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How Green Wall Imploratory Strategies Can Be Facilitated and Optimized through Public Engagement?

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Abstract

A green wall is a sustainable strategy that has been proven in numerous studies to mitigate climate change. This strategy can be applied in indoor and outdoor environments. Through reviewing studies, it becomes clear that although the environmental and socioeconomics of green wall (GW) are addressed in many studies, there is a lack of information related to public acceptance of citizens' green walls. In this research, through quantitative methodology, two academic and non-academic approaches to the effective mechanism of two subjective and hidden variables: public engagement and green wall optimization measured and evaluated. This research was conducted in the city of Tehran, Iran in 2024. The participants in this research included 200 people and a combination of men and women from Tehran. The final result showed that public engagement can significantly increase green wall acceptance by engaging the public and enhancing their awareness about this nature-based solution.

Keywords: Green Wall, Public Engagement, Optimization, Structural Equation Modeling, Tehran.

Introduction

Environmental protection refers to any operation that takes place to maintain the environment or prevent its destruction (Panwar et al., 2011). Environmental protection is an effort that protects the natural environment to preserve the health of the environment and humans, at the personal, organizational, or governmental levels (McKinley et al., 2017). Due to the growth of population and technology, the biophysical environment is sometimes neglected (Depietri et al., 2017). Human activities impact climate change negatively effects (Myers et al., 2015).

Environmental protection is influenced by three interwoven factors: environmental laws, ethics, and education (Kaura, 205). Each of these three factors affects the environment both at the level of international decisions and at the level of behavioral and personal values. According to Yuen et al. (2015), public participation in decision-making is necessary to ensure environmental protection; additionally, it can improve social capital in urban areas (Farrokhirad & Foroutan, 2015).

A green wall is a wall that is partly or entirely covered with vegetation (Manso & Castro-Gomes, 2015) and is classified into two groups including indoor and outdoor greening. Depending on GW characteristics and climate conditions it can provide various environmental benefits. Also, some different techniques and methods can be used to create GWs in different dimensions to create space in the interior or exterior of the building. There are various definitions in literature like Vertical greening systems (Perini et al., 2011; Pérez-Urrestarazu et al., 2015), vertical gardens (Ramesh-

kumar, 2018), bio walls (Yang et al., 1995) and green walls (Palermo & Turco,2020; Manso et al., 2021; Susca et al., 2022).

As shown in this research, one of the most famous and beautiful GWs in the world is in the city of, while thousands of tourists take pictures with it every year, but do they think about the real function of these green walls? Generally, there are two types of GW Living walls (Riley, 2017; Fox et al., 2022) and Green façade (Hunter et al., 2014; Bakhshoodeh et al., 2022) that can be installed in buildings regarding the situation. This system is usually installed on the walls of buildings, houses, commercial buildings, and even indoor spaces. The green wall has environmental in various climate conditions (Mazzali et al., 2013; Larsen et al., 2015; He et al., 2017; Dahanayake et al., 2018; Farrokhirad, 2020; Gao et al., 2023), biodiversity (Collins et al., 2017), sound barrier (Azkorra et al., 2015) aesthetic benefits (Sutton, 2014), well-being (Gunn et al., 2022) health (Cardinali et al., 2023) by designing and creating a layer of plants in front of the wall surface.

Unlike traditional walls that have only one surface layer, the GW can provide more space for plants to grow and also improve the air quality (Irga et al., 2018) of the environment. Usually, installing a GW requires proper design (Ascione et al., 2020), proper maintenance (Gunawardena & Steemers, 2020), and selection of proper plants (Cameron et al., 2014). It also requires regular care and maintenance so that the plants grow well, and the GW has a long lifespan. GW as an accepted nature-based solution (Martin et al., 2021) needs to be considered as a building regulation to achieve sustainability benefits. Moreover, public acceptance of policies depends on people's perspective on the decision-making process and its results according to the IPCC (IPCC, 2018).

Meanwhile, public engagement plays an essential role in the acceptance of GW as a sustainable approach through knowledge enhancement and providing more precise information regarding GW performance. Public Engagement in the local community means the process of using the individual or group capabilities of stakeholders to achieve a group goal (Reed et al., 2018). In this process, conscious behavior, collective will, collective acceptance, choice, and the existence of common needs are important.

What is important in a successful Public Engagement process is feeling the need to solve a problem, recognizing that problem, and feeling the need for group cooperation according to the level of knowledge and capabilities of people and their knowledge of existing abilities and facilities and maximum use of them (Fung, 2015).

If we look at Public Engagement as a right (see Article 27 of the Universal Declaration of Human Rights), we realize that every human being has the right to engage in determining their destiny according to the Universal Declaration of Human Rights. Public Engagement in a local community begins with sensitization, which is the first step of Public Engagement (Nabatchi & Amsler, 2014). The focus of this study is how GWs can be used more optimally with the awareness of the people regarding place-based and user-based perspectives. While the usage of GWs for aesthetic purposes is widely acknowledged, it appears that not everyone is aware of the public's support for attention to the quality, and utilization of these benefits.

This research aims to evaluate and measure the role of public engagement in facilitating the protection and maintenance of GWs through the review of theoretical literature in the subject area of the research, i. e. the efficiency and GWs characteristics. In the research method, this question will be introduced along with the possible answers to them, that is the research hypothesis, and comprehensively in the form of a model. This study is innovative in that it uses a qualitative approach to include the public in using GW to increase public acceptance and awareness of this plant-based technology. The study's findings highlight the need for greater cooperation between GW enterprises,

stakeholders, and academic scientists by planning public workshops and events and offering chances for public participation to demonstrate the primary functionality of GWs.

Theoretical

Green wall implication. Nature-based strategies, such as vertical green systems (VGS), have environmental, social, and economic benefits (European Commission, 2015; Safikhani et al., 2014). With the typology of the GW, the range and degree of benefits will vary (Cameron et al., 2014). The benefits of a GF can be divided into two scales: the public and the private benefit scale (Shewka & Muhammed, 2012). The benefits of VGS in this research are split into ecological, environmental, social & aesthetic, and economic benefits. Ecological advantages include urban-scale adaptation and mitigation, and protection of natural resources. Environmental benefits are known as the key advantages function in urban and building scale.

Like, for decreeing negative effects of UHI (Akbari, 1992), improved air quality (Ottelé et al. 2010), water efficiency, and urban wildlife fall into the category of urban scale benefits while, energy-saving (Wong et al., 2009), sound reduction (Perez et al. 2016) and thermal comfort (Safikhani et al., 2014) located in building scale. Aesthetic value and human well-being apply to urban and building scales. From an economic point of view, costs from energy-saving and enhanced landing value are on a building scale (Manso et al., 2021).

Envelope protection, and life cycle cost reduction at the same time act on urban and building scales. The remarkable point is the relation between these benefits, and they can affect each other. For example, decreasing the harmful effects of UHI can influence well-being and human health, although they are in different categories. Also, reducing energy demand can enhance the real state value of buildings, especially in the residential sector. Moreover, due to residential buildings' contribution to increasing energy consumption, some of the benefits can be seen in the scale of residential buildings, including these benefits, which can be directly and indirectly affected.

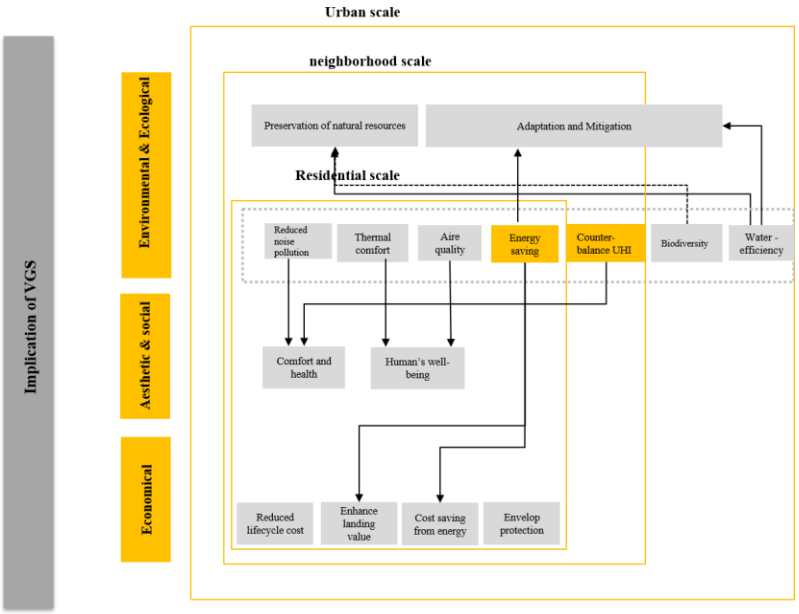

Figure 1. Benefits of VGS, based on urban, neighborhood, and residential scale
Source: Farrokhirad, 2021

Public engagement. To effectively combat climate change, people must actively participate in education and action; this requires the use of "minds, hearts, and hands" (Wolf and Moser, 2011). Demski (2021) outlines the following potential benefits of public engagement on net zero: increased awareness, decision credibility, enhanced trust, stronger political trust, more equal policies, and support for democracy. An increasing body of research has shown that citizen science programs give participants a deeper understanding of science and its processes, increase public awareness of the variety of scientific studies being conducted, and give their interests greater prominence (Bonney et al., 2016) "Citizen Science" is a catch-all term for a wide range of programs that include the people in science.

Alan Irwin created it in the middle of the 1990s as a means of enhancing public confidence and scientific literacy in the United Kingdom (Riesch & Potter, 2013). Irwin believes that "citizen science" aims to liberate scientific inquiry from its conventional institutional and professional context. According to this definition, examples of "citizen science" include community-based urban planning or environmental science programs that are sensitive to local needs and involve people in the conduct and control of research (Irwin, 2015).

Relations between citizens and local governments have weakened over the past two decades due to the lack of public service delivery (West, 2004). Public Engagement is seen as an effective solution to the crisis of public trust and governance (Thaker et al., 2019).

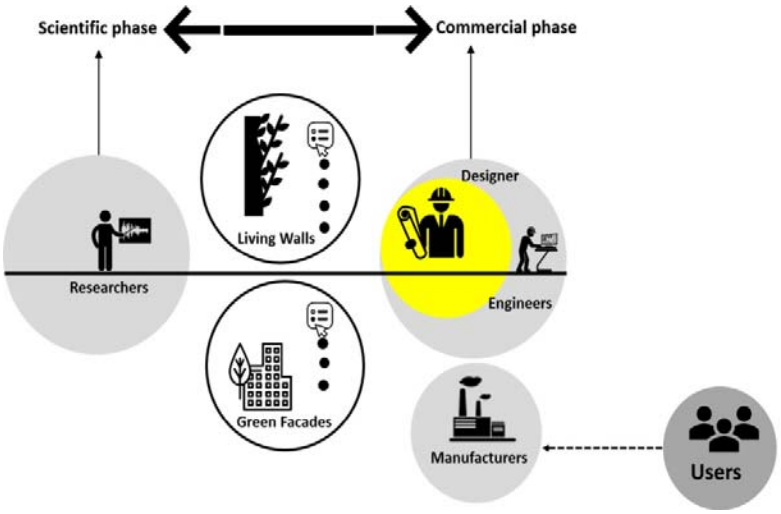

Figure. 2 Schematic figure of the relation between researcher and designer
Source: www.civilengineeringaid.xyz

As illustrated in Figure 2, no connection between users and academic areas deeply focuses on GW advantages scientifically. Regarding Life Cycle Cost analysis investigated in previous studies (Perini & Rosasco, 2013; Manso et al., 2021) the high cost (Riley, 2017) is the main challenge of GW installation on a wide scale mostly related to maintenance cost (Huang et al., 2019). Understanding the benefits that come from GW explained by experts from a scientific point of view can be helpful. Creating direct public engagement of citizens can increase effectiveness, legitimacy, and social justice (Fung, 2015). Moreover, it helps professionals and decision-makers understand a subject better and more profoundly (Salter et al., 2010).

The idea is that the public should be more fully involved in the policy-making process, as officials seek views and public engagement, instead of treating the public as merely passive recipients of policy decisions (Holmes, 2011) The basic premise of political theorists, social commentators, and even politicians is that Public Engagement increases public trust in officials, improves citizens' political engagement, strengthens democratic ideals, and even improves the quality of political decisions (Banerjee & Dutta, 2022). However, the potential benefits of Public Engagement in restoring public trust have not yet been confirmed (Campbell & Rudan, 2020). Citizens' Public Engagement is sustainable only if citizens support it and their Public Engagement is actively supported by the government. (Stott et al., 2024).

People in a local community have a right to know what is happening in their community. Consultation and submission of opinions by the people can be considered in this regard. People in a local community participate in group meetings and express their opinions (Pascaris et al., 2021). Afterward, it is necessary an open conversation regarding the needs and concerns of users in the local community. Sometimes committees or social structures are formed. The next step is role modeling and public engagement in executive activities. After that, he enters a step that can be called "the involvement of the individual in the workflow", in such a way that he is considered a part of the process and cannot be separated from this process.

Entering this process means empowering people in the local community (Naghibi Iravani et al., 2024). If the identification of people's needs at the local level leads to local action, it leads to Public Engagement to fulfill the need, while the need may lead to demand, but it does not create Public Engagement (Lo Presti, et al., 2023). The result of local empowerment activities should be local action to meet local needs (Samami et al., 2024; Khanian et al., 2019). Public Engagement is the Public Engagement of individuals with various structures and institutions of democracy, including voting, contacting political representatives, campaigning and lobbying, and participating in consultations and demonstrations.

Citizen Public Engagement can be about changing the way people (as politicians, developers, and citizens) interact with each other to make key decisions (Gheitarani et al., 2020). This ladder has 8 steps from the lowest level of Public Engagement to the highest level as follows:

1- Ferbikarane 2. Psychotherapeutic (these two levels are non-public engagement) 3-Information 4-Consultation 5-Partial position (these three levels are demonstration) 6-Partnership 7-Power enforcement 8-Citizenship control (These three levels are the highest levels of Public Engagement (Cantador et l., 2020).

Methodology

In this study, a quantitative methodology was employed. The nature of study variables is ultimately translated into quantifiable values and their relationships are assessed in quantitative technique.

In this way, based on the review of theoretical literature on the subject, in the second section, we will show the fixed relationships with a solid line and the assumed relationships with dotted lines, thus they can be examined in the form of research hypotheses. Finally, these dashes will be removed or converted to a solid line.

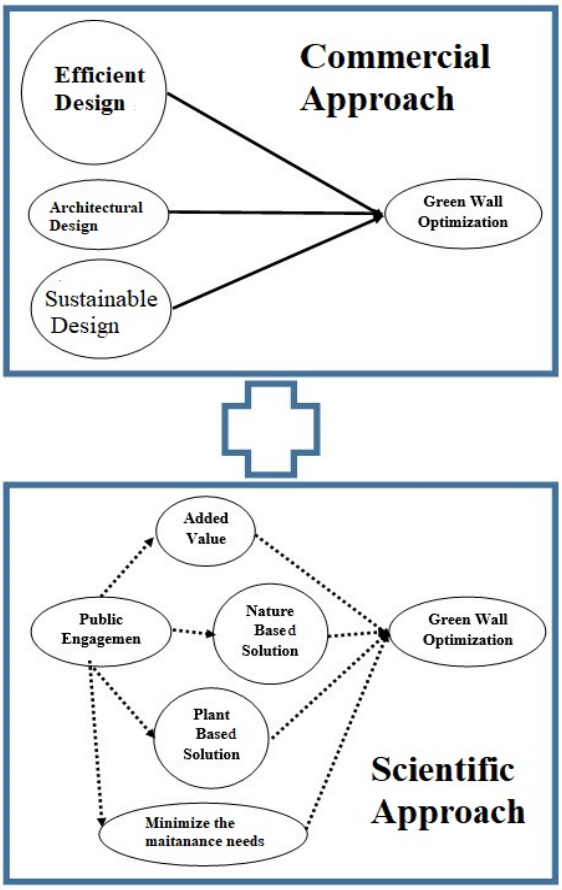

Figure 3. Proven and hypothesized relationships between green wall productivity and public engagement according to the theoretical literature (nature-based) plant-based solution, enhance public awareness
Source: Authors, 2024.

Figure 4. Green walls in Paris neighborhoods
Source: Authors, 2022

Sample and statistical population under study

In the theoretical literature, the subject of predetermined fixed relationships has been shown in the form of an academic approach. In this figure, it is seen that creating and maintaining GWs requires spending a lot of money, specialized design, and specialized solutions. On the other hand, it can be seen in the same figure that in the non-academic approach, through a non-specialist approach, the creation and maintenance of GWs is done only with convergence and general public engagement in this matter.

The technique of data analysis in this research is the use of the structural equation method because the nature of the variables of this research is subjective and cannot be measured through direct interviews. The software used to analyze information in structural equations was AMOS V. 22 software. The assumed models in Figure number one are drawn in AMOS V. 22 software. Through the pilot study, the value of Cronbach's alpha among 32 test samples, Cronbach's α value was greater than 0. 8, which indicates the validity of the questionnaire used in this research.

Equation 1: How to calculate Cronbach's alpha

$$\rho_T = \frac{k^2 \overline{\sigma_{ij}}}{\sigma_X^2}$$

ρ_T = tau-equivalent reliability

k = number of items

σ_{ij} = covariance between Xi and Xj

σ_X^2 = item variances and inter-item covariances

To measure and measure the nature of six hidden subjective variables, the validity of the questionnaire was confirmed through a basic study among 32 people with a response rate of 98%. Before using the specialized tool of structural equation software, i.e.. AMOS V. 22 software, the structural relationships between the variables that have an obvious relationship with each other will be measured, measured, or proven.

Results

The questionnaire related to external factors was distributed among 508 citizens in the city of Tehran, Iran. After re-examination, a total of 35 questionnaires were removed for the reasons mentioned earlier, and finally, 200 questionnaires were used. Out of a total of 200 people, 287 were women and 186 were men.

Structural Equation Methodology after completion. In path analysis, the coefficient of determination (R2) is used, and hence the appropriateness of the model can be evaluated, and the value of each variable can be determined using the beta weight (which is called the standardized path coefficient in path analysis). In addition, path analysis enables us to understand the mechanism of the effect of variables on each other. Path analysis determines how direct and indirect the effect of each variable is. Thus, path analysis provides a great deal of information about causal processes in an easily understandable way.

Table 1. Measuring the existence of correlation relationship in the non-academic approach model

		Public Engagement	Added Value	Nature Based Solution	Plant-Based Solution	Needless of Expert Maintenance	Green Wall Optimization
Public Engagement	**Pearson Correlation**	1	0. 79**	0. 83**	0. 25**	0. 75**	0. 95**
	Sig. (2-tailed)	-	0. 000	0. 000	0. 000	0. 000	0. 000
	N	200	200	200	200	200	200
Added Value	**Pearson Correlation**	0. 83**	1	0. 92**	0. 58**	0. 87**	0. 94**
	Sig. (2-tailed)	0. 000	-	0. 000	0. 000	0. 000	0. 000
	N	200	200	200	200	200	200
Nature Based Solution	**Pearson Correlation**	0. 83**	0. 92**	1	0. 98**	0. 24**	0. 63**
	Sig. (2-tailed)	0. 000	0. 000	-	0. 000	0. 000	0. 000
	N	200	200	200	200	200	200
Plant-Based Solution	**Pearson Correlation**	0. 25**	0. 58**	0. 98**	1	0. 21**	0. 50**
	Sig. (2-tailed)	0. 000	0. 000	0. 000	-	0. 000	0. 000
	N	200	200	200	200	200	200
Needless of Expert Maintenance	**Pearson Correlation**	0. 25**	0. 87**	0. 24**	0. 21**	1	0. 84**
	Sig. (2-tailed)	0. 000	0. 000	0. 000	0. 000	-	0. 000
	N	200	200	200	200	200	200
Green Wall Optimization	**Pearson Correlation**	0. 95**	0. 94**	0. 63**	0. 50**	0. 84**	1
	Sig. (2-tailed)	0. 000	0. 000	0. 000	0. 000	0. 000	-
	N	200	200	200	200	200	200

**** Correlation is significant at the 0. 01 level (2-tailed).**

Source: Author, 2024

The relationship between variables has several modes, and as a result, the relationships between variables can be examined in several modes:

A. Correlation: When we want to test the relationship between two variables, we use the curve method. For example, when we want to check the relationship between two variables A and B, we use correlation coefficients such as Spearman and Pearson.

B. Regression (multivariable): When we want to test the relationship between several (at least 2) independent variables with a dependent variable, we use the multivariable regression method. As a result, in this method, we are faced with at least two independent variables (predictor) and only one dependent variable (criterion). The relationship between two variables A and B as independent variables with dependent variable C can be an example of this connection.

C. Path analysis: The fundamental difference between the path analysis method and the multivariate regression method is the existence of the mediating variable in the path analysis method. As a result, in the path analysis method, we are faced with three categories or levels of variables, which include independent variables, mediating variables, and dependent variables. As a result, we have at least 1 intermediate variable in the path analysis.

D. Structural equation modeling: the main difference between this method and other methods is the presence of two types of variables in this method: obvious (observed) variables and hidden (latent) variables. Usually, the hidden variables are the same as the main variables, and the obvious variables are the questions that exist for the hidden variables in the questionnaire. In this method, the data and information that we do not have for the hidden variable and these variables are measured through the obvious variables for which there is data and information.

Path analysis is used to test causal models, and it requires setting up a figure in the form of a causal figure, and it helps us see what we are looking for. Figure 5 shows the structural equation model tested in AMOS V. 22 along with standardized path coefficients.

In figure (5), the direct and indirect paths of the influence of the hidden variables on the Green Wall Optimization and Public Engagement variables are displayed. Table number (1) shows the path coefficients of these direct and indirect paths along with the error rate of each path. As indicated in figure (4) and Table (1), the coefficients of the path of Added Value to the perception of security are lower than the standard limit (0. 3). This issue is also true for the direct and indirect path of Nature Based Solutions to GW Optimization Public Engagement and these path coefficients are less than the standard limit of 0. 3 and are not significant. The direct paths of Nature Based Solutions to security perception and security perception to GW Optimization Public Engagement are also less than standard and non-significant.

Discussion

In this part, the information obtained from the previous part will be examined and evaluated. Especially in the two-way relationship with the theoretical foundations and findings of this research, which is based on the requirements of the methodology determined to conduct the research and the output data extracted from it.

Among the significant paths, the path of Added Value to Green Wall Optimization and direct and indirect Public Engagement has the highest path coefficients and are known as critical paths in the mentioned model. Although there is a strong relationship between “Added Value” and “Nature Based Solution”, this issue does not have a final effect on Green Wall Optimization, because the intensity of “Nature-Based Solutions” effects on Green Wall Optimization is not strong enough.

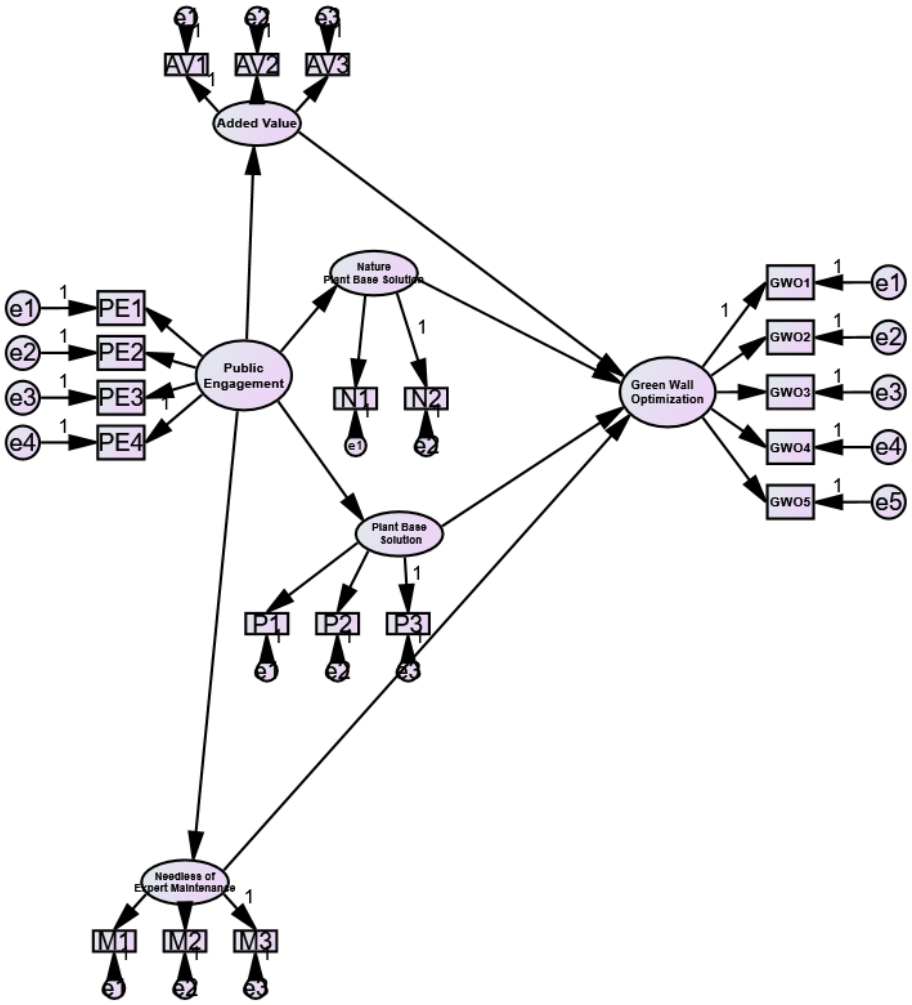

Figure 5. Structural equation model tested in AMOS V. 22 software with standardized path coefficients
Source: Authors, 2024

Although the effect of security perception on Green Wall Optimization through Public Engagement has been proven by various studies (Romanova & Salah, 208; Farooq et al., 2020), there is a lack of study in this area specifically in developing countries like Iran with limited financial resources. Contrary to the previously stated expectations, Nature-Based Solution did not have an impact on Green Wall Optimization through Public Engagement, since this point is also thought-provoking, and its possible causes should be discussed.

Measuring the relationship between Green Wall Optimization and Public Engagement

According to the general goal of the present study, which is to verify the comprehensive model of urban public engagement promotion through Added Value factors, we measure the correlation between the set of Added Value factors. For this purpose, through the correlation analysis, the statistical relationships of the set of Added Value factors of urban public engagement are investi-

gated. To measure the correlation between the Added Value factors, the correlation between the two sets of data should be tested.

In the section on Green Wall Optimization and Public Engagement, through citizens' perceptions of Public Engagement, their opinion to and about objective variables is measured.

In the field of external factors, however, Green Wall Optimization and Public Engagement are measured by other subjective factors that affect citizens' judgment of Public Engagement, apart from objective factors. Therefore, it will be possible to investigate the relationship between the Added Value factors through citizens' perceptions of Public Engagement. Figure number (5) shows the relationship between the Added Value factors of measuring Public Engagement.

Through correlation analysis, it was found that two categories of Added Value factors have a strong correlation with each other. In this context, the value of the correlation coefficient or the value of the coefficient (R) is 0. 87 at the significance level of p<0. 001 was calculated that the magnitude of this coefficient indicates the existence of a very strong and statistically significant relationship between the two variables Green Wall Optimization and Public Engagement in the Public Engagement questionnaire and the external factors questionnaire.

Therefore, it can be concluded that there is a strong relationship between the Added Value factors in the comprehensive model of measuring Public Engagement through Added Value factors. Figure (5) shows the effect of Added Value factors on Green Wall Optimization and Public Engagement. Therefore, in the comprehensive model of Public Engagement promotion through Added Value factors, both Green Wall Optimization and Public Engagement variables can be shown in the form of one variable and the mechanism of the effect of this variable on the overall Public Engagement can be depicted.

Conclusion

Validity and fit of the structural equation model. About confirming the validity and fit of the model, to what extent our developed model based on the theoretical framework and theoretical background conforms to reality is a question that we are trying to answer with the help of fit indices. In other words, the acceptable scientific criteria for confirming the theoretical model using the collected data are the main discussion in fit indices.

The indices are sometimes called good fit indices, because the higher their value is interpreted as a sign of stronger data support for the theoretical model, and sometimes they are called bad fit indices because the higher the value of those indices, the stronger the data support. Increases are considered signs of weaker data support of the theoretical model.

Table 2. Indicators suggested by some researchers

Proposed index								Scholar
R^2	SRM	PNF	NNF	NFI	CF	RMS	X^2	
			*	*	*		*	McDonald ,R. P. & Ho, R. M.
	*		*		*	*		Hu, L. T &bentler, P. M. 1999
*	*				*	*	*	Kline, R. B. 2005
*	*				*	*	*	Boomsma, A. 2000
	*	*			*	*	*	Hooper et al,2008

Source: Authors, 2024

Hooman declares the acceptable limit for the above indicators as follows. In this section, the author builds his model indicators based on the criteria mentioned by Hooman based on his opinion (Hooman, 2005). Table 2 shows the Cronbach's alpha coefficient for each of the Public Engagement variables, the average value of each variable, and the standard deviation for them.

Table 3. Green Wall Optimization measurement model navigation tool through assumed influential factors

Standard Deviation	Mean	Cronbach's Alpha	Variable Name
7. 23	0. 759	42. 0	Public Engagement
7. 80	0. 758	27. 53	Added Value
0. 81	0. 806	15. 28	Nature Based Solution
0. 75	0. 802	94. 13	Plant-Based Solution
0. 79	0. 749	52. 14	Needless of Expert Maintenance
0. 91	0. 714	87. 25	Green Wall Optimization

Source: Authors, 2024

Table 3 shows the mean values, standard deviation, and Cronbach's alpha for each of the variables related to Public Engagement. As shown in this table, all the Cronbach's alpha coefficients related to the variables are higher than 0. 7, which shows the adequate reliability of the present questionnaire. The model fit indices were measured as (CFI=0. 875, RMSEA=0. 04, X2/DF=1. 53, RMR=0. 06), which shows the acceptable level of model fit.

Also, all the standardized factor loadings for the Added Value hidden variable measurement model were statistically significant and were calculated at an average level (about 0. 6). All the standardized factor loadings for the Nature Solution variable were also factorial significant and were measured at an average level (0. 4). These values were measured for the Plant-Based Solution variable at an average level (0. 4) and for the Green Wall Optimization variable at an average level (0. 58).

In the present sample, the chi-square value with 85 degrees of freedom is equal to 114. 025, which is not statistically significant because its significance level is relatively large (more than 0. 05). It can be concluded that the chi-square test confirms the exact fit of the model with the observed data. On the other hand, the ratio of chi-square to the degree of freedom is equal to 1. 259 and smaller than 2.

Table 4. Model fit indices

Indices	Acceptable Range	Calculated
Chi-square (X^2)	Smaller is better	114. 025
Chi-square/degree of freedom	Below 2. 0	1. 48
Root Mean Square Error of Approximation (RMSEA)	Below 0. 05	0. 032
Root mean residual (RMR)	Below 0. 07	0. 044
CFI	More than 0. 9	0. 89

Source: Authors, 2024

In addition, the root mean square error of estimation (RMSEA) is equal to 0. 089 and its 90% confidence interval is between 0. 0289 and 0. 0289. Because the lower limit of this value is less than 0. 05, it can be concluded that the degree of approximation of the model in the community is not

large. The root means the square residual index of the root mean square residual (RMR) is equal to 0. 057, which is very small and indicates the small error of the model and the acceptable fit of the model. Table number (4) shows the fit indices of the model.

The path coefficients between the hidden and manifest variables of the mentioned model and the amount of variance of each variable are fully presented in the tables and figures below, which are followed by the interpretation of the results. The success of energy-efficient strategies hinges on robust public participation, which can be fostered through effective public awareness campaigns. However, current approaches may require a renewed focus, with an emphasis on developing innovative and engaging methods to encourage public involvement in this critical area. As a last word, the non-academic approach proved its superiority over the academic approach, and in this research, the main and most critical ways of influencing public engagement on green wall optimization were determined. These routes include nature-based solutions and plant-based solutions. Finally, it is suggested to emphasize the strategies that make the green wall more acceptable from the public's point of view.

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