Development potentials and sustainability challenges of peri-urban farming in the metropolis of Rabat (Morocco)

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ABSTRACT
Urbanization is a global phenomenon. The metropolis of Rabat (Morocco), like the majority of cities, is confronted to these phenomena of population growth and urban extension, which induce consumption of agricultural areas, an increase in food demand, unemployment and environmental degradation. This urbanization has therefore increased the importance of peri-urban agriculture for employment and food security in Rabat. The economic, social and environmental roles of peri-urban farming need to be better understood in order to integrate peri-urban agriculture into urban planning. The current study aims to assess the practices, roles and challenges of this type of agriculture in the metropolis and focuses on the diversity of its functions and on its sustainability. Using stratified selective random sampling methods, 50 respondents were selected. Data collection was based on field observation, interviews and field surveys. Descriptive statistics such as frequency distribution, Chi-square test, tests of normality and homogeneity of variances and Principal Component Analysis (PCA) were used. According to the results, the dominant speculation is vegetable crops followed by arboriculture, cereals, leguminous and some livestock rearing such as beef, sheep and poultry farming. The peri-urban agriculture in Rabat is characterized by the specificity and the diversity of its production systems, it is a multifunctional activity: it contributes to the economic development of the metropolis by creating jobs and generating income for farmers, its food supply and its environmental beatification. However, it faces several constraints: precariousness and cost of labor force; absence of laws regulating this activity; lack of training and technical supervision of peri-urban farmers and shortage of water resources. The improvement in the political and institutional framework observed today in Morocco to drive change is encouraging. To maintain this positive dynamic, the actors of peri-urban agriculture: namely researchers, decision-makers and the local community, must work together to guarantee its future development.

1. Introduction:
Peri-urban agriculture is of vital importance for food security in several African countries because of its role in supplying cities in agricultural products and the fight against unemployment [1]. When dealing with the topic of urban and peri-urban agriculture, there are many definitional challenges with the terms referring to a diverse range of activities to include crops, livestock, poultry, and aquaculture production and ranging in scale from rooftop gardens to larger cultivated open spaces [2]. In simple terms, urban agriculture is defined as the growing, processing, and distribution of food and other products
through intensive plant cultivation and animal husbandry in and around cities [3]. Urban and peri-urban farming can take a variety of forms but, conceptually speaking, it refers to crop and livestock production within cities and surroundings. Urban agriculture plays a large part in contributing to sustainable urban development. As more and more people are living in cities, urban farming is emerging as an attractive means of supplying urbanites with food. At the same time, it is an important strategy for reduction of hunger and poverty, improvement in resident health, and climate change mitigation and adaptation. Urban and peri-urban agriculture, in the form of the alternative paradigm as defined by Sumner et al. (2010), carries enormous cultural potential creating sustainable systems of farming. Urban agriculture is reshaping the landscape of cities contributing to worldwide strategies to create sustainable cities [4-5]. It integrates multiple functions in densely populated areas offering an alternative land use. In addition to food production, urban agriculture also offers a wide range of other functions such as energy conservation, waste management, biodiversity, nutrient cycling, microclimate control, urban greening, economic revitalization, community socialization, human health, preservation of cultural heritage and education [6]. In an effort to take control of food security, social issues, and environmental degradation in their communities, residents in many major cities have undertaken urban agricultural activities that create opportunities to provide food, jobs, environmental enhancement, beautification, education, inspiration, and hope. It is estimated that 800 million city dwellers around the world, including developed countries, engage in agriculture to feed themselves and their families with reports that in some Latin American and African cities, up to a third of the vegetable demand is met by urban production [4]. Urban agriculture is here to stay. Urban agriculture, in the form of the alternative paradigm as defined by Sumner et al. (2010), carries enormous cultural potential creating sustainable systems of farming. Urban agriculture is reshaping the landscape of cities contributing to worldwide strategies to create sustainable cities [4-5].

In Morocco, the percentage of urban population increased from 43% to 55% between 1982 and 2004 and will probably reach 70% by 2050 [4]. Taking into account the complex space economy of urban cities, multitasking to promote enhanced use of farmland within urban areas can become a win-win situation [5]. At national scale, few systematic studies have been carried out on peri-urban farming. However, the continued growth of the Moroccan cities indicates that a broader and more systematic understanding of the peri-urban farming is necessary to determine its importance and to help determine the best way to develop this type of agriculture in order to contribute to sustainability and food security for the country in the future. The current study aims to assess the socio-economic contributions of peri-urban farming to livelihoods and the constraints faced by farmers in study area and focuses on the diversity of the functions of this activity and on its sustainability.

2. Material and methods:
The study area was delimited to a radius of 40 km from the urban core of the city of Rabat in order to remain within the peri-urban perimeter while ensuring the presence of farms with the majority of existing speculations in the region. Five study areas and 50 respondents were selected. Both primary and secondary data sources were used. The primary sources of data for this study were collected from sample households that practice peri-urban agriculture. Data collected through questionnaire are quantitatively tabulated, interpreted and presented by using statistical methods such as frequency distribution, Chi-square test, Tests of normality and homogeneity of variances, means comparison test and Principal component analysis (PCA). All analysis and calculations were performed on the SPSS version 26 (Statistical Package of Social Sciences, V26.0) and Ms Excel. The secondary sources of data were sourced from various published and unpublished documents of the regional agriculture department office and public administration offices of Rabat and from annual statistical reports.

![Figure 1. Location of the surveyed farms within the study area.](image-url)
3. Results and discussion:

3.1. Exploratory analysis of socio-demographic data in the study areas:

According to the results, the most dominant age group is that of 51-60 years with 34% compared to other classes. The study also reveals that the two classes 51-60 years old and 61 years and over represent 64% of the respondents, this shows that the farmers of the five study areas are mainly elderly people (Figure 2).

Following the analyzes results, the majority of respondents have 20 years of experience or more (76% of the surveyed population). This can be explained by the fact that 86% of operators are over 41 years old. The 10% belonging to the under five years of experience class are:
- young farmers up to 27 years old who have just finished their higher education and are helping their parents with agricultural work while waiting for them to find other work.
- new farmers who have just bought plots out of passion for agriculture.

Regarding the motivation of farmers to do peri-urban agriculture, 46% of farmers practice agriculture because of poverty and unemployment. These are mainly farmers from the most disadvantaged segment of the population whose level of education does not exceed secondary education and who have inherited the land from their families. In developing countries, urban agriculture is practiced to generate self-employment and direct revenue or savings leading to greater social stability [5]. The survey results reveals that Peri-urban agriculture is the main income source for almost 78% of the households interviewed, which indicates its important role for urban livelihoods as well as for employment opportunities. According to a study carried out in Dar Es Salaam, Tanzania, peri-urban agriculture provided an estimated 20% of all jobs in the town [8]. In Lomé, Togo, the mean monthly income of a market gardener amounted to that of a senior public servant [9], and in Nairobi, peri-urban agriculture used to provide the highest self-employment earnings in small-scale enterprises and the third highest earnings in all of urban Kenya [10].

The study also shows that 80% of the surveyed population did not go beyond secondary education and no farmer among those visited has received technical supervision and only one farmer of the agriculturalists was able to participate in a training on the production of exotic plants. It was a nurseryman.

3.2. Analysis of the variables relating to the mode of land acquisition and the cultivated area in the five study areas:

The survey results reveal that “Le Melk” (inheritance and purchase) is the most dominant mode of acquisition (96%) (Figure 3).
In developed countries, urban agriculture takes place often on small pieces of land tucked away in corners of cities either rented or on own parcel of land with community gardens maintained by a group or community such as school gardens [5]. According to the major findings of the study, the most dominant area class is 0-3 ha (48% of the farms surveyed), these are mainly small family farms (Figure 4).

3.3. Analysis of activities types and cropping systems:
It is observed that the most dominant speculation is vegetable crops followed by arboriculture, cereals and leguminous and fodder crops (Figure 5). Both cash and food crops are mainly vegetable crops and cereals such as common wheat, potatoes, tomatoes, etc. Using the Student’s T-test, the averages of yields in peri-urban farming systems are equal to those in conventional agriculture (Table 1). This can be explained by the use, in peri-urban agriculture, of the same technical operations of conventional agriculture, in particular organic and chemical inputs, phytosanitary products, methods of spreading fertilizers, phytosanitary treatment techniques and irrigation of crops.

The study shows that livestock is a practice less regarded by farmers in the region: 54% of respondents do not practice livestock while 46% who do it have only a small herd. In general, the most common types of livestock farming practice in the study area includes: beef farming, sheep farming and poultry farming practices. Such types of farming activities are kept in both peri-urban and rural areas of the country for various uses including milk and milk products, meat, eggs, food, cash and various cultural uses [11].

![Figure 4](image1.png)

**Figure 4.** The figure presents the area classes of the surveyed farms in different study zones.

![Figure 5](image2.png)

**Figure 5.** Speculations practiced by the respondents according to the study area.
Table 1. Average yields of some crops grown in peri-urban agriculture (PUA) and conventional systems in the metropolitan area of Rabat (Morocco).

<table>
<thead>
<tr>
<th>Average yield</th>
<th>PUA</th>
<th>Conventional agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bean q/ha</td>
<td>10.5</td>
<td>9</td>
</tr>
<tr>
<td>Soft wheat q/ha</td>
<td>17.17</td>
<td>18.7</td>
</tr>
<tr>
<td>Potato t/ha</td>
<td>22.14</td>
<td>32.5</td>
</tr>
<tr>
<td>Tomato t/ha</td>
<td>34</td>
<td>32.2</td>
</tr>
<tr>
<td>Zucchini t/ha</td>
<td>10</td>
<td>13.5</td>
</tr>
<tr>
<td>Carrot t/ha</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Avocado kg/tree</td>
<td>36.17</td>
<td>50</td>
</tr>
<tr>
<td>Corn t/ha</td>
<td>12.25</td>
<td>35</td>
</tr>
<tr>
<td>Barley q/ha</td>
<td>35.6</td>
<td>11.9</td>
</tr>
<tr>
<td>Green bean t/ha</td>
<td>7</td>
<td>8.5</td>
</tr>
<tr>
<td>Oats q/ha</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Alfalfa t/ha</td>
<td>47.5</td>
<td>62</td>
</tr>
<tr>
<td>Onion t/ha</td>
<td>20</td>
<td>19.5</td>
</tr>
<tr>
<td>Pumpkin t/ha</td>
<td>11.33</td>
<td>37.5</td>
</tr>
<tr>
<td>Citrus Kg/tree</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Pea t/ha</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Eggplant t/ha</td>
<td>22</td>
<td>40</td>
</tr>
<tr>
<td>Plum kg/tree</td>
<td>31.5</td>
<td>34.3</td>
</tr>
<tr>
<td>Peach kg/tree</td>
<td>40</td>
<td>28.8</td>
</tr>
<tr>
<td>Vine t/ha</td>
<td>37.5</td>
<td>45</td>
</tr>
</tbody>
</table>

3.4. Sustainability challenges of Peri-urban agriculture in the Metropolis:

According to Krishnan et al. (2016) [12], urban agriculture integrates three main principles of sustainability:

1. Environmental health: Sustainable urban agriculture is supportive of environmental health in that it requires low input of water and low to no use of fertilizers and pesticides.

2. Economic profitability: Sustainable urban agriculture reduces transportation costs of shipping between local producers to local markets.

3. Social wellness: Sustainable urban agriculture provides opportunities for social interaction and individual recreational opportunities [6].

As elsewhere in Africa and around the World, peri-urban agriculture in Rabat contributes to the food security of the urban poor and provides them with significant employment opportunities. In addition, it is a major component of the agricultural sector and of the entire economy of Morocco. In the metropolis of Rabat, peri-urban agriculture is indeed multifunctional, ensuring both a food production function (fruits and vegetables) intended for sale, a socio-economic function (It allows the creation of employment for the benefit of the region’s youth and the generation of income for farmers) and an environmental function. Results of the survey indicate that peri-urban farming in the metropolis of Rabat has a significant environmental impact that must be taken into account when implementing policies concerning this activity. It participates in the development of open spaces that are difficult to build, thus contributing to the creation of a beautiful landscape for urbanites. It limits the building pressure and maintains green belts for the urban population seeking green spaces for relaxation. Peri-urban farming has also an important role in the recycling of livestock products by using the organic manure in the agricultural production process. Jouve and Padilla (2007) [13], who demonstrated that the peri-urban agriculture offers several functions such as food, socio-economic, environmental and territorial services, confirmed the same results. This agriculture, by preserving open spaces within cities, creates favorable conditions for the existence of sustainable cities [14-15]. According to the major findings of the study [16-18], peri-urban agriculture in the metropolis of Rabat faces several constraints such as: legal constraints mainly related to the absence of laws regulating this activity at the national level and the obligation of some operators in the peri-urban area to pay housing tax. It is also subject to a certain number of technical constraints: insufficient workforce and high labor costs, lack of technical supervision and support from the concerned body and it mainly suffers from difficult access to irrigation water. For all these reasons, municipal authorities must incorporate urban and peri-urban farming in urban development plans. With better infrastructure, education and training, and access to agricultural finance, farmers could benefit from increased crop yields and stronger connections to local, regional, and international markets.
4. Conclusion:
In future, it is necessary to pursue a more progressive and sustainable policy for urban and peri-urban agriculture on the fringes of the metropolis of Rabat and in Morocco in general. The current national agricultural policy supports this intention. The next steps are to rationalize local policy towards the same objective in a more specific way. To define in the development plans a system of protection of land and its use redefined in specific areas dedicated to urban and peri-urban agriculture. Following this, it will be easier to address issues related to peri-urban agriculture and health, to improvement of the environment, income generation, social cohesion and waste management. In the absence of the plurality of intervening actors and the diversity of initiatives on urban agriculture, there is not yet a multi-actor framework for exchanges and sharing of experiences. The establishment of a stakeholder platform is strongly desired by the actors for a better sharing of information and experiences and the implementation of operational actions and advocacy for a sustainable development of the sector.

References: