Original Article

Neural network analysis of the functions of social participation in improving the environment

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Received: 15 Sep 2022 **Accepted:** 24 Feb 2023 **Published:** 04 Mar 2023

Abstract

Background: The aim of this research was to investigate the effect of the participation functions in green space projects of Tehran Municipality on the development of the areas covered by these projects.

Methods: The present study was an analytical cross-sectional design that 34 employees of municipal green spaces in Tehran were selected by random sampling method. Artificial neural network is a practical method for learning various functions. The questionnaire used in this study was developed by an extensive reviewing of the existing literature on the research topic by the researcher and using the opinions of the advisors and supervisor. Data collection was done using a questionnaire and analysis was done with SPSSWin16 and MATLAB.

Results: There is a significant relationship between urban social functions, urban economic functions, urban environmental functions, urban institutional functions, rural social functions, participation. Urban environmental functions of participation in green space projects, urban institutional functions of participation in green space projects, and rural social functions of participation in green space projects in total account for 55% of the variable changes in the development of the covered areas. The use of artificial neural networks showed that the municipality's green space has been effective in urban and rural population changes.

Conclusion: there is a significant relationship between the social, economic, environmental, institutional, and rural social functions of participation and the development of the covered areas, urban planning managers can use neural network to investigate the role of municipal green spaces in urban and rural population changes so that effective action can be taken.

Keywords: Growth and Development Neural; Networks, Computer; Parks, Recreational; Social Participation.

Cite this article as: Arfaee M, Zand A, Ahmadi S, Dehyouri S. Neural network analysis of the functions of social participation in improving the urban green space. *Soc Determinants Health*. 2023;9(1):1-9. DOI: http://dx.doi.org/10.22037/sdh.v9i1.39429

Introduction

The importance of urban green space in its life and sustainability and its physical, natural and social impacts on the urban system is undeniable. The existence of green space land use, proportional and per capita distribution dedicated to it based on demographic needs is one of the basic issues in urban management (1). The pressure to use service land uses, especially the green space, has increased due to constant green space area compared to population density, the increase in the

intensity of using green space, and the reduction in its ecological and recreational efficiency (2). With the emergence of the powerful Achaemenid civilization, and then Ashkans and the Sasanians in Iran, the art of green space design entered the field of science and mysticism so that the concepts of Bagh Hasht and Bagh Shahr indicate the relationship between nature and ancient Iranians. These concepts were considered the source of existence and creation and the factor of dominating the external world (3). In general, from an environmental point of view, the urban green space should provide ecological and environmental benefits in the form of radiation absorption, noise pollution reduction, oxygen production, temperature reduction, the impact of the greenhouse phenomenon, city ventilation, and the psychological impacts of the green space in the nature (4). Millward & Sabir, emphasized the role of urban forest parks in providing social and environmental services with measurable value for cities (5). Chiesura, emphasized the importance of nature of the city on welfare of citizens and urban sustainability, the source of positive feelings and useful services to meet non-material and spiritual human needs (6-11). Leeuwen et al. (12), Ajilian-Mommataz et al. (13) and Najafi Teroujeni et al., emphasized the impact of urban green space on improving the quality of urban life (14). Given what was stated on the importance of green spaces in various economic, social, environmental and institutional dimensions, it seems important to investigate the role of the functions of this land use. Therefore, the present study aimed to investigate the impact of the functions of participation in green space projects of Tehran Municipality on the development of the areas covered by these projects.

Methods

The present study was an analytical cross-sectional design in terms of examining the variables. The statistical population of this study included the employees of the green space organization of Tehran city. Cochran formula was used to determine the sample size. Accordingly, the sample size in this study was determined at 170 people. In this study, random sampling method was used, so that five districts were randomly selected from different districts of the green space organization. Then, 34 people were randomly selected from each district and they were investigated. Necessary analyses were performed using SPSS version16 and MATLAB software. Artificial neural network is a practical method for learning various functions such as functions with real values, functions with discrete values and functions with vector values. A trained neural network can make a decision as an "expert" in this category of information it has received for analysis. Once a network is configured for a specific application, that network is prepared training. To start this process, the initial weight is randomly selected. Then, training or learning begins. First, the results of the questionnaires are entered into the MATLAB software, and then the neural network is trained using the adopted data in that software. According to this training, the data for other states that have not been trained are estimated. Finally, the results of neural network estimation are compared with the results of questionnaires.

The questionnaire used in this study was developed by an extensive reviewing of the existing literature on the research topic by the researcher and using the opinions of the

advisors and supervisors, as well as the opinions of the informed experts of the municipality's green space organization. It includes two parts. The first part includes 19 items to measure the rate of changes in the cases presented before and after employment. The second part includes 63 items to measure the impact of activities in green space projects on social impact in different sectors. In this questionnaire, a 5-point Likert scale is used. Also, Pearson's correlation coefficient was used to measure test-retest reliability. Therefore, in the first stage, the questionnaire was completed by 170 green space employees who were randomly selected. In the second stage, it was completed again by the same 170 people with an interval of one week, and the Pearson correlation coefficient was obtained at 0.921.

Since the significance level was obtained at <0.001, which was smaller than 0.05, the obtained correlation coefficient is significant and the test-retest reliability coefficient for the whole scale was 0.921, indicating a high reliability. Also, Cronbach's alpha was used to calculate the reliability of the questionnaire. Accordingly, using the preliminary test, the questionnaires were first completed by 30 experts outside the research sample. Then, Cronbach's alpha coefficient was calculated at 0.97, which indicates the high reliability of the questionnaire. The general goal of this study was to investigate the impact of the functions of participation in green space projects of Tehran Municipality on the development of the areas covered by these projects. For this purpose and to achieve the general goal of the study, the specific goals of the study are:

1- Familiarity with some personal and professional characteristics of the respondents

2- Identifying and investigating the impact of urban social functions of participation in green space projects of Tehran municipality on the development of the areas covered by these projects.

3-Identifying and investigating the impact of urban economic functions of participation in green space projects of Tehran municipality on the development of the areas covered by these projects.

4-Identifying and investigating the impact of urban environmental functions of participation in green space projects of Tehran municipality on the development of the areas covered by these projects.

5- Identifying and investigating the impact of urban institutional functions of participation in green space projects of Tehran municipality on the development of the areas covered by these projects.

6-Identifying and investigating the impact of rural social functions of participation in green space projects of Tehran municipality on the development of the areas covered by these projects.

7- Investigating the impact of participation in green space projects of Tehran Municipality on the economic and social status of employees

8- Investigating the role of green space in urban and rural population changes using artificial neural network.

Results

The demographic characteristics of the respondents shows on Table 1.

Table 2 shows the correlation of the independent variables of the research with the dependent variable of the development of areas covered by green space projects. Regarding the correlation of research variables with the variable of "development of areas covered by green space projects", the following results were obtained:

The results of the correlation coefficient between the two variables of urban social functions of participation in green space projects and the development of areas covered by green space projects ($p<0.001$ and $r=0.687$) indicate that there is a positive and significant relationship between these two variables at the error level of 1%. Therefore, the research hypothesis is confirmed with 99% confidence. The results of the correlation coefficient between the two variables of urban economic functions of participation in green space projects and the development of areas covered by green space projects ($p=0.001$ and $r=0.596$) show that there is a positive and significant relationship between these two variables at the error level of 1%. Therefore, the research hypothesis is confirmed with 99% confidence. The results of the correlation coefficient between the two variables of urban institutional functions of participation in green space projects and the development of areas covered by green space projects ($p<0.001$ and $r=0.615$) show that there is a positive and significant relationship between these two variables at the error level of 1%. Therefore, the research hypothesis is confirmed with 99% confidence. The results of the correlation coefficient between the two variables of rural social functions of participation in green space projects and the development of areas covered by green space projects ($p<0.001$ and $r=0.573$) show that there is a positive and significant relationship between these two variables at the error level of 1%. Therefore, the research hypothesis of is confirmed with 99% confidence.

Table 1: The demographic characteristics of the respondents

Row	Classify	No (Percent)
Age (years)	less than 36	29 (17.1 %)
	37 - 50	73 (42.9%)
	over 51	68 (40%)
level of education	below diploma	92(54.1 %)
	diploma	65 (38.3 %)
	associate degree	5 (2.9 %)
	bachelor	7 (4.1 %)
	master's degree or higher	1 (0.6 %)
Employment history	up to 5 years	63 (37%)
	6 to 15 years	85 (50%)
	16 to 30 years	22 (13%)

Also, the results of multivariate regression in a stepwise manner showed that the variables of urban social functions of participation in green space projects and rural social functions of participation in green space projects entered the regression equation, and in total, they explain 55% of the changes in the variable of development of the areas covered by green space plans. Table 2 shows a summary of the steps of entering the independent variables into the regression equation

Moreover, to test the significance of the differences between the responses of the participants in green space projects before and after participating in the green space project in terms of changes in their economic and social status, the correlated t method was used. Its results are presented in Table 3.

Based on the results, there is a significant difference between the views of

Table 2. Correlation of variables with the variable of "development of areas covered by green space plans"

independent variable	dependent variable	p-value	R value
Urban social functions of participation in green space projects	The development of areas covered by green space plans	0.000**	0.678
Urban economic functions of participation in green space projects	The development of areas covered by green space plans	0.001**	0.596
Urban environmental functions of participation in green space projects	The development of areas covered by green space plans	0.003**	0.524
Urban institutional functions of participation in green space projects	The development of areas covered by green space plans	0.000**	0.615
Rural social functions of participation in green space projects	The development of areas covered by green space plans	0.001**	0.571

**: Significance at the 0.01 level

Table 3. Summary of the steps of entering the independent variables into the regression equation

Variables entered into the regression equation	steps	B coefficients of the variables entered into the regression equation	R^2	F
Urban social functions of participation in green space projects	1	3.862	0.501	** 28.152
Urban social functions of participation in green space projects	2	0.960	0.582	* 18.818
Rural social functions of participation in green space projects		0.446		

**: Significance at the 0.01 level

*: Significance at the 0.05 level

respondents regarding their socio-economic status before and after participation in green space projects at the error level of 1%. Thus, the research hypothesis is confirmed with 99% confidence (CI: -19.083 _ -16.081).

In other words, participation in green space projects affects the socio-economic status of employees. Also, to investigate the role of green space in urban demographic developments (tourism, entrepreneurship, return of immigrants, cost of living), expert system (artificial neural network) and MATLAB software were used. The results of the questionnaires were extracted according to the stated evaluation process. According to these results, an experiment was conducted to evaluate the accuracy of this training. Its results are presented in Figure 1.

The neural network is trained based on the data of the questionnaires and makes estimates for other questionnaires according to the figure. Examining the accuracy of neural network estimation results for questionnaires that had not been evaluated before showed that based on this training, the neural network can estimate the results with high accuracy.

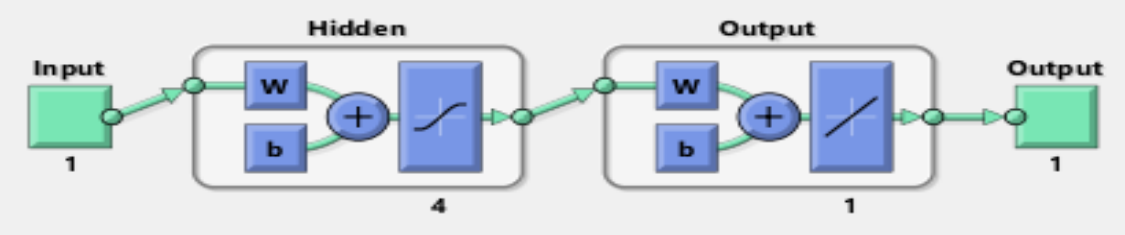

Figure 1. Neural network with its layers in MATLAB software

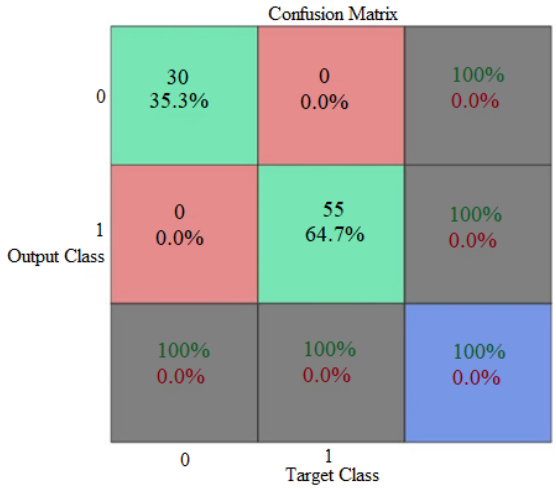

Figure 2. Neural network estimation accuracY

As shown in Figure 2, correct and incorrect classification is done in the form of a matrix. Correct classification shows green squares and the incorrect classification shows red squares. The smaller the percentage in the red squares and the closer it is to zero, the higher the classification accuracy. According to this limited training, the system could estimate other states with 100% accuracy.

Discussion

The results of present study revealed that there is a significant relationship between urban social functions of participation in green space projects and the development of areas covered by green space projects. Thus, in case of paying attention to urban social functions and strengthening cases such as proper access of all people to basic needs, and protection of cultural heritage, value and ecological systems, development and enrichment of culture, art and entertainment, proper access of women, young people and those who need economic, social and political opportunities, preparation for facing natural disasters, acceptance of diversity, development of areas covered by green space projects in terms of entrepreneurship development, tourism and the return of immigrants and poverty reduction will be achieved. This result is in line with the results of the studies conducted by Millward & Sabir (5), Chiesura (6), Janadleh (7), Araya et al. (8), Ziersch et al. (9), Motamedi et al. (10), and Amirfakhrian et al. (11). Also, the research results indicate a significant relationship between the urban economic functions of participation in green space projects and the development of areas covered by green space projects.

Since urban economic functions in this study include the issues of poverty reduction through wealth generation and balancing and having an appropriate share of development benefits, reducing debts, strengthening equal access to goods and services, investment and expanding markets for industries and sustainable activities such as tourism, agriculture, technology and information, development and promotion of local markets and economic activities, calculation of natural resources in national and local budgets, the development of areas covered by green space projects will be promoted, if the mentioned items are promoted. This result is in line with the results of the studies conducted by Millward & Sabir (5), Janadleh (7), Leeuwen et al. (12).

According to the results of the present study, there is a significant relationship between the urban environmental functions of participation in green space projects and the development of areas covered by green space projects. Thus, in the case of paying attention to cases such as balancing the sustainability of forests, mountains, water and rainfed lands and pastures and marine ecosystems and local rivers, cleanliness of the environment and reducing damage to it, protection of plant and animal diversity,

strengthening the range green consumers' options, the development of areas covered by green space projects will be also realized. This result is in line with the results of the studies conducted by Millward & Sabir (5), Janadleh (7), Leeuwen et al. (12), and Ajilian-Mommataz et al. (13).

The results of this study indicate that there is a significant relationship between the urban institutional functions of participation in green space projects and the development of areas covered by green space projects. The urban institutional functions of participation in green space projects in this study include access and the ability to participate widely in democratic processes, lack of concentration in decision-making and resource allocation, determining and setting the framework for national and local cooperation among the companies, organizations and civil institutions, strengthening transparency and accountability, coordinating local frameworks with national frameworks for managing information and access, strengthening authentic and ethical values supporting democratic values. Therefore, promoting them in the areas covered by the green space plans will result in the development of these areas. This result is in line with the results of studies conducted by Motamedi et al. (10) and Najafi Teroujeni et al. (14).

Also, the results revealed a significant relationship between the rural social functions of participation in green space projects and the development of areas covered by green space projects. Thus, with the change in family, social, and professional roles resulting from participation in green space projects, change in rural stratification, change in rural appearance, and change in exploitation systems in the areas covered by green space projects, these areas will also be developed. This result is consistent with a study conducted by Zanjani et al. (15).

Moreover, there is a significant difference between the views of the respondents regarding their socio-economic status before and after participating in green space projects. Thus, with the participation of employees in green space projects, the goals such as paying salaries approved by the Ministry of Labor at a specific time and regularly, paying regular bonuses, having a sense of continuing activities in this area, providing appropriate and safe tools and equipment for work, performing activities with the aim of long-term efficiency and reducing negative impacts, having a sense of job security, providing sufficient funds to perform activities related to maintenance and reconstruction and improvement of green space will be achieved. This result is consistent with the results of studies conducted by Chiesura (6), Araya et al. (8) and Amirfakhrian et al. (11).

Also, the results of the present study showed that if the neural network is trained using 50% of the MATLAB software data, the remaining 50% of the test data can be estimated with 100% accuracy in the next step. Therefore, based on the training of this system in a short period of time, as well as the evaluation of other countries, green space experts can be helped to improve the process of expanding green space. Therefore, by using the expert system (neural network), the role of green space in urban and rural demographic developments, including presenting new and creative ideas, identifying new opportunities, mobilizing resources,

starting a business or company, innovation and creativity Check out (16).

Urban green spaces, as a part of urban open spaces, are considered the main factor in the structure of the urban landscape, improving ecological conditions, leisure and recreation to improve the quality of the urban environment (17). The human environment is a comprehensive concept that includes all the impacts of external factors and their interrelationships that cause biological balance. The way of humans relationship with the environment, their communication, and the affectability of the characteristics of ecosystems have a significant impact on the emotional and psychological quality of humans. The new dimension of urban sustainability in today's heterogeneous and unsustainable cities is social sustainability which is mutually related to the role of parks in increasing the participation rate of citizens (18). Also using sponsors as finance and support to establish some kind of public or business relationship could be a good solution for optimal urban green space maintenance (19, 20).

Recommendations

Improving recreational facilities and equipping all city parks as much as possible with safe places for children to play and suitable sports equipment for children and teenagers such as table tennis and so on. Increasing the per capita level of urban parks by locating and building new parks, especially around Tehran, whose vast non-urban spaces have the potential to create new parks. Preparation of urban parks in accordance with the needs and conditions of the general citizens and considering the limitations of women, the elderly, disabled people and children, who need a place for recreation and relaxation according to their own conditions in terms of the safety of the existing equipment, providing security, lighting, passages and so on.

Conclusion

Based on the results of the present study and the importance of urban and rural demographic developments in the country's development, the exact role of municipality green space projects in urban and rural demographic developments is not clear. Hence, it is necessary for top and middle managers of related organizations to investigate the role of municipality green space projects in urban and rural demographic changes to find the best solution for the balance of population dispersion based on municipality green space projects, and use the neural network system to take effective action in line with urban and rural development to reduce costs and save money.

Funding/financial support

There is no funding.

Authors' contribution

Masoumrh Arfaee and Azita Zand developed the study concept and design. Serveh Ahmadi acquired the data. Sahar Dehyouri and Masoumrh Arfaee analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

Informed consent

Questionnaires were filled with the participants' satisfaction and written consent was obtained from the participants in this study.

Conflict of interest

The authors declare that they have no conflict of interests.

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