1. Introduction

Community garden, one of the important element providing high-density urban area with green space is crucial for ecosystem services (Wolch et al. 2014). Researches on green spaces in urban areas mostly focus on parks and their green cover. In fact, the green cover is one of the most critical parts in terms of securing green spaces in urban areas, with many studies so far including McCormack et al. (2010), Sallis et al. (2012) stressing the proximity of and physical activities at urban green spaces.

In particular, gardening in urban area is one of the well-known and crucial solutions for interacting with green space (Lewis 1996). Also, community gardens in urban areas are regarded as a useful tool not only for fostering sustainable urban planning and design but for enhancing the self-sufficiency of food for participants which in turn could help boost the overall food security.

True, community gardens and urban agriculture share their purposes in terms of cultivating crops in urban areas. But the former is deemed more helpful in solving a variety of physical and social problems in urban areas, as working on community gardens itself could have physical benefits and provides food production in an environmentally friendly way (Irvine et al. 1999), among others.

Recent studies on community gardens have also highlighted their importance in the job satisfaction and socio-economic terms based upon the analysis of several cases in the United States, and Nursery and Garden Industry Australia Limited (2006) pointed to the significance of community gardening from restorative and community-building perspectives, all of which stressed that community gardening has been maximized as a valuable method to resolve diverse urban problems and to promote urban regeneration. Other researchers, including Fox, Koeppel, & Kellam (1982) and Cashdan et al. (1982), have also emphasized that community gardening is a sustainable way to react to such urban problems as suburbanization, disinvestment and urban blight.

In this line, Kim, Oh, and Kim (2016) called for securing cultivating lands with an easier access and further researches on possible economic effects of community gardens in order to make it sustainable.

Related studies on this issue so far, however, have simply presented research indications in space, community and policy perspectives, and the analysis on the economic aspect of community gardening mostly have done on urban agriculture (UA) which is a novel primary industry in urban areas. Such a limitation appears to be resulted from difficulties in securing samples and the subsequent limits, as community gardening is largely carried out by urban residents who use idle spaces to which they can have an easy access, different from the more-organized UA. In this context, more proactive and in-depth studies on participants in community gardening are needed (Oh and Kim 2014).

As different cities have different physical, social, cultural and economic circumstances of their own, in particular, practical researches on each place and alternative measures to promote the sustainability of community gardens would be needed.
Accordingly, this article aims to shed light on economic elements of community gardening to explore ways to make it more sustainable, with the subject being participants in South Korea’s capital city of Seoul which is one of the East Asian countries where community gardening as well as UA have taken on in recent years. By presenting several points of indication, the study will seek ways to promote residents’ long-term participation so as to foster the sustainable development of community gardening.

2. Data collection & methodology

In order to explore elements that affect community-gardening participants’ consistent engagement, this article employs the following methods in carrying out a survey and the statistical analysis.

First, 29 indices in 11 categories presented by Statistics Korea (KOSTAT 2016) were taken in order to find economic elements that would link to the sustainability of community gardening.

Of them, second, several indicators were chosen such as the total household income, expenditures for housing/water/heat/light, and food costs, in order to look into effects such indices on the household economics would have on community gardening activities.

Third, the concept used in the Mougeot (2000) research was adopted here to draw independent variables using the aforementioned indices, which looked into possible economic effects of the crop cultivation by individual urban dwellers. In his paper, Mougeot concluded that the self-provisioning has nothing to do with the individual income, but it would be, at least in part, indispensable for poor households.

Accordingly, this research chose two indices to measure the poverty level of urban residents to quantitatively assess effects of community gardens on household budget: one is Engel’s coefficient, which means the proportion of income spent on food, and the other one is Schwabe index, a measure of housing costs relative to total household expenditure. As a means to measure the level of poverty among urban dwellers, the two indicators here are to grasp what roles the community gardening play in economic terms in case of Seoul.

Values of Schwabe index and Engel’s coefficient were adopted as independent variables to learn their effects on dependent variables. Due to technical matters in terms of the data obtainment, the analysis was based upon the quarterly materials of respondents’ income and expenditure made three months ahead of the polling.

The formulas to calculate each variable are as follows:

\[
(a) \frac{Q_{EC}}{H_{iq}} = \frac{F_{eq}}{H_{iq}} \quad (b) \frac{Q_{Si}}{H_{iq}} = \frac{H_{eq}}{H_{iq}}
\]

\(H_{iq}\), which is used in each formula, means the average income during the three months. The formula to calculate the respondents’ expenditures on food and beverages to draw the respondents’ Engel’s coefficient \((a)\) is as follows:

\[
F_{eq} = \frac{1}{3} \sum_{m=1}^{3} (F_{em1} + F_{em2} + F_{em3})
\]

\(Fem1 \sim 3\) means the sum of monthly expenditures of two indicators on food and beverages among household consumption indices released by the KOSTAT, which is required to calculate the respondents’ Engel’s coefficient.

The formula for the average monthly expenditure on housing, needed to draw Schwabe index seen in \((b)\), is as follows:

\[
H_{iq} = \frac{1}{3} \sum_{m=1}^{3} (H_{em1} + H_{em2} + H_{em3})
\]

Here, \(Hem1 \sim 3\) refers to the sum of the monthly expenditures on two indicators among the household consumption indices, and each indicator includes expenditures for housing, water, heat and light.

In calculating Schwabe index, it is common to separate the PIR, or price to income ratio, of those who own their own house, from the RIR, or the rent to income ratio, among those who do not own one (Cho and Kim 2014) in order to draw the housing and light/water expenditures. Here, however, such a measure of separation was not made as the Schwabe value ultimately means a total aggregation of the household income.

As several researches, including Cho and Kim (2014), and Oh & Kim (2015), adopted the Schwabe index to evaluate the level of household poverty, this article also took it, along with Engel’s coefficient, as an independent variable, to learn its possible effects on dependent variables.

Last, hours respondents spent in community gardening activities, the size of managed lands, and possible yearly changes in their cultivating land size were measured to draw independent variables to figure out the current status of community gardening. The formula to calculate the increase in the land size \((r)\) is as follows:

\[
(c)^{\left(\frac{A_{n+1}}{A_{t}}\right)} = \frac{An}{AT}^{n} - 1
\]

Here, ‘A1’ means the size being managed in the primary year, “An” the current size, and “n” the duration (year) of the participation.

The regression analysis was adopted to analyze the survey, and the dependent variable is the participants’ willingness to continue to take part in the activities that was presented by the 5-point Likert scale (Table 1).
3. Research setting and study area

The survey was conducted on eight apartment complexes located in South Korea’s capital city of Seoul (Figure 1) on December 2015. The apartment-type housing accounts for 67 percent of the total residential buildings (Seoul Statistics 2014). The size reserved for community gardening in Seoul, the highly dense city, has grown to 143.2 ha as of the end of 2016 from 29.1 ha in 2011 thanks mainly to the Act on Development and Support of Urban Agriculture (Act of UA) (Seoul Metropolitan Government 2016).

Both public and private entities have made an intensive investment in community gardening in apartment complexes, as, in urban/architectural terms, they usually have usable spaces due to the low building-to-land ratio and idle lots for landscaping, and it could help achieve a crucial social benefit of boosting ties among neighbors within a complex.

The survey involved a total of 117 residents living in 8 apartment complexes and who participated in community gardening for over six months, with 112 valid ones being taken for the analysis. The size of the lands for the gardening was measured by pollsters on the day of the research, and the housing expense of each household, which is needed for the Schwabe Index, was measured based upon their monthly apartment management fees. The calculation for participants’ costs for food were based on their expenditure during the July–September period of 2015, with major related indices being drawn on the basis of their credit cards and cash-spending data upon their approval.

4. Results

4.1. Socio-demographical characteristics

The average age of the respondents was 53.01, and the average number of family members per household came to 2.6. On average, the size of land managed by each household was found to be 14.5 m² inside their apartment complexes and 39.66 m² outside them, and the participants spent 6.7 hours per week to cultivate their gardens inside the complexes and 9.3 hours for outside ones (Figure 2).

The average quantile of the respondents’ income stood at 4.07 out of the 10-scale level, and the average figure of their Engel’s coefficient was 15.97 percent, which is quite higher than the analysis of the KOSTAT (2017). Their Schwabe Index was 18 percent, also a bit higher than the national average of 12.66 percent in 2015.

As for types of their community gardening, 37.9 percent turned out to have used box gardens earned by the governments’ projects, and 62.2 percent have managed

Table 1. Variables used in quantitative analysis (n = 102).

| Variables                  | Measurement/Units                      |
|----------------------------|----------------------------------------|
| No. of family members      | Measured value                         |
| Average age of family members | Measured value                         |
| Income ratio (10 level)    | Comparing measured value with income table |
| Current land and size      | Measured value                         |
| Increase rate in land size | Formula (c)                            |
| Participating hours        | Measured value (weekly)                 |
| Participation duration     | Monthly basis                          |
| Engel’s coefficient        | Formula (a)                            |
| Schwabe Index              | Formula (b)                            |
| Will for constant participation | Likert scale (5 point)                  |

Figure 1. Location map of study area and survey areas.
their community gardens at empty spaces either inside or near their apartment complexes.

Of the participants who managed spaces outside the houses, 57 percent have used vegetable gardens operated by public entities and 20 percent by private entities, while the remaining 23 percent took the land in nearby areas such as hills. By types of their cultivation, a majority, or 84.6 percent, were found to have grown leaf and root vegetables such as lettuce and eatable herbs, and 12.1 percent raised flowering plants (Figure 3).

4.2. Model summary

This research model shows a high level of correlation with 0.830. The value of the adjusted $R^2$ is 0.689, which means that each independent variable reflects 68.9 percent of the dependent variable, which is the participants’ willingness to continue to involve in the gardening.

Durbin-Watson stands at 1.679, close to 2 and not close to 0 or 10, which can be translated into the suitability of the regression model. The value $F$ in ANOVA comes to 22.690, indicating that the regression line fits in the model (Table 2).

4.3. Result of regression analysis

Table 3 shows the results of the regression analysis on the effects that the independent variables – the socio-economic characteristics of the respondents and the current status of the management of community gardening – have on the dependent variable – the possibility of their continued participation.

The average age of family members in each household and the total number of their family members were found to be the demographic-socio variables which could boost the participants’ willingness to continue to involve themselves in community gardening, with each value standing at 2.189 and −2.158. The analysis indicates that the older the participants, the more they are willing to join this activities constantly.

In particular, the preliminary research showed that those in their 60s and 70s have spent the longest hours, excluding those in their 50s, in community gardening,
which means that the gardening activities do good to those who retire from office and/or the elderly citizens without jobs. In terms of the number of family members, the negative figure means that the fewer the number of family members, the more people went into the gardening. The preliminary interview also showed that 78 percent of the respondents found more chances to meet friends and neighbors through community gardening activities, which highlights one of key merits the community gardening has.

According to the analysis of the respondents’ economic features, the Schwabe Index was turned out to have little effect on their will to continue to participate in community gardening, which would be interpreted as a little linkage between community gardening and the total expenditure on housing (or the respondents’ possible poverty due to high housing expenditure).

On the contrary, Engel’s coefficient was found to have a positive effect on the respondents’ will for a constant participation. In general, the rise in the coefficient means that a household spends more on food items out of its total consumption expenditures, toughening its livelihood. In this context, it can be said that community gardening has, at least in part, contributed to households’ saving of food costs.

According to the data by the KOSTAT (2016), the Engel’s coefficient among the households led by those in their 60s ad older marked the highest with 19.34 percent. Factoring in that the regression value between community gardening and the elderly was statistically positive, this result pointed to the need to ameliorate community gardening in a way to support the elderly citizens’ livelihood and pastime.

Last, the increase in the size of cultivating lands was found to have the biggest effect on the dependent variable of this regression model. That is, the respondents’ willingness for a future involvement turned out to be raised in line with the increase in the size of their cultivating land compared to the previous year or the quarter. According to the preliminary research, the rate of the increase came to 113.5 percent, with 21.2 percent of the respondents having larger spaces. It is in this context that the increase in the supply of arable lands would be needed in order to boost the sustainable development of the community gardening.

5. Implication and discussion

This research explores the significance of the community gardening as an alternative way for the sustainable urban planning, designing, and regeneration. On the basis of such implications, a survey was carried out on the participants in the activities in the city of Seoul.

The subsequent statistical analysis showed that community gardens have played a positive role in improving life circumstances for vulnerable classes, as aimed by the municipal government.

In particular, the sustainability of community gardening turned out to have been fostered by (1) the support for and the participation of the elderly class in the socio-demographic aspect, and (2) high Elgel’s coefficient levels among mid-to-low-income brackets with the socio-economic viewpoint.

Such results indicate that community gardening has achieved a positive growth in urban areas as a means to keep negative effects of the gentrification (Cameron 1992) in check which have largely driven out low-income people and collapsed traditional communities over the course of urban regeneration projects.

However, adverse elements still loom.

The size of vegetable lands in Seoul has grown more than fivefold in five years since 2011 (Seoul Metropolitan Government 2016). While 37.8 percent of the respondents of this survey have used box gardens the city government has provided, a mere 59 percent of the box gardens out of a total 43,000 m² have been reused. (Seoul Metropolitan Government 2013), which indicates that the quality-based development of the community gardening in the city has failed to reach the level of the quantity-based achievement. Despite the Seoul government’s such efforts to boost the public interests and their participation as hosting a variety of seminars, forums, and experience programs, the unsatisfactory status quo calls for a policy expansion to attract more to manage community gardens in a sustainable fashion.

In this regard, this article has a significance as it looks into the current status of the community gardening.

Table 3. Results of all variables in regression model (n = 112).

| Independent Variables | β    | Std. Error | Std. βeta | t    | Sig. | Tolerance | VIF |
|-----------------------|------|------------|-----------|------|------|-----------|-----|
| (Constant)            | 1.477| .582       |           | 2.536| .013 |           |     |
| Average age           | .013 | .006       | .186      | 2.189| .031*| .470      | 2.128|
| No. of family members | −2.35| .109       | −1.50     | −2.158| .034*| .700      | 1.430|
| Income quantile       | .054 | .076       | .057      | .716 | .476 | .532      | 1.881|
| Land size             | .011 | .009       | .156      | 1.161| .249 | .187      | 3.356|
| Increase rate in cultivating lands | .035 | .013 | .371 | 2.662 | .009** | .174 | 3.760 |
| Participation duration (month) | .005 | .008 | .066 | 1.641 | .523 | .316 | 2.169 |
| Participation hours (per week) | .000 | .012 | −.003 | −.041 | .967 | .570 | 1.755 |
| Engel’s coefficient   | .055 | .024       | .252      | 2.304| .023*| .282      | 3.547|
| Schwabe Index         | −.001| .021       | −.004     | −.039| .969 | .381      | 2.623|

* = p < .05, ** = p < .01, *** = p < .001
management in the city with the urban-economic perspectives through the survey on the actual participants, though a further research onto community gardens in the highly dense city with a space-based viewpoint and their social functions for a more comprehensive analysis.

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