the first cluster, as it is shown in table 8. Here, one possible consideration is that in this context it would be particularly useful to implement sensitization campaigns in order to diffuse the social and environmental sensitivity among the population.

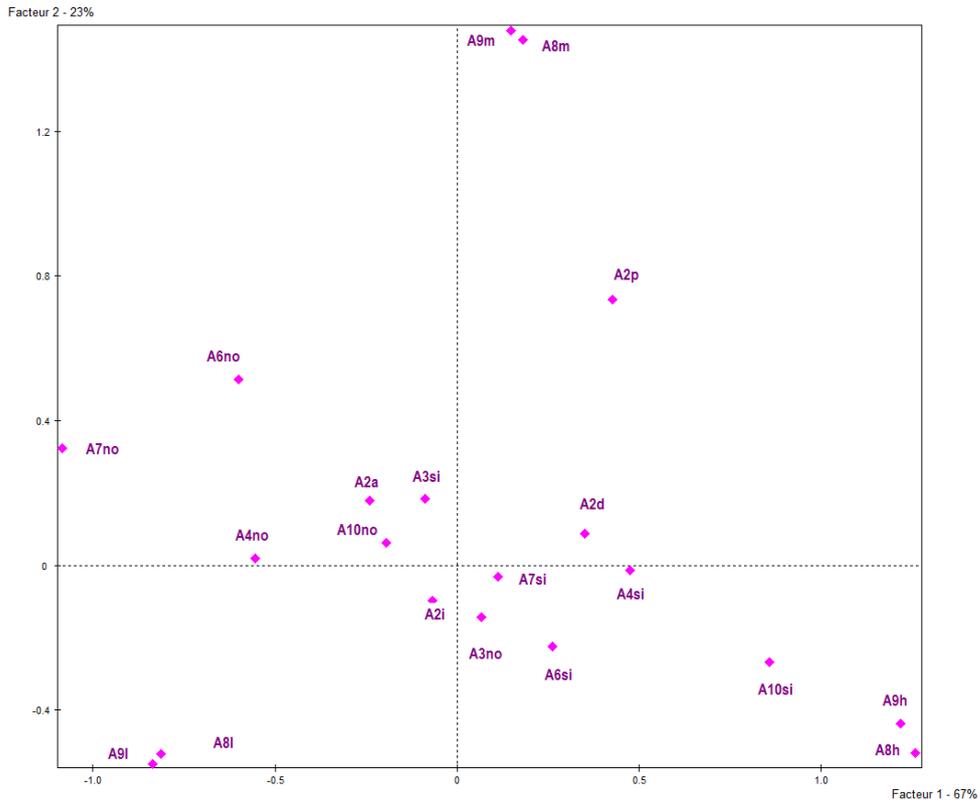


Figure 4 - The figure shows the selected eight variables on a Carthusian plane along the two axes (x, y). The two axes represents the two first components of a MCA analysis, which grouped the major part of the explained variance (90%).

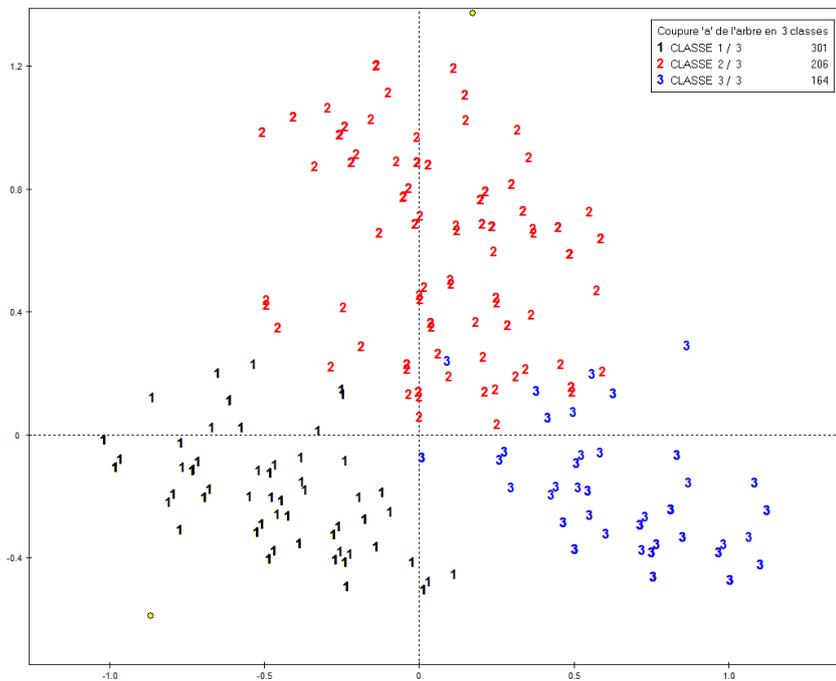


Figure 5 - Results of cluster analysis, Clustering identified the best solution as a classification of the respondents into three clusters, as shown in the figure. The first cluster (1) represents “The negatives” group, the second cluster (2) “The inactives” group, the third cluster (3) represents “The positives” group.

## Discussion and Conclusions

Results clearly reflect a diversity of perception about MGs in Dakar, which are to be in the most general perspective of UPA. While urban population is increasing fast and food quality is less controlled (FAO, 2016), people react diversely, therefore dividing between the “more sensitive” ones who care for health and sustainability, both individually and globally speaking, and the ones who don’t want or can’t afford to care about this issue.

As for “*The negatives*” cluster, respondents declare they do not know and they do not seem interested in MGs. It is clear that if they are not informed about MGs they cannot appreciate their products, either their social or environmental implications. According to FAO and World Bank (Hoorweg and Munro-Faure, 2008) who claim that policy should invest in specific communication and promotion of UPA, our results let us argue that, “the negatives” group should be the specific target for sensitization. In fact, the projects such as MGs, could make profit of the specific strata of the consumers which are potentially able to change their food habits and heavily contribute to the improvement of local economy, environmental standards and social cohesion, by involving them in food chains organization (Carpio and Isengildina-Massa, 2009; Darby *et al.*, 2008; Ruggeri *et al.*, 2016). In turn, the direct (or less intermediated) relationship between producer and consumer often plays a key role in the sustainability of these kinds of chains especially in urban areas.

In developing countries, the urban policy agenda often addresses the issue of food security through UPA, as happened in Nairobi, in which the City Council has set up a specific bill which legally allow urban agriculture (FAO, 2016); to prevent healthy risks, it has also defined several rules on food safety as hygienic standard, animal welfare and traceability. Building on these considerations on “*The negatives*”, research and policy agenda dealing with UPA should focus more and more on the sensitization of consumers, especially among the potentially most “reactive” strata of the population.

In regard of “*The inactives*” cluster, it consists of individuals on average interested in the topic of a short chain represented by MGs, but it is a segment of the population that usually can’t afford to choose where to make their purchases, and to choose to spend more in order to eat better. But if MGs and UPA project has the aim to ameliorate food access for all the population (FAO, 2016), a further investment is needed in order to make UPA value chain accessible for the poorest segments of the population. This could be achieved by fostering participation in the very first design phase of programs as well as by improving the production background, i.e. lowering production costs. In fact, according to several studies, the involvement of local stakeholders contributes both in making them aware of the dynamics of their own territory and in involving them in the implementation of improvements (Binder *et al.*, 2010).

Concerning “*The positives*” cluster, it includes individuals who give high value to social and environmental issues in their consumer choice, and who are satisfied consumers of MGs’ products; in this sense, they could become a resource for policy in advertising the MGs’ network, as “active testimonials of UPA”. This could be one of the key issues for triggering more impactful effects of UPA, and on MGs, in dealing with food security promotion. Effectively, according to Battersby (Battersby, 2013) and Maxwell (Maxwell, 1999) until now, urban policy makers and practitioners with limited budget and organizational capacity, as some African governments, use their scarce resources to address “huge problems” without a clear and specific targeting strategy. Nowadays, in light of the

massive urbanization and the “urbanization of poverty”, the increased interest in UFSs should be backed by ad hoc “profiling, targeting and marketing of UPA programs”, such as the MGs. In this perspective, while urban dwellers who are already involved in UPA and MGs’ practice, as “*The positives*”, can be essential assets for good practices diffusion and communication, sound targeting methodologies could be useful to foster the overall impact of interventions.

The present study has investigated the perception of dwellers and potential consumers about MGs’ practices and products, resulting in three approaches on the issue, deeply described in the results. These results are of much interest for any international development cooperation providers wishing to tackle the issue of UPA through development initiatives. In fact, UPA perception by consumers may be a cornerstone of impact improvement for development programmes and may explain the recorded lack of sustainability of the MSSC (Nordhagen, 2019).

Furthermore, the results suggest that UPA’s direct experience, meaning in this case the fact of knowing MGs, leads to greater degree of approval and use of MGs’ tools, confirming the importance of passed interventions.

From the DC’s perspective, our work shows the potentialities of local stakeholders’ perception analysis in building an evidence base for policymaking and in supporting the achievement of development cooperation initiatives’ impact. From the scientific perspective, since there are few researches about UPA’s perception by potential consumers and dwellers in Africa, our work shows how to merge the goals of research and local policy making. In our opinion the planning of an impactful UPA support program needs consistent analysis of UPA perception among urban dwellers in order to effectively translate policies into a virtuous UPA. Once perception is well known, during the planning of new policies, local authorities can leverage on issues which are truly felt by the population and therefore avoid miscommunication of objectives and implementation strategies. Moreover, dealing with initiatives that are already being implemented such as the case of MGs, perception analysis is specifically needed in order to better explain the achieved results and to understand unexpected difficulties. The main policy recommendations are about a wider involvement, with ad hoc strategy, of all the strata of the population into the project/policy planning and about the potentialities of sound methodologies in building solid evidence for impactful interventions. Future steps of the research may address different survey and analysis methods or could address the perception of more specific issues related to MGs and UPA. For instance, further research on MGs in Dakar could, on the one hand, enlarging the sample of the survey using the same methodological approach, and, on the other hand, test other typologies of quantitative approaches in order to elicit other suggestions and considerations useful for policy makers. Moreover, an issue that should be assessed more in depth is the perception of stakeholders about environmental and health risks linked to the production and consumption of vegetables in UPA and related value chains.

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