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# Influences on the Implementation of Community Urban Agriculture: Insights from Agricultural Professionals

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**Abstract:** Limited studies have investigated the relative influence of both external and internal factors in the implementation of community-based urban agriculture (UA) (ICUA). Furthermore, little research exists explaining how different mechanisms might influence urban residents' decision to participate in UA. Our research tested the direct effect of several predictors on ICUA using structural equational modelling. In addition, we tested the mediation effect between the predictors and the ICUA that may exist as well. Results are based on data from 200 agricultural professionals in the Zanjan province in northwest Iran. We found that "personal characteristics", "UA positive and negative consequences", "sociocultural", and "economic" factors affect ICUA. Among all factors, "personal characteristics" had the strongest direct effect on ICUA. The indirect model incorporating "attitude" provided support for the mediation model. We found "personal characteristics", "UA positive and negative consequences", and "sociocultural" influenced ICUA indirectly through "attitude." Among all factors, "sociocultural" had the strongest indirect effect on ICUA. This information is of use to policy-makers and program planners in identifying points of policy interventions and mechanisms for promoting UA.

**Keywords:** agricultural professionals; influential factors; direct and indirect effects; policy and planning; urban agriculture

## 1. Introduction

Many cities in developing nations are promoting urban agriculture (UA) in response to urbanization, climate change, and food security [1]. UA presents a unique opportunity to use vacant land and rooftops in cities for the production of healthy, chemical-free food [2]. Adding green spaces in cities to a neighborhood, including community gardens, is known to provide many benefits that contribute to sustainable urban development. These benefits are wide-ranging: UA provides job opportunities for young people and volunteers; reduces the price differences between producers and consumers; raises the environmental awareness of urban communities; contributes to people's physical and mental health [3]; improves quality of the urban environment toward more sustainable and greener cities [4]; improves food security [5]; and generates income, especially for urban and peri-urban farmers [6].

In many less-developed countries, the potential benefits of UA are becoming more recognized in policy circles, as well as at local, citizen levels [7]. Countries such as Morocco, Tunisia, Algeria,

Jordan, Egypt, and others have been using UA development policies since several years ago [8–10]. Despite the importance of UA, several countries, including Iran, have lagged behind in developing UA policies and programs. This is important as most Iranians live in urban areas. According to the World Bank [11], city dwellers in Iran in 2016 formed 74% of the total population. With this increase in the urban population is a growing concern of the combined effects of land fragmentation, water shortages, urbanization, higher food prices, more poverty, an increasing unemployment rate, and urban environmental pollution. These stresses challenge cities and, consequently, urban residents.

Concerted efforts have not yet been made by planners and policy-makers to develop a UA initiative in Iran. Although UA it is not a new concept in Iran, and urban green spaces have been maintained and even expanded, implementation of UA as an approach to solving urban challenges has not yet received sufficient attention as a solution for urban sustainability. More importantly, citizens' participation in the landscape planning and implementation of UA has been ignored [12]. To achieve UA's potential for community gardening and food production beyond social economic profitability, the implementation of UA must be participatory. While recognizing that UA is essential for sustainable urban development, the main challenge is related to developing an effective initiative that encourages urban people and institutions to participate in developing and implementing UA. Identifying the underlying factors that might contribute to the implementation of community UA (ICUA) is of utmost importance to guide the development and design of such a program, as well as to find the best ways to persuade urban communities.

Although previous studies have investigated influential factors in the adoption of UA, little research exists explaining how different mechanisms might influence urban residents' decision to participate in UA. Studies on factors influencing participation in UA have discussed contextual factors in terms of farm structures, and marketing and policy issues [13]. Other studies have addressed motivations of the residents' community to engage in UA [14–16]. While some have examined specific socio-demographic factors influencing participation in UA [17,18], limited studies have investigated the relative influence of both external and internal determinants. Further, assessments of agricultural professionals in the development of UA, particularly in developing countries, have been limited. Given this important role of agricultural professionals as specialists for UA planning and development, we analyzed the factors influencing ICUA from agricultural professionals' point of view.

*1.1. Theoretical Background and Hypotheses Development*

Decisions about ICUA are most commonly made at the municipal or district level. However, it is at the individual, personal level that determines the successful implementation of the program. Effective ICUA, therefore, requires changes in individual behavior. One way to promote behavioral change is to examine the factors that affect behavior and then apply interventions to change the behavior and their antecedents [19]. It has remained unclear which factors ultimately determine the behavior of community UA. There are a few existing theories that deal independently with factors influencing human decision-making on environmental behavior. To better understand these determinants, we integrated concepts and variables from different theoretical frameworks demonstrating that ICUA results from multiple factors.

Kollmuss and Agyeman [20] presented factors affecting pro-environmental behavior in a framework including internal factors (e.g., personality characteristics, including knowledge, emotion, motivations, and so on) and external factors (e.g., economic, institutional, and sociocultural factors). Prager [21] similarly stated that influencing individuals' behavior and changing the context was vital when the purpose was to get people involved in an environmental action. He further recognized the influential role of personal, economic, institutional, and sociocultural factors in environmental decision-making and behavior. More recent theories also take internal and external factors into consideration (see integrative theories of behavior).

Our research framework was primarily developed based on the studies of Kollmuss and Agyeman's model of pro-environmental behavior. The following review of the literature is in regard to

selected variables that affect ICUA and the related hypotheses in developing the conceptual model. Subsequently, we developed several hypotheses to inform our research.

### 1.1.1. Personality Factors

Differences in personality have been found to influence environmental engagement [22]. Several studies have shown that environmental engagement is associated with personality traits [22–24]. Krajhanzl [25] suggests that personality factors influencing environmental behavior are the characteristic qualities, motivational characteristics, abilities, and mental moods of an individual, which all affect their behavior toward the environment. Barber et al. [26] suggested that environmental knowledge was an important factor influencing behavior. He suggested that when individuals were aware of environment problems and their causes, they were more likely to act responsibly toward the environment. Findings in a study conducted in Malaysia found that urban residents' individual confidence in practicing UA was one of the factors that affected dwellers' UA implementation [27]. In accordance with the literature, we tested the following hypothesis:

**Ha.** *There is a positive relationship between personality factors and ICUA.*

### 1.1.2. Economic Factors

Economic factors have been shown to have a strong influence on people's environmental decisions and behaviors. It seems likely that individuals will take into account financial considerations (costs) when making environmental decisions associated with a new practice or program [28]. Muriithi [18], for example, reported that economic factors affected adoption of UA interventions among households in Kenya. An absence of financing and credit for urban farmers was found to constrict UA implementation [29]. The provision of credit and loans to urban farmers therefore encourages and promotes UA. Nebel et al. [28] suggested that enrolment in voluntary agro-environmental programs might be increased if financial incentives were provided. A meta-analysis of studies on the adoption of agricultural "best management practices" in the United States identified financial capacity as one of the key factors for program adoption [30]. This idea was further supported by a recent study in Sweden that showed that cost was the main factor preventing farmers in participating in a wetland creation program [31]. In view of this, it was expected that greater economic factors would lead to higher ICUA. Accordingly, the following hypothesis was proposed:

**Hb.** *There is a positive relationship between economic factors and ICUA.*

### 1.1.3. Sociocultural Factors

Studies have shown that social norms influence a wide range of environmental behaviors. Such examples include recycling behavior [32], soil conservation [33], water conservation [34], and energy conservation [35]. Findings of a study conducted in Malaysia suggested that the social environment and having a role model were two positive motivators of urban dwellers in implementing UA [27]. In fact, environmental concern is important for many people in society; however, some societies might encourage UA more than other societies. In view of this, we also tested the following hypothesis:

**Hc.** *There is a positive relationship between sociocultural factors and ICUA.*

### 1.1.4. Infrastructural Factors

Many pro-environmental behaviors take place if the infrastructural supports are provided [20]. Some of these infrastructural supports that might influence UA participation include access to land, water, seeds, fertilizers, pesticides, herbicides, tools, gardening supply stores [15,36], urban planning regulations and building codes [37], land tenure laws [38], as well as the presence of a local market

which stocks agricultural products [39]. In the United States, Inkoom [40] found a positive link between subsidies and the level of organic adoption among farmers during the transitioning phase in the United States. Access to government cooperative extension services and credits positively influenced the adoption of organic cocoa production in Ghana [41]. Al-Hassa [42] assessed factors affecting decisions to grow vegetables in Tamale Metropolis, Ghana, and found that UA was influenced by factors such as extension service, the use of inorganic fertilizer, and the availability of farmland. Also, in Kenya it was found that project design was one of the factors affecting the adoption of UA among households. The better such services were, the more likely people were to implement the program. Thus, based on the literature, we constructed the following proposed hypothesis:

**Hd.** *There is a positive relationship between infrastructural support and ICUA.*

1.1.5. Positive and Negative Consequences of UA

Predicting the potential consequences of future actions is an important cognitive process involved in understanding the decision-making process. People are motivated to do things based on promises to obtain "positive consequences" or to avoid "negative consequences" [43]. This notion has been used as a theoretical basis for intervention targeting to improve environmental behavior. The claim has been that in rational choice theory, individuals make behavioral decisions based on a calculation of the benefit and expected costs of a behavior, including monetary costs, time, inconvenience, risk factors, and so on. Studies of environmental behavior often begin with the assumption that individuals make reasoned choices and choose alternatives with the highest benefits and lowest risk. Furthermore, consequences that are obtained quickly and that are certain are more influential than when consequences are more uncertain [44]. Similar to environmental behavior, UA can bring about both positive and negative consequences.

UA produces a complex mix of potential health risks and benefits, both for urban farmers themselves and for their neighbors [45,46]. It has been argued that UA helps improves the city environment in a number of ways, such as the recycling of waste products, reducing carbon footprints, improving the beauty of the city, water management, and improving the climate by reducing temperatures and increasing humidity [47]. For instance, during the summer, green roofs reduce the amount of heat transferred through roofs into buildings [48] and cool the air by promoting evapotranspiration or increasing the humidity in cities [49]. The link between the positive consequences of UA (benefits) and urban residents' engagement in UA have been highlighted in several studies [50,51]. The association of practicing UA and nutritional status of the urban poor has been reported in several African countries such as Zimbabwe, Kenya, and Uganda as well as in Haiti in the West Indies. In these countries, it was found that families involved in UA ate more meals and had better health and nutritional outcomes [52]. In Nepal, urban farmers reported that only 11–13% of their total income came from farming activities [51].

Despite the many benefits UA provides to city residents, some constraints have been reported in developing countries as negative consequences of implementing UA [53]. Converting urban parcels into food production sites can be costly, time consuming, and legally complicated [54]. These expenses can be off putting to small community groups with limited time and money. In addition, mosquitos present can mean health risks to UA participants [55]. Rain, temperature, humidity and land-use system in place (e.g., irrigated or non-irrigated farming) affect whether a given UA site is a conducive atmosphere for breeding sites for mosquitoes [56]. Others reported health risks of wastewater and solid waste use in UA in Ghana [57]. Negative consequences of UA may influence the ICUA negatively. Accordingly, this our research tested the following hypotheses:

**He.** *There is positive relationship between UA's positive consequences and ICUA.*

**Hf.** *There is negative relationship between UA negative consequences and ICUA.*

### 1.1.6. The Mediation Effect of Attitude

The literature informs that where economic, socio-cultural, risk, benefits, personality factors, and institutional support act as predictors, attitude is also an important factor in shaping human decision and behavior. The relationships between attitudes and behavior have been established in literature [58]. Attitudes are defined as the enduring positive or negative feeling toward an object or idea. Nebel et al. [28] showed that environmental attitude to be the strongest predictor of pro-environmental behavior. Related to UA, Ngahdiman et al. [27] suggest that positive attitude toward UA was one of the factors that influenced residents to implement UA in Malaysia. In New Zealand, Lake et al. [59] quantified the influence of psycho-social factors on edible gardening by urban residents. In this research, factors such as perceived behavioural control, subjective norms and attitudes explained 58% of variance in urban residents' intention to implement UA.

Attitudes can be influenced by other factors as well. For instance, an individual may hold positive attitudes toward an environmental behavior but may not engage in an activity to support it [20]. Research has shown that economic influences environmental attitudes at the public level [60]. Sociocultural norms of society also influence environmental action by strengthening people's beliefs [58]. Gifford and Nilsson [61] suggest that the structure of attitudes that are shaped by culture might differ from one society to another: That is, sociocultural factors influence attitude, and consequently, behavior. As a result, some societies might be more encouraging toward UA than other societies. Perceived risks and rewards are thought to influence attitude positively and negatively [2,62]. There is also empirical evidence for a mediating role of attitudes between personality factor and behavior [63,64].

While the main effects of the predictors on ICUA proposed previously may exist, the attitudes of the community toward UA can encourage or discourage UA—that is, the ways in which those factors affect ICUA depend on how a community perceives UA. The study predictors seem intertwined with attitude as well. Following this reasoning, our study proposes that the relationship between the predictors and ICUA might be mediated by people's attitudes toward UA. The study further analyses the indirect effects (mediation effect) between the predictors and the ICUA that may exist as well. In accordance with the literature, we tested the following hypothesis:

**Hg.** *Attitudes mediate the relationship between all predictors and ICUA.*

In summary, we had two main objectives: Firstly, investigation of the direct effect of the predictors (economic, sociocultural, UA positive and negative consequences, personality, and institutional factors) on the ICUA; and secondly, analysis of the indirect effect of the predictors on ICUA via the mediating role of attitudes. These objectives provided the foundation for developing this study's primary objective of analyzing factors influencing ICUA in the Zanjan province of Iran (Figure 1).
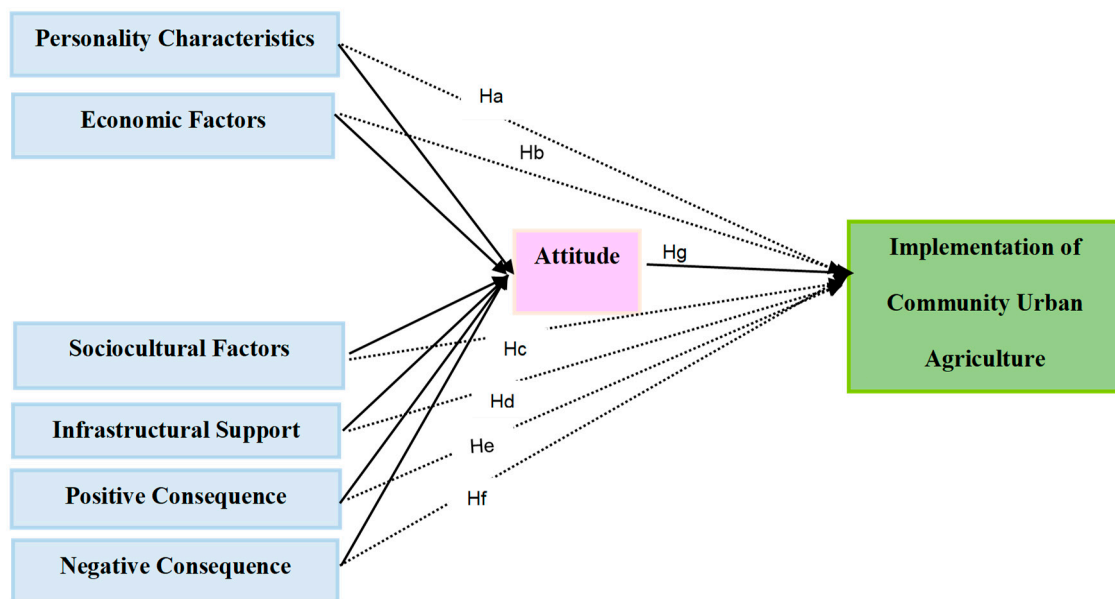
**Figure 1.** The conceptual framework which guided our research.

## 2. Materials and Methods

### 2.1. The Study Area

The study area was located in the Zanjan province in Northwest Iran. It lies 330 km northwest of Tehran and is approximately 125 km from the Caspian Sea. The province has an area of 22,164 km$^2$ and consists of seven counties: Abhar, Khodabandeh, Khorramdarreh, Zanjan, Tarom, Mahneshan, and Soltaniyeh (Figure 2). According to Iran's Statistical Centre, 1,057,461 people lived here in 2016 and it has an almost equal distribution of urban and rural populations (359,309 people live in urban areas). The province has 3.6 percent of the country's agricultural lands, and agriculture is the main occupation of people living in rural areas, due to the conducive climatic and geographical conditions of the province.
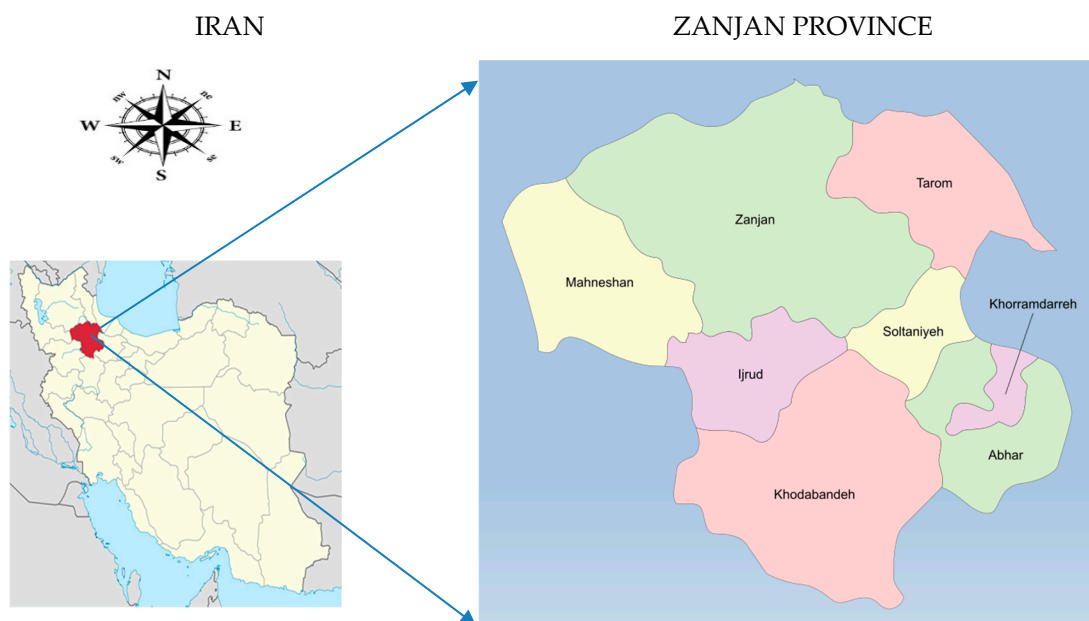


**Figure 2.** The location of our study area in Iran.

## 2.2. Participant and Procedures

The population of this study was comprised of agricultural professionals (N = 367) in various fields of agriculture (agronomy, horticulture, extension, mechanization, and animal husbandry) from the Jihad-e-Agricultural organization in Zanjan province. Using Krejcie and Morgan's [65] sample-size determination table, 200 agricultural professionals were selected, employing a cluster random sampling method from three counties (Zanjan, Mahneshan, and Ejrood) from the province. The demographic attributes of the respondents show there were more male (58.3%) than female respondents (41.7%). Respondents' ages ranged from 25 to 56 years, with a mean of 39.2 years. Results show that the majority of the agricultural professionals had university education, but this also varied in terms of educational level. The majority of respondents' highest degrees (53.3%) was a bachelor's degree, whereas 33.3% had master degree, 10.5% had technician certificate, 1.9% had PhD, and,1% had diploma. A majority of the respondents (56.5%) had more than ten years of agricultural work experience.

We developed a structured questionnaire and distributed them to enumerators. Our survey items were translated into the Persian language, and then back-translated to ensure accuracy. All items were written in Persian. The items were rated using a 5-point Likert-type scale, ranging from "strongly disagree" to "strongly agree". The scale's internal reliability assessed and showed a range of consistencies, from "acceptable" to "good". Approval for conducting research on human subjects was obtained from the director of the Jihad-e-Agricultural organization of Zanjan province. The survey was pilot-tested with 27 agricultural professionals in Khodabandeh city in the province, and final modifications were made based on their responses. Data were collected by a group of enumerators who administered the questionnaires from November 2017 to January 2018. The enumerators gave the surveys to the survey participants and returned at a specific time to collect them. The enumerators checked all questionnaires to verify that all responses had been answered.

## 2.3. Measures

ICUA, the dependent variable, was measured using a five-item scale, derived from Kollmuss and Agyeman [20] (e.g., "People I know share an interest in the UA community program").

Personality characteristics were measured using a ten-item scale derived from Kollmuss and Agyeman [20] and other literature, with some items on the original scales revised to reflect the context of the study. These items measured different dimensions of personal characteristics, including opportunity recognition, risk-taking, innovativeness, motivation, self-efficacy, and management skills (e.g., "People are seeking for UA opportunities that create new business"; "creativity is essential for people to start up UA").

The economic factor was measured using a seven-item scale adapted from Kollmuss and Agyeman [20] (e.g., "Access to capital plays an important role in ICUA").

The sociocultural factor was measured using a five-item scale derived from Prové, Dessein, and De Krom [66] (e.g., "Family and friends' approval motivates people to participate in UA").

The measure of organizational support adopted from [67] assessed different dimensions, including consultancy services, supervision, and government incentives (e.g., "UA consulting services affects implementation of the program"; "proper monitoring by government agencies affects implementation of the program"). Participants responded to eight statements on existing organizational support for UA.

The measure of negative consequences of UA assessed perceived associated risk and major constraints of implementing agriculture in an urban setting. Nine statements were developed based on the literature (e.g., "Growing crops on polluted industrial urban areas can cause a variety of health problems").

The measure of positive consequences of UA assessed the perceived benefits of implementing the program. It was assessed using a twelve-item scale derived from Moreno-Peñaranda [68] and the literature (e.g., "UA has the potential to improve nutritional intake of the poor in urban areas").

Attitude toward UA is defined as the extent that the community considers UA favorable or unfavorable. This variable acts as a mediating variable between all independent and dependent

variables. Nine statements were derived from Shamsudin, Rezai, and Kit Teng [69] (e.g., "Belief that farming, as a low-class activity, may impact ICUA").

*2.4. Analytic Strategy*

We analyzed the data using structural equation modelling (SEM) approach. Two-stage procedures were used to perform the SEM analysis through statistical software package IBM SPSS Amos22.0™. This process suggests assessing the measurement model before performing SEM. In the first stage, confirmatory factor analysis (CFA) convergent validity and discriminant validity was conducted. In the second stage, SEM was used to test the causal relationships among the latent variables, the model fit, hypotheses tested by individual paths or regression weights, and the coefficients of determinants ($R^2$). To assess the goodness of fit, multiple indicators (fit indices) were used, including the chi-square statistic, chi-square to degree-of-freedom ratio, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the non-normed fit index (NFI), Tucker-Lewis Index (TLI), Incremental fit index (IFI), and the goodness-of-fit index (GFI). It is commonly accepted that CFI, IFI, NFI, TLI, and GFI should be greater than 0.90 [70–73], and a value of 0.95 indicates a better fit. A RMSEA less than 0.05 is reported as a better fit [72,74], between 0.05 to 0.10 as a fair fit, and above 0.10 as a poor fit [70]. Lastly, a "Bootstrap" method was used to analyze the indirect effect of predictor variables on the implementation of community UA.

## 3. Results

*3.1. Measurement Model*

CFA was performed using the maximum likelihood estimate to ensure the reliability and validity of the measurement model on the data collected. To assess the measurement model, a set of goodness-of-fit indices were checked [70]. Results show that the measurement model had a good fit with the data t: $\chi^2$ (1987) = 2752.731; $p$ = 0.000 $\chi^2$/DF = 1.385; GFI = 0.720; CFI = 0.943; IFI = 0.943; TLI = 0.940; RMSEA = 0.044. The CFI, IFI, and TLI significantly exceed their cut-off value (0.9). In addition, the RMSEA was 0.044, which falls between the recommended range of acceptability (between 0.03 and 0.08) (Figure 3). The construct validity of the overall measurement model was assessed in terms of convergent and discriminant validity. The convergent validity was assessed based on the adequacy of factor loadings (more than 0.5) [70], value of the average variance extracted (AVE) (more than 0.50), and construct reliability (CR) (more than 0.70) for the measure variables. The results showed that all the items had high standardized factor-loading on their underlying constructs (ranges between minimum 0.74 (for Economic Factor items) to a maximum of 0.95 (for Attitude items), were all significant at the 0.001 level, and the AVE for all constructs exceeded the minimum criterion of 0.50, indicating that a majority of the variance was able to be explained by the constructs [75]. The assessment of construct reliability also showed that the all constructs had a CR of more than 0.70, ensuring adequate internal consistency among the measured items (Table 1). The results of assessment discriminant validity through the comparisons of square-of-correlation among two constructs with the AVE of each construct (Table 2) showed that the square-of-correlation among all two constructs was less than the AVE for each construct, supporting the discriminant validity among the constructs.
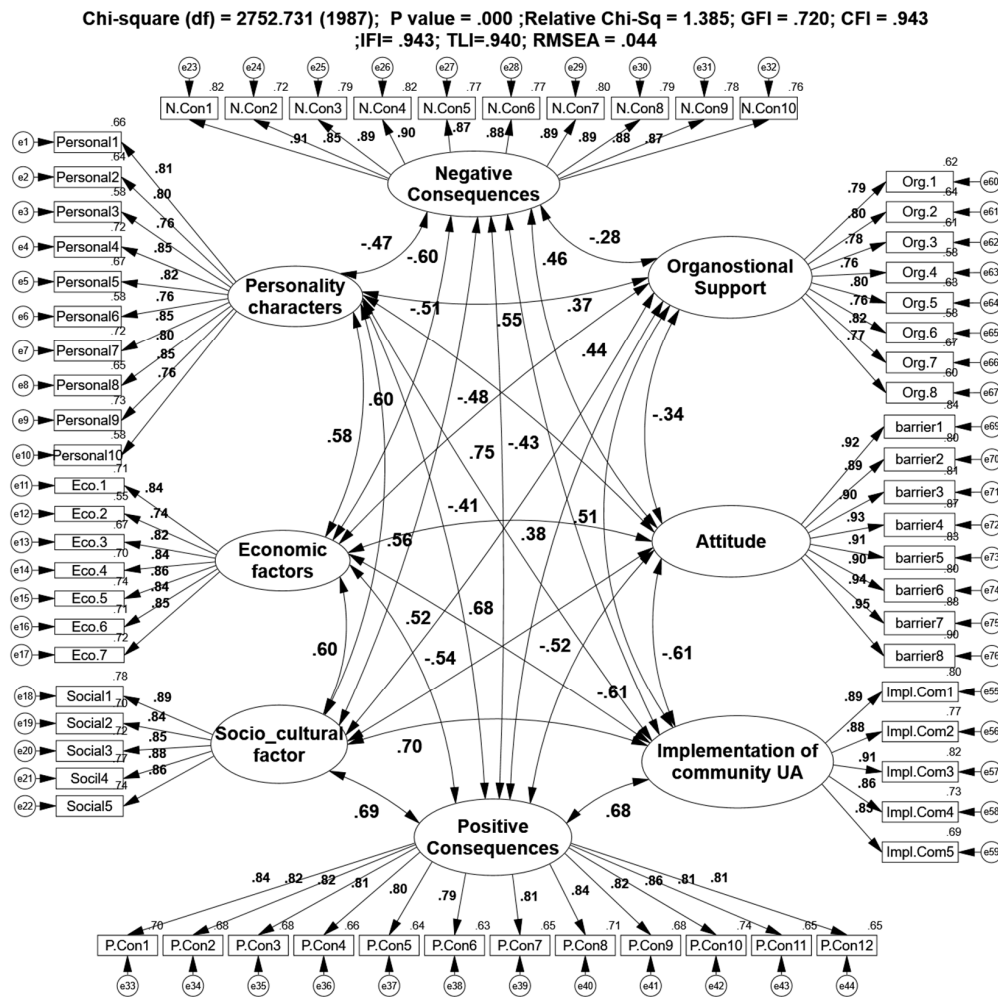
**Figure 3.** The overall measurement model based on standardized estimate.

**Table 1.** The results of the measurement model.

| Construct | Construct Reliabilities | AVE | Correlation Estimation among the Constructs ** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Personality characters | 0.940 | 0.660 | 1 | | | | | | | |
| Economic factors | 0.938 | 0.686 | 0.579 | 1 | | | | | | |
| Sociocultural factor | 0.935 | 0.742 | 0.564 | 0.603 | 1 | | | | | |
| Organizational factor | 0.928 | 0.618 | 0.548 | 0.368 | 0.438 | 1 | | | | |
| Positive consequences | 0.961 | 0.672 | 0.602 | 0.518 | 0.693 | 0.379 | 1 | | | |
| Negative consequences | 0.973 | 0.780 | −0.469 | −0.603 | −0.480 | −0.277 | −0.429 | 1 | | |
| Attitude | 0.972 | 0.833 | −0.507 | −0.412 | −0.537 | −0.336 | −0.518 | 0.460 | 1 | |
| ICUA | 0.941 | 0.762 | 0.747 | 0.677 | 0.697 | 0.508 | 0.683 | −0.613 | −0.606 | 1 |

** All correlation estimation among the constructs is significantly different from zero at the 0.001 level.

**Table 2.** Regression weights in the direct hypothesized structural model.

| Hypothesis | Unstandardized Regression Weights | S.E. | Standardized Regression Weights | C.R. | *p* |
|---|---|---|---|---|---|
| Personality characteristics | 0.411 | 0.086 | 0.322 | 4.764 | 0.000 |
| Economic factors | 0.166 | 0.072 | 0.148 | 2.301 | 0.021 |
| Sociocultural factors | 0.171 | 0.067 | 0.177 | 2.548 | 0.011 |
| Organizational support | 0.094 | 0.063 | 0.079 | 1.496 | 0.135 |
| Positive consequences | 0.192 | 0.070 | 0.179 | 2.737 | 0.006 |
| Negative consequences | −0.156 | 0.046 | −0.189 | −3.45 | 0.000 |

The correlation estimation among the constructs are presented in Table 1. Personality factors (r = 0.74, *p* < 0.01), economic factors (r = 0.677, *p* < 0.01), sociocultural factors (r = 0.697, *p* < 0.01), organizational support (r = 0.508, *p* < 0.01), and positive consequences (r = 0.683, *p* < 0.01) were all positively correlated with ICUA. Negative consequences (r = −0.613, *p* < 0.01), and attitude (r = −0.606, *p* < 0.01) were negatively correlated with ICUA.

### 3.2. Structural Equation Models and Hypothesis Testing

#### 3.2.1. Test for Direct Effects

In order to test the direct effect of predictor variables on the ICUA, a structural model that included a direct model was used. We used path analysis to estimate the path coefficients of the relationships between the constructs in the research model. The results based on the direct model showed that the model based on the goodness-of-fit indices fit the data: $\chi^2$ (1518) = 2150.272; *p* = 0.000; $\chi^2$/DF = 1.417; CFI = 0.942; IFI = 0.942; TLI = 0.939; RMSEA = 0.046. In addition, the results of direct hypothesis testing indicated that, except for organizational support (β = 0.079; C.R. = 1.496; *p* = 0.135), all the predictor variables, including personality characters (β = 0.322; C.R. = 4.764; *p* = 0.000), sociocultural factors (β = 0.77; C.R. = 2.548; *p* = 0.011), economic factors (β = 0.148; C.R. = 2.301; *p* = 0.021) and positive consequences (β = 0.179; C.R. = 2.737; *p* = 0.006), had positive and significant direct effects, while negative consequences had a negative and significant direct effect (β = −0.189; CR = −3.45; *p* = 0.000) on ICUA (Table 2). Among predictors, personality factors had the greatest direct effect on ICUA. This suggests that the hypotheses (Ha, Hb, Hc, He, and Hf) in the research framework are supported. Also, the result based on the direct-path model showed that the predictor variables could explain 74% of the variance of ICUA (Figure 4).
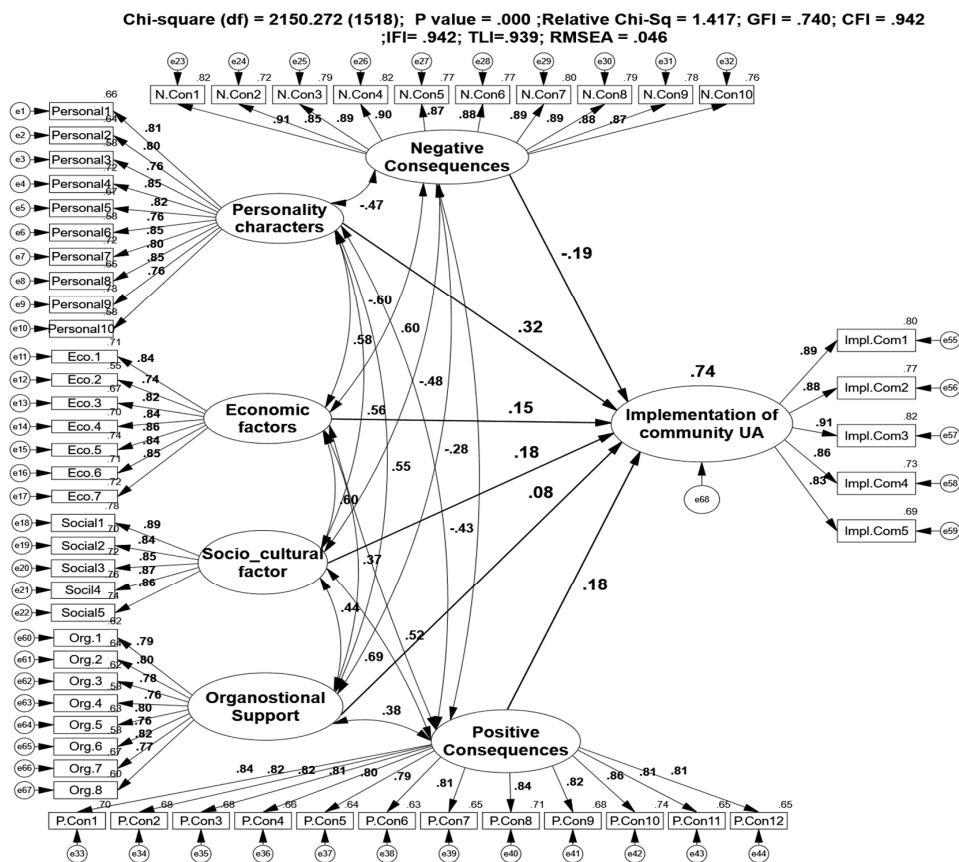


**Figure 4.** The direct structural model based on standardized estimate.

### 3.2.2. Test for Indirect Effects

In order to test the indirect effects of predictor variables on ICUA through attitude, a "bootstrap" method was used. In order to run the bootstrap analysis, 5000 bootstrap samples were requested and drawn by default with replacement from the full dataset of 200 cases. The indirect effects' predictor variables on ICUA were assessed through structural analysis comprising direct and indirect effects (Figure 5). The results suggest that predictor variables explain 39% of variance for attitude and 75% of variance for ICUA after existing the attitude as a mediation variable in the structural model (Figure 5).
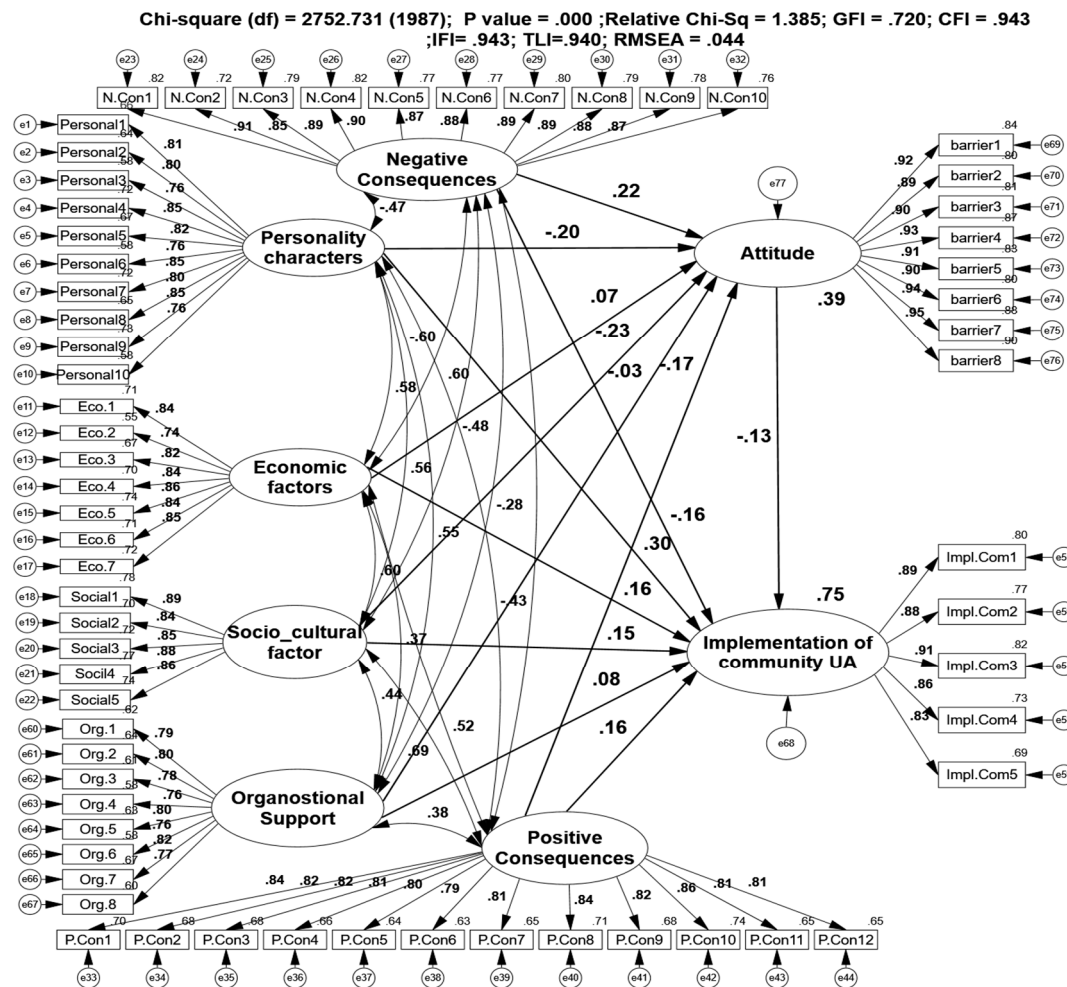


**Figure 5.** The full structural model based on standardized estimate.

Findings presented in Table 3 indicate that the standardized indirect effect of predictor variables, including personality characteristics ($\beta$ = 0.026; *p* = 0.038), sociocultural factors ($\beta$ = 0.031; *p* = 0.046), and positive consequences ($\beta$ = 0.023; *p* = 0.023), were positive and significant, while negative consequences had a negative significant indirect effect ($\beta$ = −0.029; *p* = 0.015) on ICUA through attitude as a mediation variable (Table 3); however, the results indicate that the indirect effects of economic factors ($\beta$ = −0.010; *p* = 0.273) and organizational support ($\beta$ = 0.004; *p* = 0.460) through attitude as a mediation factor were not significant on ICUA (Table 4).

Finally, the results from the overall structural model, as portrayed in Figure 5 and Table 3, show that the personality characteristics based on standardized direct effects ($\beta$ = 0.296) and total effects ($\beta$ = 0.322) had the highest contribution toward ICUA. Also, results show that the negative consequences had the second-highest direct ($\beta$ = −0.160) and total effects ($\beta$ = −0.189) on ICUA (Table 3). Among the indirect effects, the sociocultural factor ($\beta$ = 0.031) and negative consequences

(β = −0.029) had the highest indirect contribution toward ICUA through the mediation of attitude, respectively (Table 3).

**Table 3.** Direct, indirect, and total effects of variables on implementation of community urban agriculture on the full structural model.

| Variables | Direct Effect (DE) | Indirect Effect (IE) through Attitude | Total Effect (TE) |
| --- | --- | --- | --- |
| Personality characteristics | 0.296 | (−0.196 × −0.132) = 0.026 | 0.296 + 0.026 = 0.322 |
| Economic factors | 0.158 | (0.073 × −0.132) = −0.010 | 0.158 + (−0.010) = 0.148 |
| Sociocultural factors | 0.146 | (−0.235 × −0.132) = 0.031 | 0.146 + 0.031 = 0.177 |
| Organizational support | 0.076 | (−0.068 × −0.132) = 0.004 | 0.076 + 0.004 = 0.08 |
| Positive consequences | 0.156 | (−0.171 × −0.132) = 0.023 | 0.156 + 0.023 = 0.179 |
| Negative consequences | −0.160 | (0.218 × −0.132) = −0.029 | −0.160 + (−0.029) = −0.189 |

**Table 4.** The indirect effect of predictor variables on Implementation of community urban agriculture through attitude.

| Variables | Point Estimate (Standardized Indirect Effects—Estimates) | S.E. | Bootstrap | | |
| --- | --- | --- | --- | --- | --- |
| | | | Bias- Corrected (BC) Percentile 95% CI | | |
| | | | Lower | Upper | Two Tailed Significance (BC) |
| Personality characters | (−0.196 × −0.132) = 0.026 | 0.086 | 0.001 | 0.07 | 0.038 |
| Economic factors | (0.073 × −0.132) = −0.010 | 0.090 | −0.042 | 0.011 | 0.273 |
| Sociocultural factor | (−0.235 × −0.132) = 0.031 | 0.122 | 0.001 | 0.088 | 0.046 |
| Organizational support | (−0.068 × −0.132) = 0.004 | 0.064 | −0.011 | 0.026 | 0.460 |
| Positive consequences | (−0.171 × −0.132) = 0.023 | 0.089 | 0.002 | 0.079 | 0.023 |
| Negative consequences | (0.218 × −0.132) = −0.029 | 0.08 | −0.076 | −0.004 | 0.015 |

## 4. Discussion

The purpose of our research was to examine the direct and indirect effects of predictors on ICUA, and we found that ICUA was indeed influenced by several factors. In the first model (direct effect), for example, we found that "economic", "sociocultural", "personality characteristics", and "UA's positive consequences" directly influenced ICUA. Our findings are congruent with the work of Nasinyama et al. [57] who found that negative consequences associated with UA negatively influenced ICUA. However, this is in contrast to the study by Djokoto and Gidiglo [41], where organizational factors were not a significant predictor of ICUA.

Our research also found that sociocultural factors affected ICUA. Our results suggest that the role of sociocultural factors is important in encouraging people to participate in UA. This supports earlier research by Ngahdiman et al. [27] who found that having UA role models encouraged urban residents to implement UA. In other words, the more society approves of UA, the more likely that people will participate in the program. This finding is consistent with previous studies [33,35].

Economic factors were found to influence ICUA, suggesting that the provision of credit and loans to the urban community will encourage implementation of UA initiatives [76] (see also Gardner, 1994). The finding tends to confirm those from recent studies [28] that economic factors affect the adoption of UA interventions among residents.

Our findings suggest that personality characteristics influence ICUA, where it was found that personality had the highest direct effect (β = 0.322), representing the relative importance of this factor compared to other variables in explaining ICUA. This result supports the findings of previous studies examining the important role of personality for ICUA [25,26]. Our research, along with previous research, confirms that people are more likely to implement UA if they feel motivated to do so. In other words, those who possess knowledge about UA and feel motivated and confident about UA are more likely to take risks to implement UA than people who are not as motivated. This is in line with findings of a study which revealed that confidence in practicing UA influenced residents to implement

UA [27]. Similarly, lack of education and knowledge about agriculture negatively affected agricultural development programs in Nigeria [77].

The consequences of UA where shown to directly influence ICUA. This supports previous research also showing that positive consequences of UA were positively associated with ICUA [50,52]. This might be due to the individual's preference for fresh and chemical-free food available from UA sources, which would make it more likely to encourage community participation in UA. Furthermore, the potential impact of UA on decreasing city temperature and humidity during the summer may influence ICUA. Accordingly, we found the negative consequences of UA were negatively associated with ICUA. These results support the idea that risk factors might discourage residents' participation in UA [54]. Taken together, our findings suggest that communities are more likely to implement UA if they perceive UA will directly benefit them. That is, they might participate because they feel that it is important for them personally and at the community level. However, the risk factors associated to UA might offset these and negatively influence peoples' decisions to implement UA.

Our results provide evidence of the direct effects of predictors on ICUA, and additionally reveals the indirect influences of predictors on ICUA. In particular, we found that "UA's positive consequences", "sociocultural factors", and "personality characteristics" had significant positive indirect effects on ICUA, and that "negative consequences" had significant negative indirect effects on ICUA. In the second model (indirect effect), our findings suggest that attitudes toward UA mediate the effect of "UA's positive consequences", "sociocultural factors", "negative consequences", and "personality" on ICUA. As a result, those predictors, intertwined with attitude, represented attitude as an important factor influencing ICUA. This might suggest that while the main effects of predictors on ICUA exist, peoples' perceptions of UA can encourage or discourage them to implement the program. In other words, the ways in which those factors affect ICUA mostly depend on how people perceive UA.

Attitude is commonly understood to affect environmental behavior. This is consistent with the findings of Ngahdiman et al. [27] whose research found that positive attitude toward UA influenced Malaysian residents to implement UA. Brick and Lewis [64] also reported that environmental attitudes mediated the relationships between personality traits and environmental behavior. Among the indirect effects, the sociocultural factor had the highest indirect contribution toward ICUA through attitude, indicating that the effect of sociocultural norms on ICUA depend on how people view UA.

Despite this well-understood, important role of attitude in the second model, it did not fully mediate the effect of predictors on ICUA due to the direct effect of predictors on ICUA. In addition, the indirect effect estimates were smaller than the direct effects estimates. Comparing the two models, the direct model is better than the indirect model, as it contributes more variance to ICUA. Furthermore, the differences in total effect is clearly attributed to the direct influences of predictors on ICUA. One possible explanation for this might be due to the negative relationship between attitude and ICUA. It seems that the attitudes of residents might pose potential conflicts with urban planners and policy-makers. These agricultural professionals perceived that community residents viewed UA as an inappropriate or undesirable activity due to their lack of related skills. Another reason for negative perceptions of UA could relate to social status, that some urban people might view farming as a lower-status activity, which might discourage them to be associated with UA. The agricultural professionals who participated in the study themselves may have strong beliefs about the appropriateness of implementing UA in urban areas. They might agree that the benefits of UA to solve many urban problems might exist, but they also might believe the negative opinions held by citizens on UA will not produce unfavorable opinions of themselves.

Finally, findings from these two models demonstrated that organizational factors did not have an indirect and direct relationship with ICUA. With regard to the non-significance of organizational factors, it would seem that the agricultural professionals participating in this research know well of the absence of UA laws and regulations of government institutions. This might lead them to surmise personally that this means UA has low institutional status and, therefore, might avoid UA and seek

out work that is of higher status. In addition, they may feel there is insufficient UA planning and monitoring by government agencies to support community UA, meaning they might believe their engagement in ICUA would likely fail. In fact, the absence of organizational support may have influenced the importance of this factor among agricultural experts.

## 5. Conclusions

Our research found several critical factors influencing ICUA. We found that "personal characteristics", "UA's positive and negative consequences", "sociocultural factors", and "economic factors" affected ICUA. Among all factors, "personal characteristics" had the strongest direct effect on ICUA. In addition, we found that "personal characteristics", "UA's positive and negative consequences", and "sociocultural factors" influenced ICUA indirectly through "attitude". Among all factors, the "sociocultural factor" had the strongest indirect effect on ICUA. The study results revealed that the direct model was better than the indirect model at predicting ICUA. In general, this study stressed that both the internal and the external factors are important in promoting UA and increasing public engagement in UA.

Our findings have implications for public policy-makers, public officials, and program planners regarding UA initiatives, as well as UA policies in Iran and in other countries. While some people may show a strong tendency to participate in the program and might easily be induced to engage in UA activities, others might be less so. Since it is well-understood that UA provides more benefits than risks, governmental institutions could provide the top-down leadership—necessary leadership—to move UA forward to help the nation improve environmental sustainability. Governmental policies promoting, encouraging, and incentivizing this would need to be directed toward community members at the grass-roots level. Governmental policies would also need to provide the necessary resources for outreach education and in support of UA people and activities. To accomplish this, policies and outreach education activities would need to target the various positive personal characteristics discussed in this article that tend to help people become engaged in UA.

Informational strategies can also be employed to increase community awareness and knowledge of UA. Urban people acquiring new, evidenced-based knowledge of UA benefits may also motivate people to support community engagement policies and programs. In addition, communities that already possess innovative and risk-taking characteristics (early adopters) should be identified and then become important targets for governmental assistance and outreach education. This is important because different communication channels and messages may be developed and then work for different people depending on differences in personal characteristics.

We believe program planners should take the importance of sociocultural support into consideration. Public policy can be designed and legislated to stimulate demand for UA and to promote positive cultural norms in the society that directly encourage ICUA. Agricultural and non-agricultural organizations (related to social and cultural development) could also play an active role in disseminating UA information by holding educational awareness campaigns, education events, and distributing educational material such pamphlets and posters, and can use social and multimedia communication channels directed at community members. In addition, we believe UA role models to be one of the best ways to strengthen social and cultural norms in order to move communities and people to adopt UA. Modelling and providing information about successful community UA from other countries might also stimulate public engagement.

We believe interventions should focus on promoting UA's benefits. This means there is firstly a need to quantify UA benefits to community members. Once this is understood, then the benefits might be used to overcome the negative perceptions of UA. We believe that if the people perceive UA as having a negative impact on personal comfort and safety, these fears can be effectively changed into a positive way by demonstrating and explaining UA's benefits. "Economic factors" are also clearly very important when designing UA's policies and initiatives to promote UA. Financial assistance and other forms of support in the form of grants, loans, and/or credit must be made available to communities

and community members to assist ICUA. In addition, financial incentives to low-income residents can potentially increase the chance of getting communities involved in UA.

We acknowledge that our research has limitations that should be addressed in future research. While the two models confirmed their ability to predict ICUA, they might not completely describe the factors influencing ICUA. The first is self-reported data provided by agricultural professional officers. Future research should collect multi-source information from urban residents. Another concern is that there are several factors (multifactorial) influencing implementation of UA that we have not examined, as it is impossible to cover all the factors influencing the behavior in one research framework. We believe that these findings encourage further research on urban residents' future participation in community UA in Iran and elsewhere.

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