



## Development and validation of a scale to assess urbanites' perception towards urban agriculture

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### ABSTRACT

There is a limited instrument that assesses urbanites' perceptions towards urban agriculture. Thus, the present study aimed to develop a valid and reliable scale to examine perception towards urban agriculture (UA). This scale aimed to eventually help in evidenced-based program and policy-making regarding UA. To do so, a scale called Perception Towards Urban Agriculture (PTUA) was developed according to the constructs proposed by Surls et al. (2014) on impacts of UA, namely: social, health, and economic. Environmental and aesthetic values are added as one construct as suggested by the literature review. The validity and reliability of the scale were established by examining 509 responses from Cebu City, Philippines. Exploratory factor analysis was performed and confirmed the hypothesized four-structure model of which the percentage of variance explained by the scale is 83.849. The model was further analyzed using the confirmatory factor analysis method through the Maximum Likelihood approach. Three model fit indices recorded satisfactory results (CFI = 0.962; NNFI = 0.959; RMSEA = 0.062), thus, further supporting the four-factor scale. The other analyses, such as convergent validity, concurrent validity, and reliability, also provide further evidence of the scale's validity. There may be an issue with respect to scale's discriminant validity, but the conceptual distinction of each factor is the ultimate purpose of retaining the factors or items. In conclusion, PTUA scale is a valid and reliable tool to evaluate urbanites' perceptions towards UA as input for introducing UA programs and policies.

**KEYWORDS:** *factor analysis, perception, scale development, urban agriculture*

### 1 INTRODUCTION

Urban agriculture (UA) is a food system component with limited regulations in many urban areas globally before, meaning it received less attention from the policy-makers (Audate et al., 2019). However, in recent years, an investment in UA programs and policies have

bloomed to combat several issues such as rapid urbanization, climate change, lifestyle changes, and technological advances (Tuijl et al., 2018). Further, these initiatives are done for various reasons. For instance, the urban areas in developing countries in Southeast Asia adopted UA to secure sustainable and safe food resources and generate income. This may also mitigate waste, reduce pollutants, and improve the social capital of a rapidly growing population (Lee et al., 2010; Indraprahasta, 2013; Linwattana, 2013; Anuada & Melodillar, 2017; Cortes et al., 2022). Meanwhile, in the context of developed countries, UA tends to function on social, health, recreational and educational benefits (De Zeeuw et al., 2011; Tornaghi, 2014; Dueñas, 2019). Although the motivations between both contexts are diverse, the discourse is the same. The growing interest in investing in UA is a response to issues on malnutrition and food security crisis in the metropolitan areas (Stewart et al., 2013; Juniawati & Hayuningtyas, 2017; Audate et al., 2019). However, the shift of resolving the food system crisis from an economic to a more sustainable and social or participatory approach by means of adopting UA also faces a number of challenges.

### Challenges in Adopting UA among Southeast Asian Metropolitan

A study on the status of UA's institutional mechanisms in Jakarta, Indonesia revealed that regulatory support has not been entirely uniform. Its Ministry of Interior Decree and Ministry of Public Works have contrasting declarations about open green space. The former ministry categorizes urban agricultural activity as a form of green open space and a formal activity with ecological or economic purpose. Meanwhile, the latter opposed the declaration according to the ministry's spatial planning regulation. In effect, there are no clear guidelines on which areas in the city are classified as agricultural. It is also reported that there are no economic incentives given by the government to local farmers. Instead, the responsibility is assumed by private companies through their corporate social responsibility scheme whereby they permit the local community to use their lands for agricultural activities. Finally, there has been no clear evidence about providing information and

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other support, such as market development in the city for the farmers (Indraprahasta, 2013).

Meanwhile, a field-based research in Hanoi, Vietnam reported that urbanization itself is the main factor affecting the practice of UA in the City. The liberation of their economy and opening up to international markets resulted in inevitable demands for land use conversion and rice production area reduction. However, this does not indicate that UA is no longer practiced. Instead, there is a major shift towards producing higher-yielding and more valuable market-orientated crops such as safe vegetables and flowers or ornamentals. For instance, farmers producing peach trees or bonsai received greater compensation than those producing rice. This policy is directed towards the government's aim for Hanoi to fit into the modern image of a City, thus, encouraging only modern types of agriculture (Lee et al., 2010).

Finally, Bangkok also has its shares of constraints in the practice of UA. One of those is the lack of large open spaces. Thus, agricultural activities are done in residue spaces such as on the rooftops of malls, gymnasiums, commercial and residential buildings, and other establishments. However, plants grown in these areas have to deal with physical stressors associated with microclimate conditions like urban heat, glare, and pollution. These stressors normally affect the growing conditions of plants, although some may thrive and fit in. In addition, land use control and policy support are considered major challenges for UA in Bangkok. Thus, the government is urged to provide incentives for local farmers who are growing food and regulating the import of low-cost foods because this has a profound effect on local agriculture economics. Lastly, the city's agricultural food productions have higher capital outlay and maintenance than in rural settings (Suteethorn, 2009).

These undesirable challenges, experiences, and policies will likely affect the adoption, practice, and perception of urban dwellers towards agriculture. However, an initial examination of people's perception towards UA before introducing or adopting UA to a metropolitan community could have helped address or prevent the emergence of these unwanted challenges and experiences by some metropolitan areas in Southeast Asian countries indicated above. The result of the initial examination of their perceptions will provide insights that can inform policy making and program design related to UA. When the perception is known earlier, there will be a shed of light about the acceptance and probable outcome if UA is introduced in a particular community. For these reasons, there are available studies that examine urban dwellers' perception of UA. These are usually prelude towards adopting UA projects, programs, and policies. The present study documents three of these types of studies.

### **Studies of Perceptions on UA**

There is a growing literature about urbanites' perceptions of adopting UA activities. Among the documented studies which surfaced and reported up to date are as follows: First, a study on perceptions and attitudes towards urban gardening in Mucheke town,

Masvingo, Zimbabwe was done as a basis of recommendations to the City council towards opening more spaces for urban gardening. The study employed a pilot-tested questionnaire, focus group discussion, and field observation. It was participated by individuals aging 46-50 years old, and most of them have positive urban gardening perceptions. These perceptions include the following: as a significant program for the community, as a source of earnings and food resources, and as an independent venture that does not necessarily rely on assistance from donors. However, a great percentage of them did not perceive it as a significant means of generating income rather a contributory factor that can minimally augment their earnings (Chimbwanda, 2016).

In the subsequent year, a survey investigated urban dwellers' intention towards practicing UA in Malaysia was conducted. It was assumed that the likelihood for Malaysians to be involved in UA is high, just like other nations worldwide. The study then served as an initial step towards promoting UA among citizens in the cities to respond to food resources' increasing demands. Using structured questionnaires, results revealed that urban dwellers have positive perception and confidence to practice urban agricultural activities. These individuals also account the influence of their environment to do UA and become good role models who create social impact through UA as factors influencing them to have desirable perceptions towards UA (Nghadiman et al., 2017).

Recently, a separate survey on perception about urban farming activities in Malaysia's metropolitan areas was conducted as a preliminary step in agricultural activities' embedment process. It employed survey questionnaires distributed personally and online, and results revealed that urban dwellers have favorable perceptions concerning UA. Specifically, economical aspects and living expenses were perceived as having great significance and purpose in growing or cultivating foods. Other perceived importance were environmental, social, and physical well-being (Hussain et al., 2019).

In summary, when examining the goals of these studies, these are directed towards the recommendation, promotion, design, and adoption of UA. However, there is an underlying gap shared by these studies. When examining the trends of how data were collected with regards to perception of UA, it is evident that there is a lack of a unifying framework. It is characterized by employing researcher-made scales whose validity were not established but only reliability (e.g. Chimbwanda, 2016). Only the scale used by Nghadiman et al. (2017) that examined factors affecting UA's urban dwellers

practice had gone through validity and reliability tests yet confirmatory factor analysis was not performed. By combining the gaps of the previous studies, the present study aimed to address these by developing a valid and reliable scale to examine perception towards UA (PTUA). This scale aimed to eventually help in evidenced-based program and policy-making regarding UA.

## 2 MATERIALS AND METHODS

### Research Environment and Participants

The participants of this study were from Cebu City, Philippines. They were recruited via voluntary sampling technique, a non-probability sampling design whereby samples are drawn based on willingness and qualification of an individual to participate in the study (Alvi, 2016). In particular, the target participants were individuals above 18 years old and have contrived or authentic experience in urban agriculture. These participants were informed ahead that their participation in the study was voluntary and they may withdraw in the event that they feel any discomfort during the research process without incurring penalty or loss on their end. There were 509 individuals who responded in the study of which 217 and 292 were from the North and South District of Cebu respectively. Figure 1 shows the complete distribution of the respondents when grouped according to different socio-demographic profiles.

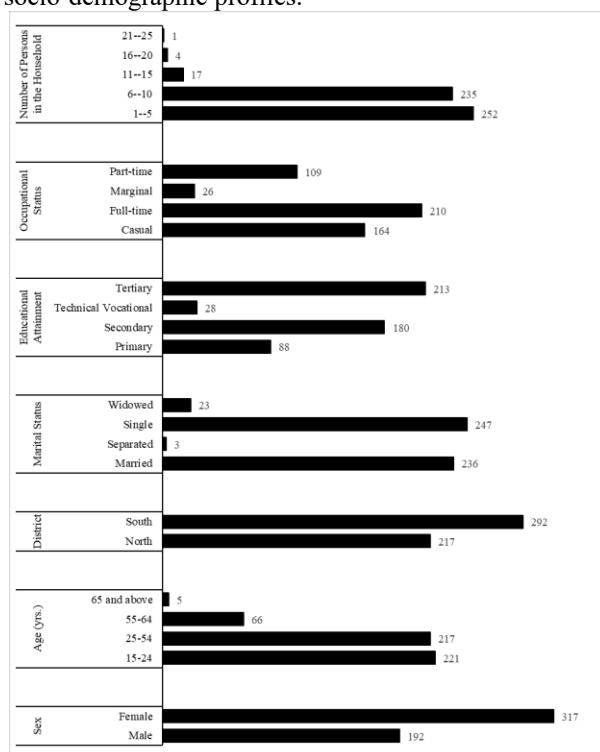


Figure 1. Socio-demographic profiles of the participants

### Instrument Development

The PTUA scale was developed based on practical guidelines recommended by Barry, Chaney, Stellefson, and Chaney (2011). Thus, it underwent multiple stages of development and validation which involved the following processes, namely: (a) outlining the construct(s), (b) developing scale design and structure, (c) generating sample items, and (d) pretesting the scale. These steps characterize the attribute of a sequential exploratory mixed methods research design (QUAL  $\square$  Quan) which integrates both qualitative and quantitative data with the former being collected initially and given greater emphasis.

#### A. Outlining the Constructs

The initial step indicated above is a critical stage in scale development which functions to outline the domains or context of the constructs. In the present study, the perception areas or values of UA proposed by Surls et al., (2014) which include social, health, and economic impacts served as the constructs. The social impacts refer to the impacts on human interactions of the built environment. The health impacts relate to improving the health of inner city residents. Finally, the economic impacts refer to the perceptions of urbanites towards the impact of UA in job creation, food expenditures, savings, among others. However, environmental and aesthetic values are added making four constructs all in all.

#### B. Developing Scale Design and Structure, and Generating Items

A literature review was utilized as a deductive approach in initially generating items within the aforementioned constructs. The review generated 32 items which were unevenly distributed into four perception areas of the PTUA scale. Table 1 reflects the items contained in each construct. Each item was designed to be rated on a five-point Likert scale (5 = strongly disagree, 4 = disagree, 3 = undecided, 2 = agree, and 1 = strongly agree). There were three content experts who determined the content validity of all the items contained in the instrument. The evaluation was done by rating each item on a four-point Likert scale (1 = irrelevant, 2 = needs modification, 3 = relevant, 4 = strongly relevant) to facilitate the calculation of Aiken's Validity Index (AVI) of each item.

#### C. Pretesting the Scale and Data Analysis

Subsequently, the scale was administered online of which five hundred nine (509) individuals responded to the invitation to participate in the online survey. This sample size is considered adequate upon calculation of Kaiser-Meyer-Olkin (KMO) which resulted in 0.986 and Bartlett's Test of Sphericity (BTS) which is significant ( $p < .000$ ). The scale was then available for Principal Components Axis (PCA) Factoring to estimate the

correlation matrix's factorability and determine the number of factors. Only factors with Eigen values greater than 1.0 were included. The resulting number of factors eventually went through principal components and maximum likelihood analysis through Varimax with Kaiser Normalization as its rotation method. Only items with criterion loading 0.5 and above were included in the final factors for a pragmatic reason.

whether the factors obtained using exploratory factor analysis (EFA) would be confirmed. The confirmatory factor model was examined by utilizing IBM SPSS Amos 26 Graphics.

### 3 RESULTS AND DISCUSSION

**Table 1.** Scale Design and Structure

Item Code	Factors/ Item Statement	Level of Perception				
		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
<b>Factor 1. Social Value</b>						
SocV1	Urban agriculture promotes tourism haven.					
SocV2	Urban agriculture creates a sense of pride in place.					
SocV3	Urban agriculture enhances community development.					
SocV4	Urban agriculture builds social capital in communities.					
SocV5	Urban agriculture functions as medium for learning experiences.					
SocV6	Urban agriculture functions as medium for youth development opportunities.					
SocV7	Urban agriculture may lead to awareness of environmental issues and ethics.					
SocV8	Urban agriculture may lead to sustainability and food systems.					
SocV9	Urban agriculture provides access to land.					
SocV10	Urban agriculture instills value for farmland preservation.					
SocV11	Urban agriculture encourages social interaction.					
<b>Factor 2. Economic Value</b>						
EconV1	Urban agriculture provides skills training.					
EconV2	Urban agriculture creates jobs.					
EconV3	Urban agriculture incubates new business industries.					
EconV4	Urban agriculture creates reliable markets for small farmers to expand their operations.					
EconV5	Urban agriculture reduces food expenditures.					
EconV6	Urban agriculture saves personal money.					
EconV7	Urban agriculture yields more affordable produce.					
EconV8	Urban agriculture saves money for government agencies maintaining vacant lots.					
EconV9	Urban agriculture supports low-income residents.					
<b>Factor 3. Health Value</b>						
HealV1	Urban agriculture enhances population's quality of life.					
HealV2	Urban agriculture ensures food safety.					
HealV3	Urban agriculture increases fruit and vegetable consumption.					
HealV4	Urban agriculture leads to food and health literacy.					
HealV5	Urban agriculture improves mental well-being.					
HealV6	Urban agriculture fosters the quality of physical health.					
<b>Factor 4. Environmental and Aesthetic Value</b>						
EaAV1	Urban agriculture is environment friendly.					
EaAV2	Urban agriculture promotes the use of organic fertilizer.					
EaAV3	Urban agriculture enriches visual quality of a city.					
EaAV4	Urban agriculture enhances the quality of urban environments.					
EaAV5	Urban agriculture increases urban green areas and open spaces.					
EaAV6	Urban agriculture promotes waste mitigation.					

Then, the scale reliability was determined by Cronbach's alpha. Finally, confirmatory factor analysis (CFA) with maximum likelihood method was performed to determine

The factor analysis examined 32 items of the scale. Table 2 shows the results of the analyses performed of which the number of factors is retained (i.e. four), and all

items reached the criterion loading set at 0.5, thus, none is removed. The total percentage of variance explained by these four factors is 83.849. However, there were two items (i.e. EaA1 and EaA2) that load to the perception area which they were not originally assigned. EaA1 loads to health values although it was initially assigned to assess environmental and aesthetic values of UA. Since promoting the use of organic fertilizers in UA and being environment-friendly have health implications, this likely explains why this item loads under health value. Meanwhile, Item EaA2 crossloads to both health values,

and environmental and aesthetic values, but is retained to the latter factor. The scale reliability as determined by Cronbach's alpha ranges from 0.957 to 0.980 within subscales and 0.991 for the entire scale. These results indicated that the scale has ideal stability.

Then, confirmatory factor analysis (CFA) with maximum likelihood method was performed to determine whether the four-factor structure obtained using exploratory factor analysis (EFA) would be confirmed. As shown in Figure 2, several goodness-of-fit indices (GFIs) indicate reasonable to good model-data fit, thus

**Table 2.** Items and subfactors of the scale including criterion loadings, mean, SD, AVI, Chronbach's alpha values, and percent of variance explained

Factors/Item Number	Communalities	Mean ± SD	AVI
<b>Factor 1. Social Value</b> ( $\alpha=.980$ , 11 items, % variance=27.155)			
SocV11	0.740	1.92 ± .977	1.00
SocV6	0.719	1.90 ± .944	1.00
SocV7	0.696	1.87 ± .990	1.00
SocV4	0.685	1.93 ± .957	0.90
SocV10	0.678	1.89 ± .971	0.80
SocV2	0.677	1.89 ± .931	0.90
SocV9	0.672	1.92 ± .950	1.00
SocV1	0.671	1.92 ± .948	1.00
SocV8	0.653	1.81 ± .973	1.00
SocV3	0.647	1.79 ± .950	1.00
SocV5	0.645	1.91 ± .946	0.90
<b>Factor 2. Economic Value</b> ( $\alpha=.973$ , 9 items, % variance=21.981)			
EconV4	0.675	1.91 ± 1.044	1.00
EconV7	0.672	1.96 ± 1.024	1.00
EconV6	0.672	1.96 ± 1.020	1.00
EconV8	0.669	2.04 ± .981	1.00
EconV2	0.648	1.90 ± .968	1.00
EconV3	0.641	1.90 ± .969	1.00
EconV1	0.632	1.88 ± .967	1.00
EconV5	0.626	1.97 ± 1.002	0.90
EconV9	0.614	1.94 ± 1.028	0.90
<b>Factor 3. Health Value</b> ( $\alpha=.968$ , 7 items, % variance=21.762)			
HealV2	0.728	1.87 ± .954	0.80
HealV3	0.709	1.90 ± .977	0.90
HealV6	0.696	1.89 ± .971	1.00
HealV1	0.689	1.87 ± .966	1.00
HealV4	0.673	1.87 ± .969	1.00
HealV5	0.664	1.92 ± .975	1.00
EaAV1	0.554	1.86 ± 1.000	0.80
<b>Factor 4. Environmental and Aesthetic Value</b> ( $\alpha=.957$ , 5 items, % variance=12.952)			
EaAV2	0.527	1.90 ± .960	1.00
EaAV5	0.648	1.88 ± .999	1.00
EaAV6	0.642	1.92 ± .997	1.00
EaAV4	0.561	1.88 ± .976	1.00
EaAV3	0.519	1.91 ± .963	1.00

Note. Overall  $\alpha=.991$ , Kaiser-Meyer-Olkin Measure of Sampling Adequacy=.986, Bartlett's Test of Sphericity=23,765.56,  $p<.000$ ,  $df=496$ , Total Variance=83.849%

providing confirmatory evidence for the factor structure generated during EFA. The Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI) are higher than 0.9 which is the recommended value by Hu and Betler (1999); and the RMSEA (.062) also indicated reasonable model-data fit based on the standards proposed by Jöreskog and Sörbom (1993). The Chi-square/df ratio, which results in 2.973, is above the threshold value of 2.0 but is considered acceptable according to Kline (1998). This is expected because the study involves a very large sample size, thus producing a large Chi-square that is significant. Chi-square is not usually recommended also when evaluating model fit involving large sample size (Karakaya-Ozyer & Aksu-Dunya, 2018). In this study, there were 509 individuals who responded in the online survey. Thus, the 32 items are retained. The path diagram of the items' factor loadings are presented in Figure 2. The factor loading of all items are above 0.7, indicating good convergent validity (Gefen et al., 2000).

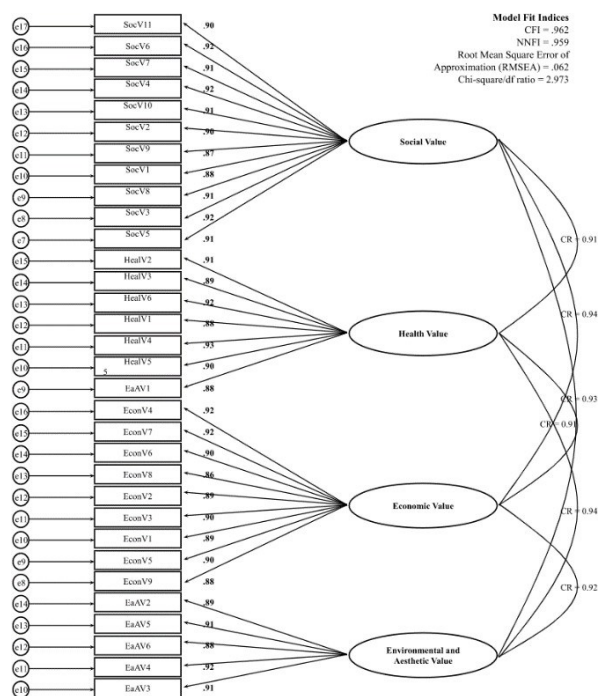


Figure 2. Confirmatory Factor Analysis of PTUA

Table 3. Mean, SD and inter-factor correlations of factor indices

Factor	Mean ± SD	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1. Social Value	1.89 ± 0.880	1.00			
Factor 2. Economic Value	1.94 ± 0.915	.914**	1.00		
Factor 3 Health Value	1.89 ± 0.900	.891**	.880**	1.00	
Factor 4. Environmental and Aesthetic Value	1.90 ± 0.911	.895**	.886**	.910**	1.00

Note. \*  $p < 0.05$ , \*\*  $p < 0.01$

With respect to discriminant validity of the scale, Table 3 shows the correlation between factors examined. Results indicate overlapping but not to the extent that it compromises the psychometric properties of PTUA. The conceptual distinctions of each factor is one reason for retaining them all in the instrument. In the same table, the correlations coefficients between factors also reveal concurrent validity of PTUA. All are statistically significant at the  $p < 0.01$  level and demonstrate very strong positive correlation. The internal consistency reliability was no longer reassessed because no item was removed after performing CFA, indicating that the instrument has ideal stability.

#### 4 CONCLUSIONS AND RECOMMENDATION

The PTUA scale was subjected to validity and reliability tests in the present study. Three GFIs of the CFA results support the four-factor scale. These GFIs were CFI = 0.962, NNFI = 0.959, and RMSEA = 0.062. The other analyses, such as convergent validity, concurrent validity, and reliability, also provide further evidence of the scale's validity. There may be an issue with respect to scale's discriminant validity, but this may be addressed in future studies. The conceptual distinction of each factor is the ultimate purpose of retaining the factors or items. When comparing the items among factors, there is apparent evidence that each factor measures different sets of perceptual domains. In conclusion, the validity and reliability of the PTUA scale is established through the different forms of validation performed in the present study (i.e., content, convergent, concurrent validity, and reliability). In this regard, the scale may be used when evaluating urbanites' perceptions towards urban agriculture as a basis for implementing UA initiatives which may be a project, program, or policy.

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