# RESIDENTS' ATTITUDES TOWARD ACCEPTANCE OF THE GREEN INFRASTRUCTURE PLAN OF THE CITY OF DRAMA

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## ABSTRACT

A complex Green Infrastructure (GI) plan has been designed for the city of Drama, which is located in northeastern Greece. This plan is being implemented since 2018 and it is expected to be completed in the succeeding three years. The Drama city GI plan aims to upgrade and enhance the bioclimatic, environmental and socio-economic conditions of the downtown area of the city, by inducing drastic changes in the city landscape environment. Due to the project complexity and its long implementation time, the everyday life in the city GI intervention area has been upset and several stakeholder groups are being directly affected. To contribute to the GI plan implementation success, a governance network was put into operation in order to improve the GI plan social acceptability by promoting active social participation. This paper presents the results of a survey carried out through the governance network's operation with the aim to explore the attitudes towards the GI plan of the residents of the GI plan intervention area, who are among the stakeholder groups that are being directly affected. We used purposive sampling in a way that the participants were deliberately chosen because they were residents in the intervention area of the GI plan. A total of 129 responses were collected through face-to-face interviews on site based on a specifically designed questionnaire, just before the inception of the GI project works. Subsequently, Principal Component Analysis and clustering methods were used to analyze the data collected. Three groups of residents according to three distinct attitude patterns towards acceptance of the GI plan were revealed through the analysis: a) the utilitarians, who appeared particularly interested in the perceived usefulness of the infrastructure constructions, b) the negative to change, who focused on the perceived negative impacts of the GI plan during the implementation phase and c) the positive to change, who placed more emphasis on the perceived positive impacts of the GI plan after its completion. Each group was profiled according to socio-demographic characteristics. The results of the current research are intended to be used in combination with follow-up surveys to monitor potential changes in the residents' social acceptability of the Drama city GI plan. Furthermore, the empirical results of this study could be useful for the planning agencies in other places where GI plans are to be implemented and stakeholders' involvement is sought.

## KEYWORDS

Green Infrastructure Plan, Principal Component Analysis, Cluster Analysis

## 1. INTRODUCTION

Over the past decade there has been a growing interest in designing and implementing Green Infrastructure (GI) projects in different urban environments. According to the Landscape Institute [1], the GI projects promote the interaction between the quality of natural elements and environmental, social and economic performance, aiming at improving peoples' health and quality of life, as well as creating job opportunities through green economy initiatives. In this context, the GI projects usually include ecologically oriented facilities, which are designed to provide diverse services, such as water purification, clean air, climate change mitigation, improved recreation opportunities, energy use efficiency, noise reduction and aesthetic improvement [2- 6].

However, several restrictions may hinder the successful implementation of GI projects. The most important of those reported in the literature are connected to:

i) lack of awareness and knowledge of the content and benefits of GI projects, ii) lack of data on benefits, costs and performance

iii) inadequate technical knowledge and experience and iv) community participation and social consensus [7-13].

The interest of this study concerns a multifaceted GI plan, which was set out about a year ago in Drama, a city located in northeastern Greece. The scope of this plan is to upgrade the environmental and bioclimatic conditions, and enhance the economy of the city downtown area. The Drama GI plan includes several different projects in the intervention area, such as the construction of a new sewerage and water network, the construction of underground electric lighting network, the reconstruction of road and pavements, flower beds and plantings, the installation of special bioclimatic upgrade structures, the construction of infrastructure networks with emphasis on rainwater drainage system, electric lighting in the network of public spaces, and horizontal and vertical traffic signage.

One major concern of the city's authorities responsible for the implementation of the GI plan is related to the impacts this plan may induce on different stakeholders. In this context, a governance network was established in the frame of a relevant project in 2018 aiming to increase community engagement and social acceptability of the GI plan. This network is an open structure, with no legal status at this stage. It is moderated by the authors of this article and its members include the entrepreneurs of the GI plan intervention area, representatives of agencies with concern to the GI plan and residents of the intervention area. The role of the network involves mainly the following: i) information and data gathering and analysis, ii) information dissemination to interested stakeholders, iii) interactive involvement of interested social groups and individuals, iv) promotion of active social participation and increase of the project's social acceptability, v) creation and promotion of good practices of social participation and vii) collaboration with all the stakeholders for recording and evaluation of potential problems and impacts of the GI plan in the intervention area, as well as formulation and evaluation of solutions to potential problems. This article presents the results of one of a series of surveys initiated within the network's function, which was targeted to the residents of the GI plan intervention area; a group of stakeholders, who were expected to be directly affected by the plan. The specific objectives of the study involved: i) to identify the factors affecting the attitudes of the residents of the GI plan intervention area, ii) classify the residents according to their attitudes toward acceptance of the GI plan and iii) profile the groups of residents according to social and demographic characteristics.

## 2. METHODOLOGY

A survey was carried out to collect the data information with face-to-face interviews on site based on a structured questionnaire. We used purposive sampling, also called judgmental sampling, because we aimed at participants

who possessed a desired quality, that is to be residents of the GI plan intervention area [14]. The survey was carried out just before the inception of the GI project works and it is worth noting that no community consultation or engagement had taken place prior to the GI plan implementation. The questionnaire designed for this research contained questions organized in five sections: i) socio-demographic questions, ii) questions related to the level of awareness and knowledge about the GI plan, iii) questions about the perception regarding the importance of the different GI plan items in terms of the environmental and socioeconomic upgrade of the area, iv) questions about the potential benefits after the completion of the GI plan and v) questions about the potential problems during the GI plan implementation. Questions of parts (iii), (iv) and (v) were Likert-type including four scale ratings from very important to not important. The questionnaire was piloted during July 2018 to 15 residents [14] and it indicated that it required no modification and therefore, the main surveys were conducted in August and September 2018.

The questionnaires were subjected to statistical analysis using IBM SPSS version 19 software package. Statistical analysis was performed on the responses of 129 residents, who accepted to participate in the survey. Principal Component Analysis (PCA) was applied to identify the variables accounting for the maximum amount of variance within the data by considering the smallest number of uncorrelated variables. The anti-image correlation matrix, the Measure of Sampling Adequacy (MSA) and Bartlett's test of homogeneity of variances were calculated to check the appropriateness of the data for further analysis. Variables with a high proportion of large absolute values of anti – image correlations, as well as with MSA less than 0.5 were removed before analysis. An orthogonal rotation using the varimax method was performed and the criteria of eigenvalue greater than 1, the scree plot and the percentage of explained variance were applied to determine the factors in the first rotation [15-18]. Continuously through a number of different trial rotations the reduced 12 PCA variables, which related the residents' attitudes toward acceptance of the GI plan were compared to a smaller set of underlying factors, based on factor interpretation ease.

The PCA scores were subsequently subjected to cluster analysis to group the residents with similar scores into clusters of similar attitude patterns towards acceptance of the GI plan. Non-hierarchical methods were used [16,17] to develop a typology of the residents' attitudes towards the GI plan. Furthermore, cross tabulation chi-square analysis was employed to profile each group of residents exhibiting a specific type of attitude towards the GI plan according to socio-demographic characteristics.

## 3. RESULTS AND DISCUSSION

About 45% of the participants in the survey stated that they were aware of the Drama city GI plan at the time of the survey, but not elaborately informed about what the plan actually involved. From those not having prior knowledge or not been aware about the plan, 39% stated that they would like to be informed and receive information about the plan through the governance network. Additionally, approximately 34% of the already informed participants expressed their willingness to stay informed about the on-going progress of the GI plan implementation.

The factors affecting the residents' attitude towards acceptance of the GI plan and the three key dimensions derived from the PCA Analysis are presented in Table 1. The eigenvalues and the percentage of variance results for the first main components are shown in Table 2, while the scree plot test is depicted in Figure 1.

*Table 1. Main factors affecting the residents' attitude towards acceptance of the Drama city GI plan*

| ***Key attitude dimensions*** | ***Factor loading*** |
|---|---|
| ***Usefulness of the utility and bioclimatic infrastructure*** | |
| Construction of a new sewerage and water network | 0,877 |
| Construction of infrastructure networks with emphasis on rainwater drainage system | 0,872 |
| Construction of underground electric lighting network | 0,802 |
| ***Negative impacts during the GI plan implementation*** | |
| Difficulty accessing local services | 0,842 |
| Difficulty accessing the flea market | 0,822 |
| Difficulty parking vehicles | 0,772 |
| Difficulty accessing local shops | 0,720 |
| ***Positive impacts after the GI plan completion*** | |
| Functional improvement of the area | 0,876 |
| Aesthetic improvement of the area | 0,778 |
| Bioclimatic upgrading of the area | 0,709 |
| New business opportunities | 0,618 |
| Quality of life improvement | 0,608 |

*Notes:* KMO MSA = 0.723, Bartlett test of Sphericity = 504.682, df = 66, p < 0.000

*Table 2. PCA variance results for the first main components*

| ***Component*** | ***Eigenvalues*** | ***Variance Percent*** | ***Cumulative Variance Percent*** |
|---|---|---|---|
| *1* | *2,868* | *23,903* | *23,903* |
| *2* | *2,790* | *23,250* | *47,153* |
| *3* | *2,004* | *16,698* | *63,851* |
| *4* | *0,957* | *7,974* | *71,825* |

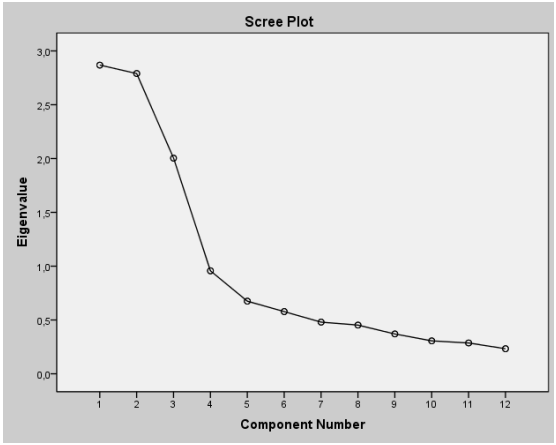


*Figure 1. The scree plot test among component numbers and eigenvalues*

According to Table 1 the residents' attitude towards acceptance of the GI plan were influenced by the following three factors:

i) the perceived usefulness of the utility and bioclimatic infrastructure, connected mainly to the construction of a new sewerage and water network.

Ii) the perceived negative impacts during the GI plan implementation with emphasis on the expected difficulty accessing services, the flea market and shops of the intervention area, as well as the expected difficulty parking vehicles in the area, and

iii) the perceived positive impacts following the GI plan completion, such as the expected functional and aesthetic improvement and the bioclimatic upgrade of the intervention area, the new business opportunities and the expected improvement of quality of life. According to the residents' attitude towards acceptance of the Drama city GI plan three groups were distinguished and named as follows: (a) Negative to change (b) Positive to change and c) Utilitarians.

*Table 3. Prediction of residents' group membership with cross-validation*

| Actual Classification | Predicted Classification | | |
|---|---|---|---|
| | Negative to change | Positive to change | Utilitarians |
| Negative to change | 48 | 0 | 0 |
| Positive to change | 2 | 53 | 0 |
| Utilitarians | 1 | 0 | 11 |
| Total N | 48 | 55 | 12 |
| N Correct | 46 | 51 | 10 |
| Proportion of Correct Classification | 95.8 | 92.7 | 83.3 |

The residents named "negative to change" comprised 41.74% of the respondents participating in the survey. These opposed the GI plan, mainly due to the difficulties they envisaged during the implementation phase. The residents named "positive to change" formed the majority of the respondents, with 47.83%. They expressed an optimistic attitude towards the GI plan because they expected it to improve the functional, aesthetic and bioclimatic aspects of the intervention area and it will create new business opportunities and better quality of life conditions. The residents, who were named "utilitarians", comprised 10.43% of the respondents. These considered the Drama city GI plan as beneficial particularly due to the usefulness of regarding the infrastructure constructions in the intervention area. The cross-validation classification derived by Discriminant Analysis is depicted in Table 3. It is evident from Table 3 that the three attitude dimensions can accurately predict and discriminate the residents' group membership. Indeed, in total were correctly classified 97.4% of the original grouped cases and 93% of the cross- validated group cases.

The one sample chi-square test was applied to identify the significant socio- demographic for the characterization of the respondents. These are presented in Table 4.

*Table 4. The most significant socio-demographic variables for profiling the residents*

| | *Chi-Square* | *df* | *Asymp. Sig.* |
|---|---|---|---|
| ***Age*** | *28,860* | *3* | *,000* |
| ***Marital status*** | *58,186* | *2* | *,000* |
| ***Number of children*** | *25,429* | *3* | *,000* |
| ***Occupation*** | *66,189* | *6* | *,000* |
| ***Education*** | *100,109* | *4* | *,000* |

The residents' detailed profile in relation to personal characteristics is shown in Table 5. It is clear that the residents who are positive to change were mainly self- employed, aged between 45 and 64, married and both Lyceum and University graduates. On the other hand, the residents who were classified as negative to change were aged between 30 and 44, are private employees with no children. Finally, the utilitarians were mostly single with no children.

*Table 5. Residents' profile according to socio-demographic characteristics*

| *Demographic characteristics* | *Negative to change* | *Positive to change* | *Utilitarians* |
|---|---|---|---|
| | *Percent residents* | | |
| **Age** | | | |
| ***18-29*** | 13,2 | 10,5 | 4,4 |
| ***30-44*** | 17,5 | 11,4 | 0,9 |
| ***45-64*** | 9,6 | 21,9 | 4,4 |
| ***>65*** | 1,8 | 4,4 | 0,0 |
| **Marital status** | | | |
| ***Married*** | 22,8 | 30,7 | 4,4 |
| ***Single*** | 17,5 | 16,7 | 5,3 |
| ***Divorced*** | 1,8 | 0,9 | 0,0 |
| **Number of children** | | | |
| ***None*** | 17,7 | 16,8 | 4,4 |
| ***One*** | 8,0 | 9,7 | 2,7 |
| ***Two*** | 13,3 | 16,8 | 1,8 |
| ***Three or more*** | 3,5 | 5,3 | 0,0 |
| **Occupation** | | | |
| ***Private employees*** | 15,2 | 8,9 | 1,8 |
| ***Public servants*** | 2,7 | 2,7 | 1,8 |
| ***Self-employed*** | 10,7 | 18,8 | 1,8 |
| ***Retired*** | 4,5 | 5,4 | 0,0 |
| ***Students*** | 3,6 | 6,3 | 1,8 |
| ***Unemployed*** | 4,5 | 6,3 | 1,8 |
| ***Other*** | 0,9 | 0,0 | 0,9 |
| **Education** | | | |
| ***Primary School graduates*** | 3,5 | 0,0 | 0,0 |
| ***High school graduates*** | 0,9 | 6,1 | 0,0 |
| ***Lyceum graduates*** | 18,4 | 19,3 | 4,4 |
| ***University graduates*** | 18,4 | 19,3 | 5,3 |
| ***Postgraduates*** | 0,9 | 3,5 | 0,0 |

## 4. CONCLUSIONS

Three different attitude patterns of the residents living in the Drama city GI intervention area towards acceptance of the GI plan, were identified, the negative to change, the positive to change and the utilitarians. The majority of the residents, almost 48% of them appeared to be positive to the GI plan implementation due to the expected benefits after the plan completion, particularly the functional, aesthetic and bioclimatic improvement of the area, the envisaged new business opportunities and improvement of the quality of life in general. On the other hand, a substantial part of the residents, about 42% showed a negative attitude towards the GI plan mainly due to the envisaged difficulties accessing the stores and services in the intervention area, as well as difficulties parking the vehicles. Finally, a small part of the residents, about 10% appeared to be rather neutral towards the GI plan implementation recognizing however the usefulness of the utility and bioclimatic infrastructure in the area. The results of the current research are intended to be used in combination with follow-up surveys to monitor potential changes in the residents' social acceptability of the Drama city GI plan. Furthermore, the empirical results of this study could be useful for the planning agencies in other places where GI plans are to be implemented and stakeholders' involvement is sought.

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