

# An Analysis of Sustainable Regeneration Considering Urban Green Infrastructure Indicators with an Institutional Participation Approach (Case: the City of Lahijan)

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## Abstract

As an urban life support system and as a new method in planning, green infrastructure design can be more effective in the function of natural systems of cities through integration in the sustainable regeneration processes as well as integrated and coordinated management of organizations involved. Multiple management systems and disharmony of state organizations and institutions in charge of urban regeneration in green infrastructure are the main issues in urban management. In this regard, using green infrastructure indicators in regeneration programs, in this research, conducted in Lahijan in 2019, the organizational relationships of staff members, including state institutions of the city were examined. Also, using a descriptive-analytical method and library information, as well as 400 questionnaires distributed among residents and 50 interviews with city managers as the staff members, after analysis and implication of the data through Pearson correlation, SPSS, and social network analysis in UCINET environment, the connection between urban green infrastructure indicators and sustainable regeneration was determined, and the interactions of institutions involved in regeneration were studied. According to the results of the questionnaires, a significance level of under 0.01 was found for green infrastructure and sustainable regeneration components; therefore, at a certain level, the relationship between the indicators of green infrastructure and sustainable regeneration was measured at 0.95. In terms of environmental indicators, due to higher correlation coefficients and mean, the impact was higher than the other two indicators. State institutions are highly capable of preserving the urban green heritage by increasing inter-institutional interactions and awareness. Therefore, to realize this approach, it is necessary to raise the awareness of each institution and collaboration among actors to increase the executive power of the staff committee members. Accordingly, the executive power of institutions is based on inter-institutional relations and collaboration and increasing the managers' knowledge about sustainable indicators of regeneration in the rehabilitation of urban green infrastructure of Lahijan.

**Keywords:** Sustainable urban regeneration, Urban green infrastructure, Sustainable development, Inter-organizational interaction

## 1. Introduction

Sustainable urban regeneration is a new approach in the new millennium that considers all social, economic, physical, environmental, and managerial aspects in an integrated, strategic, and urbanistic perspective. Accordingly, the regeneration of urban green infrastructure is defined not as a project independent from macrostructures, but in conjunction with the spatial and social structures of the city (Khabiriand Alvandi, 2017). Despite the wide scope and spatial scale of studies on these infrastructures, they are all conducted with the aim of planning and sustainable land management, and planning for them depends entirely on the ecological concepts of landscape, such as structure, function, continuity, and dynamics (Marcucci and Jordan, 2013: 56). In Iran, in 2014, the government established a regeneration staff committee to improve organizational relations for participatory management (Iran Urban Regeneration Company). In terms of organizational relations, the main problem is the excess of different stakeholders from private and public institutions

among which there is no coherent coordination and planning (Babaii et al, 2017: 18).

After the passage of several decades of having the experience of employing regeneration plans through conservation and development, examining the results of these policies can be a topic for extensive investigations (Khatami Far et al., 2019). Lahijan has different natural infrastructures including foothills, rivers, wetlands, and forests, lack of attention to which in new urban development processes creates problems from the environmental point of view and disturbs the ecological balance of the environment. Rising temperatures in the city, declining green space per capita, and severe floods during rains, despite extensive development and implementation measures in the area, require serious attention to these infrastructures to prevent their destruction. With urban regeneration on the agenda of urban and municipal management programs in recent years, a new window was opened in front of Lahijan managers and urban planners to pay attention to historical and worn-out tissues along with other target areas including dysfunctional tissues, urban suburbs, and areas with the highest rural area, as a priority in urban

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planning. However, regeneration projects in Lahijan are focused more on worn-out inefficient historic areas of the city and they ignore natural environments despite their abundance in the city. On the one hand, urban projects are increasingly destructing the infrastructures, and on the other hand, the regeneration programs are poor in the implementation phase due to the multiplicity of management, non-coordination of organizations, and lack of interaction and involvement of staff member institutions. Thus, the present study aims to analyze the sustainable regeneration concerning urban green infrastructure in Lahijan, and the inter-organizational relations of staff members, so that the involved institutions can achieve integrated and comprehensive solutions for sustainable urban regeneration while maintaining independence. Unfortunately, the urban regeneration management of Lahijan was unable to use the potential of the institutions involved, and the staff members and regeneration projects face poor implementation due to lack of managers' knowledge and lack of communication between institutions, while they have the biggest plans.

Therefore, this study seeks to examine the concepts of 'green infrastructures' and 'sustainable urban regeneration' to find an answer for the questions "to what extent can one provide common solutions for sustainable urban development by creating integration between the two concepts? Moreover, "how can executive actions by organizations involved in urban regeneration be strengthened?" One objective of the research is to connect the green infrastructure and urban regeneration to use them in urban planning processes, which facilitates the power of green infrastructure in sustainable regeneration and guarantees the goals of sustainable development. It also analyzes the inter-organizational interactions of staff members, so that the institutions involved can achieve integrated solutions for sustainable urban regeneration while maintaining independence. Given this background, the research questions that pursue the above objectives are as follows:

What are the areas and capabilities of urban green infrastructure to achieve sustainable regeneration? In addition, how can executive actions by organizations involved in urban regeneration be strengthened? Based on the above objectives and questions, the research hypotheses are as follows: natural conditions of cities are the most fundamental capability of urban green infrastructure for sustainable regeneration, and increased interaction and inter-organizational involvement of institutions involved in urban regeneration leads to strengthened executive actions. The motives of specialists and state institutions, as the main factor influencing the rehabilitation of green infrastructure in the process of sustainable urban regeneration for Lahijan, have never been studied, although they are the main investors, managers, regulators, and coordinators of sustainable urban regeneration. Sustainable urban regeneration routing by recognizing the capabilities of green urban infrastructure and analysis of inter-organizational relations of the involved bodies are considered as the innovative areas of this research, which were obtained for the first time in the form of academic research in Iran.

## **2. Research Background and Theoretical Foundations**

Sustainable urban development is the result of environmental discussions related to environmental issues, especially the urban environment, which is proposed along with "sustainable development theory" to support environmental resources (Haddad Larjani, 2016). Specifically, green infrastructure is a designed and managed network of natural and semi-natural factors that are related to other environmental elements, and its purpose is to improve the ability of nature to serve the ecosystem (Masoudi, M, 2016: 7). Green infrastructure development is one of the key factors throughout city planning because its benefits have a direct impact on the environment and the quality of the residents' life (Moayedzadeh, 2020). the objective of sustainable urban regeneration whit integrated approach is to protect the consolidation of human- nature transplantation, the improvment of the quality of urban life and the regulation of human relations, technology and nature (Moazeni et al., 2018).

Green infrastructure is a network of green spaces and water systems that provide various environmental, social, and economic values and services to urban communities and ensure the viability and sustainability of the urban environment (Ely and Pitman, 2014). It is an environmental framework for environmental, social, and economic sustainability (Bendict and McMahan, 2006). City management practices in the field of urban regeneration with a variety of complexities, especially with complex issues and challenges fail in response to conventional models of urban management and the need for a platform for incremental and integrated actions (Richard, Smith, 2002: 127).

Integrated urban management coordinated with staff committees, municipal and relevant institutions (both state and public), under the supervision and local policy of the city council, is a general model in the formulation of municipal tasks. Without this unity and coordination between organizations, the efficiency, and effectiveness of the set of resources and measures taken to manage the affairs of the city and its development is highly questionable (Kazemianand Saedi Rezvani, 2004: 16). The reason for the importance of organizational interaction is that the success of policies, in addition to being dependent on the appropriate combination of policy objectives and tools, is largely dependent on the interaction between private and public organizations (Bikar et al., 2004: 27) and the degree of compatibility with the organizations of the society (Raheem, 2014: 455). Therefore, for sustainable urban regeneration management, it is necessary to achieve effective participation of all actors based on a bottom-up process, and participation, awareness, and trust with balance in power relations between actors with the aim of interaction and facilitation (Firoozzi et al., 2017). In general, inter-organizational collaboration covers various aspects, all of which are examined under the inter-organizational aspect (Babaii and Ebrahimi, 2016:20, quoted by Gazendam). Inter-organizational collaboration efforts all have an interactive structure that focuses on collaboration and partnership between organizations to achieve a common goal(s) (Bailey, D. and Koney, K. M. 1995).

According to the findings of a study entitled 'Ecotourism and its Role in Sustainable Development of Urban Tourism' with

Lahijan as the case (2013), the natural touristic attractions of Lahijan provide a very good opportunity for the development of the ecotourism industry and tourism development. Especially, in the absence of identification and evaluation of potential and actual capabilities and also planning based on scientific standards, sustainable development of nature tourism in this city, due to its natural attractions and tourism, will fail to improve the quality of natural resources, with emphasis on the preservation of those resources and the economic and social development of local communities, which are an integral part of the natural areas (Najafi et al., 2013).

The results of Akbari and Ansari research in 2016, which measured the role of city parks in the quality of life and the level of citizens' satisfaction with those spaces, indicate that the quality of the environment is one of the factors affecting the attraction and presence of people in the parks and there is a significant relationship between the quality of the environment and the quality of life. Analysis of inter-organizational relations and collaborations was common after discussions by

people such as Selznick (1957), March and Simon (1958), Chandler (1962), Lawrence and Lorsch (1967), Thompson (1967), Katz and Kahn, and others (1978), and after environmental pressures were identified. People like Benson and Williamson were also pioneers in this area. According to Suomi, inter-organizational collaboration is often considered as the development of a set of styles and interactions between internally disruptive organizations (Babaei and Ebrahimi, 2016:20, quoted by Suomi). In an article entitled 'Experimental Analysis of Urban Management and Public Services in Chinese Cities' by Ying et al. (2005), a sample of the urban management of some cities of China was examined. As a comparative study, the results show that there are currently different patterns of urban management in China. Researchers identified some main factors influencing the conditions that led to the formation of different patterns of urban management.

Table 1  
shows some of the other studies conducted on the research topic.

Researcher	Year	Title
<b>Olivier Sykes, Wolfgang Börstinghaus, Chris Couch</b>	2011	'Thirty Years of Urban Reconstruction in the United Kingdom, Germany, and France: The Importance of Space and the Way of Dependence'. A study of reconstruction experiences in three countries: England, Germany, and France. The results show the dependence of the regeneration achievements of each country on its policies
<b>Mohammadidoust</b>	2011	Public-Private Partnership, A New Strategy in Rehabilitation and Regeneration of Worn-out Urban Tissues
<b>Roosta</b>	2011	Research project to explain the position of various state, public, private, non-governmental ... institutions in the renovation of worn-out tissues
<b>Danesh Shakib et al</b>	2016	Reconstruction of historical tissues in the direction of sustainable urban development - a case study of historical tissue of Lahijan, to express the sustainable and integrated reconstruction and protection in economic, cultural, social, and physical fields, which can be achieved by improving the quality of historical parts of the city, along with other areas. The task should be done in the form of written plans with the cooperation of all organizations.
<b>Moradi Chalgani</b>	2016	Ph.D. thesis, 'Redefining Inter-Organizational Relations in Urban Decision-Making Environment to Improve the Quality of Life, with Emphasis on Reducing the Risk for Cultural Heritage in the City of Isfahan'
<b>Mohebbifar et al</b>	2017	Ph.D. Thesis, 'Theoretical Model of Public-Private Partnership Governance Based on Interactive Network Approach) Case Study: Inefficient Urban Regeneration Plans

(Source: Mohammadidoust, 2012, Roosta, 2012, Danesh Shakib et al., 2016, Moradi Chalgani, 2016, Mohebbifar et al., 2017. And Chris Couch et al, 2011.)

### 3. Research Methodology

This research applies a descriptive-analytical approach. The information and data were collected from the library and using field methods. The population of the study was the residents of Lahijan to whom 400 questionnaires were distributed, and interviews were carried out with 50 experts and managers of institutions being members of the Urban Regeneration Center. The research area is the main and legal area of Lahijan located on the east of Gilan. According to the statistics provided by the Statistics Center of Iran in 2016, Lahijan had a population of

104,000. Based on the Cochran sampling technique, 400 people were selected as the population. The information required to construct the content of the questionnaire and the interview (library information) was compiled based on the theoretical framework using content analysis, after reviewing the theoretical texts including definitions and views and theories of thinkers. The time interval in terms of executive operations was from April to October 2019. The data collected from the questionnaire was analyzed using appropriate statistical techniques, and the results were provided using descriptive and inferential statistical

techniques. Descriptive statistics indicators such as frequency, frequency ratio, and general questions were used to discover the mentality of users and clients about the city's green infrastructure to review and analyze information about the general characteristics of respondents. All statistical operations were performed using Office and SPSS software. The first hypothesis was tested using t-test and Pearson correlation. To answer the research questions, a local questionnaire with 3 economic (5 items), social (8 items), and environmental (4 items) indicators was developed and distributed among the statistical population. The reliability of the questionnaire was calculated at 88.7 using Cronbach's alpha for 30 samples, which indicates the desirability of the research tool. The statistical sample was selected randomly to provide an equal opportunity for each member of the population. To analyze the data from field studies and to answer the questions, SPSS, descriptive statistics (mean, standard deviation, and variance), and inferential statistics (t-test and regression) were used. Once the interviews were analyzed, social network analysis in the UCINET environment was used to analyze inter-organizational interactions. To assess the executive power of state agencies involved in urban regeneration programs, it was necessary to estimate the betweenness centrality using the data from interviews with relevant institutions, which was obtained using a matrix. The resulting diagram shows that

entity  $x$  needs to cross entity  $z$  from the shortest distance to communicate with entity  $y$ . The shortest path is the possibility of a disrupted connection between two organizations by the third one (Borgatti, 2005). Finally, according to the main objective of the study, the relationship between urban green infrastructure and sustainable regeneration criteria was measured, and the inter-organizational interactions of staff members were analyzed

Lahijan, as the center of Lahijan city, is the largest city on the east of Gilan province (Figure 2), located on foothills, with a population of 104000 people, according to the 2016 census; it is the third-most populous city in Gilan province after Rasht and Anzali. It has a temperate climate and a high average annual rainfall. With an area of 1600ha, this city has a limiting natural feature that prevents the uniform expansion of the city. The general land slope is from south to north and groundwater is easily accessible. This city is located on the main road from Rasht to Mazandaran; due to different natural green infrastructures including foothills, rivers, wetlands, and forests, and lack of attention to them in the new urban development processes, it faces environmental issues and problems, which disturb the ecological balance, such as rising city temperatures, declining green space per capita, and severe flooding during rains.

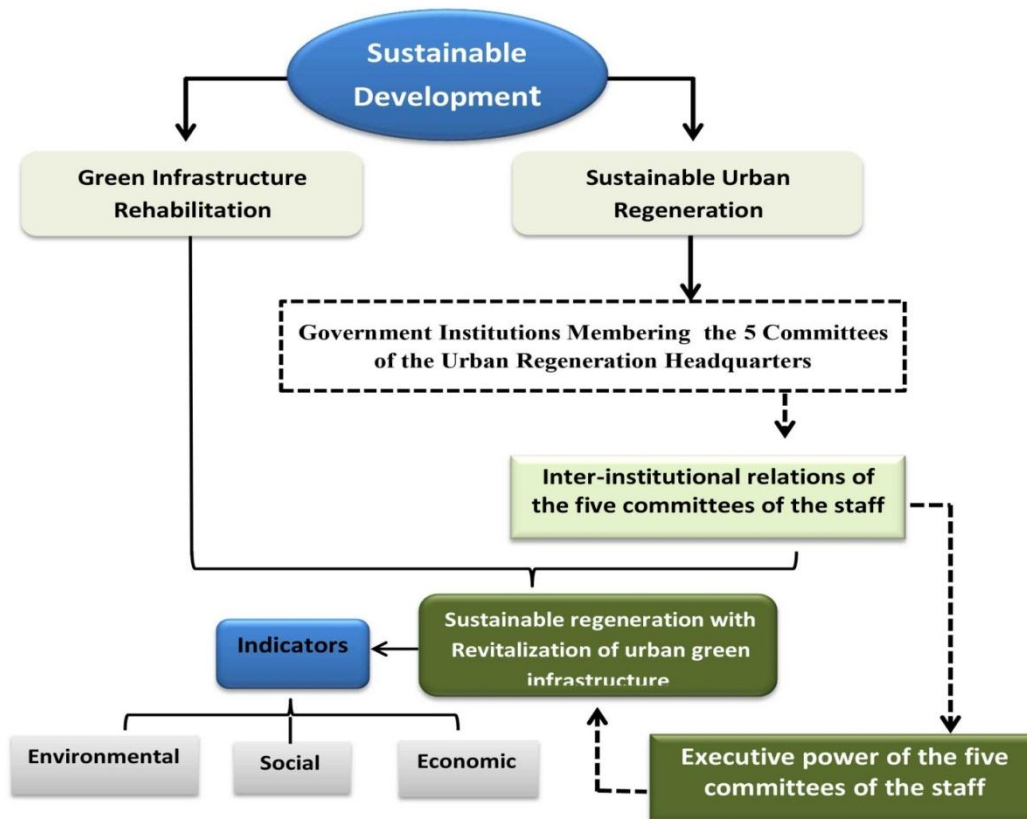


Fig. 1. Theoretical framework of research, a conceptual model of the research based on the theoretical foundations.

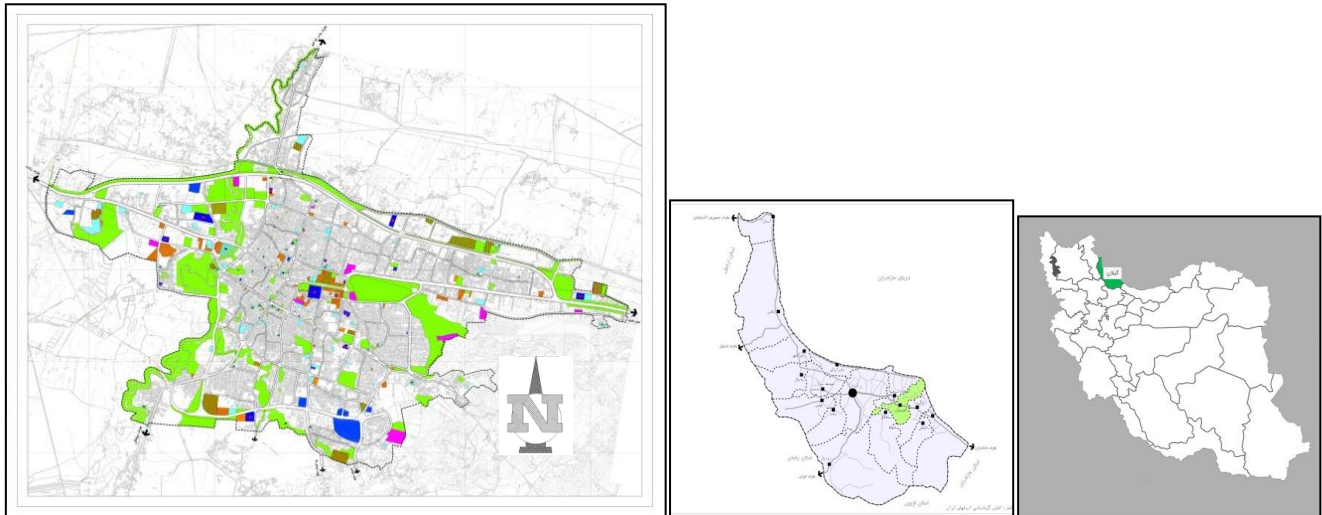


Fig. 2. The photo on the right shows the geographical location of the study area in Iran, photo in the middle shows the location of Lahijan in Gilan province. Moreover, the photo on the left is the map of Lahijan, which shows the location of green infrastructure including rivers, wetlands, foothills, parks, and green spaces marked as green spots  
(Source: Pouya Naghsh-e-Shahr-o-Bana, 2013)

#### 4. Research Discussion and Research Findings

The proof to the first hypothesis of the research, based on the data and findings from 400 questionnaires, is that regarding the components of economic indicators (employment, economic development, and revitalization, land and housing, investment, creative economy) with the confidence of 95% and 5% error, and with a degree of freedom of 399, the mean difference for the differential between the mean of the sample and the mean of the test (3) indicates that the mean of the sample is greater than the test value. The confidence intervals for the indicator have the same significance and do not cover number zero, and the significance level of the test is 0.000, which is less than 5% error. Therefore, it is concluded that the observed difference is significant and the positive difference of the means refers to the impact of urban green infrastructure on economic indicator components (employment, economic development, and revitalization, land and housing, investment, creative economy).

Regarding the components of social indicators (quality of life, social pride, creative class, social empowerment, traditional culture, creative industries, cultural exchanges, cultural life), considering 95% confidence and 5% error, and with a degree of freedom of 399, the mean difference between the differential for the mean of the sample and the mean of the test (3) indicates that the mean of the sample is greater than the value of the test and the

confidence intervals for this indicator have the same significance and do not cover number 0, and the significance level of the test is 0.000, which is less than 5% error. Therefore, it is concluded that the observed difference is significant and the positive mean difference refers to the impact of urban green infrastructure on the components of social indicators (quality of life, social pride, creative class, social empowerment, traditional culture, creative industries, cultural exchanges, and cultural life).

Regarding the components of environmental indicator (ecosystem conservation, pollution prevention, land conservation, quality of life), considering 95% confidence interval and 5% error, with 399 degrees of freedom, the mean difference for the differential between the mean of the sample and the mean of the test (3) indicates that the average of the sample is higher than the value of the test, and the confidence intervals for the indicator have the same significance and do not cover number 0 and the significance level of the test is 0.000, which is less than 5% error. Therefore, it is concluded that the observed difference is significant and the positive difference of the means refers to the impact of urban green infrastructure on the components of environmental indicators (ecosystem conservation, pollution prevention, land conservation, quality of life), shown in Table 2.

Table 2

T-test values for measuring the relationship between urban green infrastructure and economic, social, and environmental indicators of urban regeneration

Single-sample t-test						
Test Value=3						
	t-test statistics	Standard deviation	Significance level of 2	Mean difference	Reliability of 95%	
					Upper limit	Lower limit
<b>Economic indicator</b>	20	399	0/000	0/29445	0/3225	0/2664
<b>Employment</b>	35/401	399	0/000	0/63528	0/6706	0/6000
<b>Economic development and revitalization</b>	16/104	399	0/000	0/20821	0/2336	0/1828
<b>Land and housing</b>	4/019	399	0/000	0/09875	0/1471	0/0504
<b>Investment</b>	31/171	399	0/000	0/67750	0/7220	0/6348
<b>Creative economy</b>	6/930	399	0/000	0/14750	0/1075	0/1893
<b>Social indicator</b>	33/478	399	0/000	0/52089	0/5515	0/4903
<b>Quality of Life</b>	25/064	399	0/000	0/59750	0/6444	0/5506
<b>Social pride</b>	17/482	399	0/000	0/37833	0/4209	0/3358
<b>Creative class</b>	22/705	399	0/000	0/42417	0/4609	0/3874
<b>Social empowerment</b>	39/285	399	0/000	0/92125	0/9674	0/8751
<b>Traditional culture</b>	29/600	399	0/000	0/72500	0/7732	0/6768
<b>Creative industries</b>	11/494	399	0/000	0/25000	0/2928	0/2072
<b>Cultural exchanges</b>	18/867	399	0/000	0/44500	0/4914	0/3986
<b>Cultural life</b>	20/972	399	0/000	0/44583	0/4658	0/3852
<b>Environmental indicators</b>	43/448	399	0/000	0/87304	0/9125	0/8335
<b>Ecosystem conservation</b>	27/782	399	0/000	0/62833	0/6728	0/5839
<b>Contamination prevention</b>	40/749	399	0/000	0/92833	0/9731	0/8835
<b>Land conservation</b>	30/941	399	0/000	1/02250	1/0875	0/9575
<b>Quality of life</b>	45/195	399	0/000	0/91300	0/9527	0/8733

Therefore, generally, in this study, after reviewing the research literature and identifying different dimensions of green infrastructure development, which are common to sustainable urban regeneration, 3 economic, social, and environmental indicators, and 17 criteria for measurement of the effect of residents' perceptions of green infrastructure development and its impact on sustainable urban regeneration in the city of Lahijan were assessed through the questionnaire.

The results of the statistical and thematic analysis showed that the development of green infrastructure had profound effects on the local community. From the environmental point of view, and the point of view of the local community, it was found that preserving green infrastructure lands in Lahijan was a priority, and preventing the spread of pollutants to maintain clean air improves the quality of life and adherence to the

conservation of the ecosystem in the areas inhabited by citizens. From a social point of view, the local community believed that increasing and enhancing the recreational facilities and spaces in areas with green infrastructure promoted social and traditional supervision of the protection of the facilities and urban services, reviving the traditional culture and integration of local communities leading to the improved quality of life of the residents of the area. The more the desire of tourists to use those spaces, the more the cultural exchanges between residents and tourists will be promoted by increased social communications. There will also be a wide range of cultural activities such as holding cultural events and festivals that form the cultural life of the residents, which is a reason for the attendance of the creative class of artists and craftsmen, and changing the style and forms of traditional arts and local handicrafts made by them,

which, improving the positive image of the place of living and creating the social pride, makes people interested in moving back to the area. Eventually, cultural commercialization such as the creation of handicrafts and local arts, and the development of services and facilities such as libraries, theaters, and local exhibitions will promote creative industries in this infrastructure. In terms of economy, it was clear that from the local community's point of view, the development of green infrastructure is a factor for encouraging more investment by them and thus increasing economic benefits, promoting local businesses, and creating new job opportunities. If it happens, with the attention of state organizations, foreign currency will be injected into the economy of the region by tourists, which is followed by economic development and revitalization,

leading to the creation of industries and creative economic activities, such as theaters, cinemas, museums, etc., that result in increases in real estate prices in the region and eventually, improving the housing situation of the local community.

To prove the second hypothesis of the research, direct interviews with managers were conducted. At first, for obtaining the opinion of urban managers on regeneration in Lahijan to obtain local indicators of urban regeneration approach and green infrastructure, direct interviews were carried out by the researcher with the urban regeneration workgroup consisting of 50 people to evaluate and infer their deep perceptions, attitudes, interests, and beliefs. Table (3) was extracted based on maximum response.

Table 3  
Summary of interviews with officials

<b>Item</b>	<b>Frequent responses</b>
<b>Familiarity with green infrastructure</b>	Uninformed
<b>Familiarity with urban regeneration</b>	Limited information
<b>Integrating urban regeneration into green infrastructure</b>	refers more to upgrading the environment
<b>How to intervene in urban regeneration</b>	Uninformed
<b>Imagination about urban regeneration</b>	Regenerate worn-out tissue Specific and out of reach policy Contrary to legal restrictions Lack of upstream documents It is a managerial matter and has financial benefits Unaware of the features of financial exemptions if implemented by departments
<b>The most important issue in regeneration</b>	Revitalize worn-out tissue Historical and cultural heritage protection The need for an investor in this field
<b>The number of executive exchanges of each institution with others</b>	With more intermediaries for some organizations and without intermediaries with other institutions
<b>How people intervene publicly</b>	Uninformed
<b>Profitable mechanisms of urban regeneration</b>	Directly upgrade green infrastructure
<b>The main obstacles in integrating green infrastructure and regeneration</b>	Lack of upstream documents No budget allocation
<b>Effective tools and operational plans</b>	Upcoming notifications

(Source: Findings of the dissertation, 2020)

According to table 3, such an issue is not mentioned in the documents and the officials are not familiar with the process.

In the following, using descriptive-interpretive research strategies, the social network analysis technique in the UCINET environment was used to describe and interpret the level of executive power of policymakers and city managers as members of specialized workgroups of Lahijan Urban Regeneration Committees. The most important feature of the network analysis approach is that

it transforms partial interpretation and analysis, according to the characteristics of independent subjects, into interpretation and analysis of phenomena according to the interactions between actors as a system (Borgatti, 2005). One of the interview questions put to the institutions involved in the Lahijan regeneration programs was 'Which organization the relevant organization had more executive and functional exchanges with?' and 'How are they prioritized?' The interviewees evaluated their answers according to Table 4.

Table 4

Evaluation of the level of inter-institutional relations of the 5 urban regeneration committees of Lahijan

The amount of executive and functional exchanges of the institutions involved in the five committees	Rate
No relations	0
Limited relations to the extent of informing	1
Holding joint meetings intermittently and in a limited way	2
Organizing joint meetings continuously and intermittently	3
Holding joint meetings regularly but at long intervals	4
Holding regular and close meetings	5
Excellent relations and participation	6

According to the results of the responses analysis, communication with the governorate, municipal, cultural heritage department, and other departments according to

the need in the project, were prioritized and announced by the members of the committees. After analysis, a summary is presented in Table 5.

Table 5

Policymakers and city managers, being the members of the specialized workgroups of Lahijan urban regeneration committees

ID	factor	ID	Factor
Governorship	1	Power Department	9
Municipality and City Council	2	Trade, Mining and Industry Organization	10
Department of Cultural Heritage	3	Labor Department	11
Department of Natural Resources and Environment	4	Tax office	12
Department of Road and Urban Development	5	Endowments Directorate	13
Faculty members of Islamic Azad University	6	Department of Telecommunications	14
Department of Water and Sewage	7	Housing Foundation	15
Gas Department	8	Department of Agriculture	16

Finally, a matrix was obtained as the software input based on which the inter-organizational communication network was depicted using betweenness centrality<sup>1</sup>. In this network, the nodes that are close to each other, have more inter-organizational interaction with each other, and the nodes that are closer to the center, indicate more effectiveness in the decision-making processes and

implementation of sustainable regenerations. In addition, the size of the nodes has the greatest impact on the implementation of decision-making and management programs. Figure (3) shows the interactions between urban regeneration institutions based on betweenness centrality that shows which organization has more power in implementing urban regeneration programs.

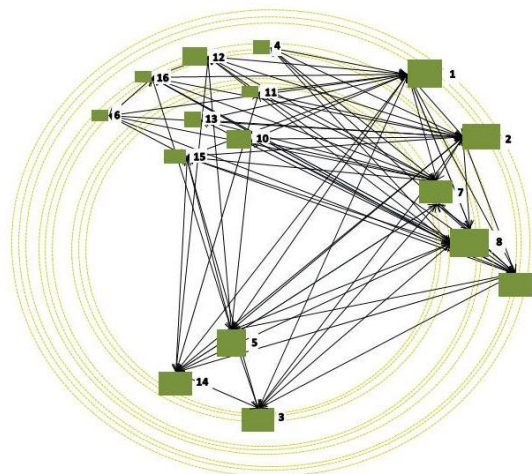


Fig. 3. Executive power network of actors involved in the regeneration of Lahijan based on betweenness centrality.

Accordingly, the actors are divided into 3 classes. The first class with identifiers 1, 2, 7, 9, and 8, who are the

mayor, the governor, and the heads of water, electricity, and gas departments, and have the most executive power



among the actors involved in sustainable urban regeneration programs. They have wider and stronger relations with each other and with other sides and are municipal executive departments playing an executive role in almost all committees of urban regeneration projects.

The second class with identifiers 3, 5, and 14 includes the heads of cultural heritage, road, and urban development, and telecommunications departments, who have more extensive relations within the organization than the first class and the extent of influence in decision-making processes and the implementation of urban regeneration by them is more than the first class.

The third class with identifiers 6, 4, 16, 12, 10, 11, 13, and 15, including faculty members, directors of the Department of Natural Resources and the Environment, Agriculture Organization, Tax Office, Industry, Mining, and Trade Organization, Department of Labor, Endowments Directorate, and the Housing Foundation, who are agents with the least amount of executive power and less intra-network interactions.

According to the findings, municipals, and water, electricity, and gas departments are the most important institutions active in policy-making and implementation of urban projects, and cultural heritage, natural resources, and environment departments that are directly related to urban regeneration and they have been unable to find their true and worthy place. The fragmentation of urban management makes the structure of the city inadequate and complicates issues more and more. Municipals, governorates, education, and water, electricity, gas, and telecommunications departments, and dozens of other organizations and institutions often interfere in urban

affairs without coordination. Each organization looks at urban issues according to its facilities and work dimensions and there is no comprehensive view.

Not all of these organizations have much in common, consult, and participate in affairs.

## 5. Conclusion

According to the results from the analyses of the information of the questionnaires using SPSS, there is a positive and significant relationship between urban green infrastructure and economic, social, and environmental indicators. According to the above studies, regarding the first hypothesis of the research, i.e. "the most basic capabilities of urban infrastructure for sustainable regeneration is the natural ecological conditions of cities", with t-test studies according to the obtained reports and Table 2, it is found out that, in addition to the effectiveness of all three environmental, economic and social criteria, the environmental criteria and natural ecological conditions have the most impact, followed by the highest social and economic impact. Therefore, it is supposed that if the necessary and sufficient attention is paid to urban green infrastructure, the promotion of urban regeneration in economic, social, and especially environmental indicators will be obtained. Hence, the first hypothesis of the research is proved.

In addition, in the environmental indicator, the conservation of green infrastructure lands, in the social indicator, social empowerment, and in the economic indicator, the investment have the highest average and therefore the highest effect, which are shown in Figure 4 and 5.

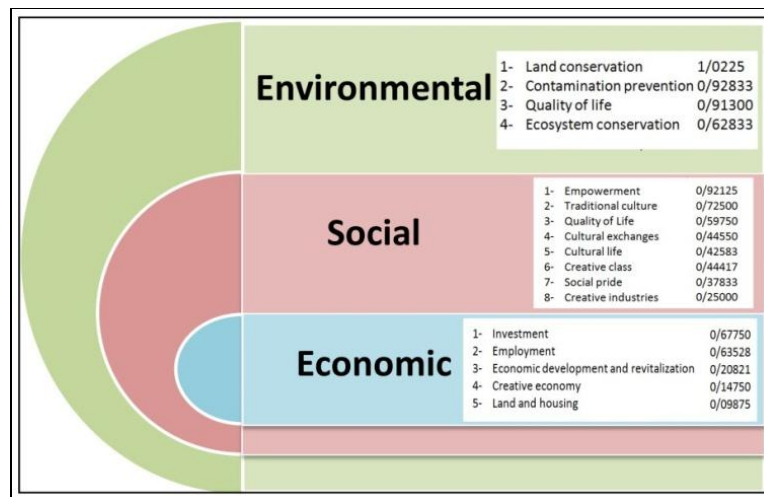


Fig. 4. Ranking the economic, social, and environmental indicators based on their average from the perspective of the local community

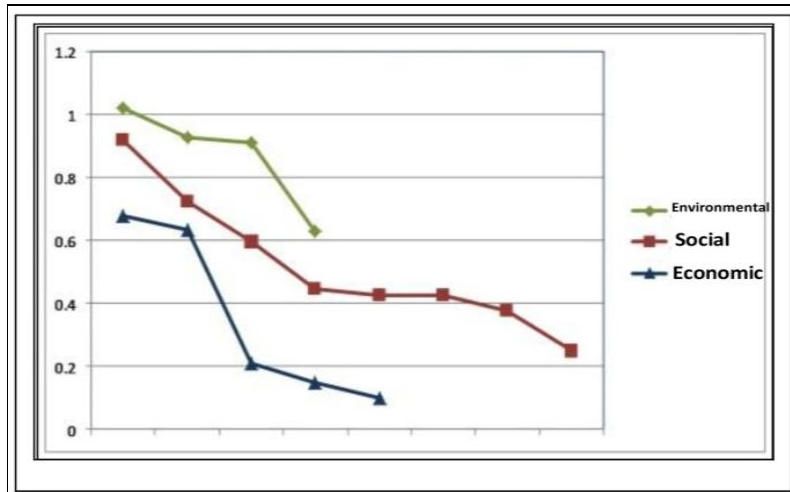


Fig. 5. The effects of the three indicators on sustainable regeneration of urban green infrastructure

Regarding the second hypothesis of the research and the results of the analysis of the institutional relations of urban regeneration management, and given the fact that the head of the urban regeneration committee is the governor, and the secretary is the mayor, the two relevant institutions together with the cultural heritage department, which are directly related to sustainable urban regeneration projects, with thematic and local plans and a comprehensive plan of worn-out tissue in the set of urban plans, compared to other members of the committee, are a priority to carry out operational projects with higher and more effective preference. The important point is that the network analysis considers the cultural heritage department as having a moderate position in terms of the degree of influence on the executive decisions, and the first and second cases together with water, electricity, and gas departments have a stronger influential role on operational projects. This indicates the fact that the consciousness of the relevant administrative institutions about the process of sustainable regeneration, which was estimated low in the results of the interview, can be very efficient in its effectiveness. Because these institutions, despite low awareness and also medium priority from the point of view of the committee members, according to the interview, due to the close interactions they have with the municipal in all executive regeneration projects, formed the strongest executive role in the network analysis chart with the betweenness centrality, along with other municipal and governorate institutions, which means the more the level of their awareness is, the greater their impact will be.

The effective middle-class analysis introduced Cultural Heritage, Road and Urban Development, and Telecommunications Departments as having more internal administrative and formal relations with each other compared to other organizations, but the important point is that they are farther away from the other classes in the network analysis circle. This indicates that they do not have much contact with other institutions being the members of the Urban Regeneration Committees. Since the Cultural heritage department has a significant role to play in urban regeneration projects, it has to undertake

more policy-making, management, and supervision tasks in urban regeneration activities, participate more in regeneration programs, and replace their organizational interests with interactions based on mutual interactions and common goals.

The important point about the third class, which includes more organizations with less intra-interaction, is the presence of the most scientific group among the members of the five regeneration committees, i.e. the faculty members in this class, which can play the most important role of intellectual leadership in this process. In other words, in the current situation where the lack of information and scientific awareness about urban regeneration is significant in responses of the interviewees, a more prominent and fundamental role should be given to them due to the availability of sufficient scientific tools by them to make proper use of its scientific capacity. Another important issue in this class is the presence of the Department of Natural Resources and Environment, which shows the abandonment and absence of this organization in management and executive issues, while the decisions made by it are among the basic decisions of land use planning. Considering that the research subject is the use of the capacity of urban green infrastructure, it should be noted that if the current situation continues, the destruction of other urban green infrastructure is expected. In fact, in the centralized management system of state institutions involved in urban regeneration in Iran, the state remains the dominant player in the regeneration of worn-out and historical tissues. This issue is completely different from the results of European samples where the involvement of state institutions in the regeneration of areas with urban green infrastructure is a distinctive feature compared to Iran. This issue needs a more objective evaluation and revision of the processes in Iran. On the positive side, state institutions can achieve balanced development through careful and systematic planning in sustainable urban regeneration programs and switch their sole focus from reviving worn-out and historic tissues to the maintenance of urban green infrastructure. On the other hand, this should take place

with caution because state and management institutions related to urban regeneration in Lahijan lack the international experience and scientific and executive capacities required for green infrastructure regeneration projects. The private sector so far has had short-term, profit-driven, and intermittent participation in increasing the involvement in the development and rehabilitation of infrastructure in the area, and its role remains insignificant.

## **6. Suggestions**

The results of the statistical and thematic analysis showed that the development of green infrastructure had profound effects on the local community. According to the results of the research, and given the development and construction of the city toward natural land resources, wetlands, tea foothills, and, in general, the green infrastructure of Lahijan, it is suggested that, regarding the components of environmental indicator, serious laws in the urban regeneration orders are enforced by all member institutions especially those that are directly related to the natural environment of the city, such as the Department of Natural Resources and Agriculture Jihad, to preserve these lands and prevent the destruction of them. Regarding the components of social indicator, it is suggested that, in urban development planning, management organizations as public institutions including municipalities and city councils, that are directly related to people, pay more attention to human resource management and utilization of cultural potentials and promotion of qualitative initiatives considering green infrastructure through the development of citizenship culture with public education and informative programs, that leads to the development of social activities in the city of Lahijan and strengthening of the social component of sustainable regeneration. In terms of the components of an economic indicator, it is also suggested that integrated planning and presentation of investment atlas in the green infrastructure areas of Lahijan concerning sustainable regeneration programs and the obligation of state agencies for a legal mechanism for this atlas to promote the economic improvement of the city through national guidelines for regeneration is on the agenda and the relationships between urban management and people and their participation in regeneration process change from a speculative and economic perspective to a broader and more inclusive approach to revitalizing green infrastructure. The need to preserve green infrastructure of cities to achieve sustainable regeneration and attention to the important role of economic, social, and environmental factors of urban green infrastructure in the sustainability of urban regeneration projects due to the sustainability of the projects should be considered, and strengthening and maintaining the urban green infrastructure to facilitate citizen participation and social interaction in sustainable regeneration process to allocate green infrastructure to uses that guarantee social interaction and increase the productivity resulted from investment on the uses should be prioritized in regeneration programs. Since the only organization in charge of Lahijan Regeneration

Management is the municipality, it is necessary to carry out policy-making and executive and strategic management tasks based on the participation of all institutions.

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