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Ecological Survey of Urban Plaza to Maintain and Improve Energy Consumption Management in Architecture

Mehdi Ramezani[a], Abazar Mehrali[b]*

[a]*Master's Student, Department of Architecture, Faculty of Art and Architecture, Yazd Branch, Islamic Azad University, Yazd, Iran*
[b]*Assistant Professor, Department of Architecture, Faculty of Art and Architecture, Yazd Branch, Islamic Azad University, Yazd, Iran*

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Research Article

Abstract

The purpose of this research is to investigate the ecological aspects of urban plazas in order to improve energy management and preserve it in architecture. The research method in this study is descriptive-analytical. In the descriptive part of the research, the subject literature related to the urban plaza and the ecological approach has been discussed. In the analytical part, first, 47 ecological criteria effective in promoting energy management in the urban plaza have been identified and then sent to experts and analyzed through the Delphi method. In the third stage, according to the results of the Delphi method, using the structural analysis method and Mic Mac software, 21 influential factors were identified and then the driving forces were extracted. The results include 5 decisive and influential driving forces including: symmetry and closeness of nature with human habitat with a weight of 653, use of renewable energy with a weight of 588, protection of landscapes with a weight of 588, integration of architecture and green space with a weight of 571 and the use of ecological materials with a weight of 555 are directly effective on improving energy management using ecological criteria. Also, 6 risk driving forces include: energy management with a weight of 641, thermal insulation with a weight of 581, use of smart systems with a weight of 577, use of solar energy with a weight of 556 and efficiency in the use of clean energy with a weight of 550 They are indirectly effective on the conditions of the plaza to improve energy management through ecological criteria. In fact, for energy management in urban plazas with an ecological approach, 5 main driving forces should be considered in locating and designing

* Corresponding author. Tel: +98-9131514382.
E-mail address: mehrali_abazar@yahoo.com

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the plaza, and 6 risk driving forces should be considered as secondary factors. According to the results of the system analysis, it can be said that the way the variables are distributed in the scatter plane indicates the instability of the system.
Keywords: Plaza Architecture; Energy Management; Ecological Criteria

1. Introduction

As public and central spaces in cities, urban plazas play an important role in social life and urban activities. The ecological survey of the urban plaza in order to improve energy management and preserve the environment can lead to the improvement and optimization of these spaces. By designing and implementing urban plazas with a focus on ecological principles, it is possible to learn how to optimally use energy from natural sources such as sunlight and wind, reduce energy consumption for lighting, heating and cooling plaza spaces, use clean and renewable energy sources such as solar panels and Solar energy production systems, optimization of water use and proper waste management. Energy efficiency (EE) can potentially enhance socio-economic growth and promote sustainable development, which is a prerequisite for gaining competitive advantage in today's business environment (Caiado et al., 2017). This significant increase in demand for energy efficiency can be attributed to the rapid growth of the construction and ancillary services sector and the increased demand for suitable living conditions and new products (Zhang, Shen and Wu, 2011).

Sustainable management of natural resources and urban green spaces creates an important challenge with the continued expansion of cities. Urban green spaces, including parks, gardens, and trees, play a vital role in providing ecosystem services such as air purification, microclimate regulation, noise reduction, and opportunities for recreation and social interaction (Guo, Zeng, and Lee, 2023; Ban et al., 2023).

The ecological review of urban plazas includes the evaluation of the design of green spaces, the use of green construction materials and technologies, the provision of clean energy sources and energy management during the life of the plaza, the evaluation of the environmental and social effects of these spaces and their impact on the quality of life of citizens. By examining the ecology of urban plazas and providing suitable solutions, it is possible to try to perform more optimal energy management in these spaces and reduce the harmful effects on the environment. Also, creating ecological urban plazas can help improve the quality of life of citizens and create green and sustainable spaces in cities.

Based on this, the present study was formed with the aim of ecological survey of the urban plaza in order to improve energy management and preserve it in architecture, which can answer the following questions:

- What indicators are effective in the ecological review and promotion of energy management of the urban plaza?
- How to improve the energy management of the urban plaza through ecological indicators?

2. Theoretical Foundations

2.1. Ecological Design

As one of the branches of ecological design, ecological architecture focuses on environmental effects and sustainable development. The main approach of ecological architecture is to simultaneously identify the organism and the environment while examining the relationships between the two; Because the environment itself has standards that disrupting its balance minimizes

the chance of survival of various animal and plant species. Therefore, ecological architecture, which today is generally under the title of sustainable architecture, can significantly reduce the destruction of the environment (Asghari, 2010).

Ecology is the study of the distribution of microorganisms or a group of organisms in an environment and is usually mistakenly used synonymously with natural environment or environmentalism; But in practice and in the field of design, ecological design means the integration of artificial biological systems with natural and human systems. In other words, ecological design is the use of ecological design principles and strategies for designing the artificial environment and lifestyle so that they are integrated, harmless and compatible with nature, which includes the biosphere (Mahdian, Abroosh, and Heydari, 2022). In fact, ecological design is peaceful design with nature. The goal of ecological design is to design to integrate the environment without harming it. Some designers equate green design with ecological design. The design that has the least impact on the environment. In ecological design, design processes can be compared based on the structure of a tree that produces oxygen, uses solar energy, and purifies water. With all these results, these designs have problems in integrating with the natural environment. One of the solutions to consider design is the shaping of matter and energy and the process of achieving needs with specific demands. It is a detailed design that connects culture and nature through the exchange of matter, energy flow, and the choice of land use. The relationship between ecology and design is a very close relationship and has a series of unpredictable complications. Ecology explains how the natural world is global and how it behaves, and design is a key intervention point for sustainability in ecology. Ecological thinking about design is a way to strengthen the connection between nature and culture. Ecological design is any form of architecture that minimizes harmful environmental effects through integration with living processes. This integration means that the design respects species diversity, minimizes resource depletion, maintains nutrient and water cycles, and protects habitat quality (Zohari, 2019).

Ecological design is a framework for unifying traditional views on design and management with environmental views, taking into account ecological considerations in spatial and temporal scales. In fact, ecological design is a comprehensive and ecologically responsive design. Ecological design as a means of modeling the processes and functions of creating and designing an urban plaza based on the ecological approach in the field of energy utilization and optimization has many benefits, which are stated in the following Table 1.

Table 1 Design methods based on the ecological approach and its benefits in energy management

Method Hi Designingo nbasis Ecological approach	**From through**	**Benefits Designing On Basis Approach ecological**
synchronized to be w ith n ature and Climate	Ventilation normal, direction get suitable for openings, lighting Appropriate, Form environmental	cooling And Heating without interest get From System Hi mechanical
Application References Blue	Total Bring Water Rain And Recycle Sewage water	fixed Become a part From Need Water consumption At Building To wATERING systems And Wash
Use From Ecological materials	Materials canvas brought able Recycle and smart	Increase Interest Veri From Energy Hi clean and Absence Contamination Environment
merge architecture And space Green	Creation roof Green, view Green And Increase space Green On Roy the earth	Shadow launch, keep Building From Sun radiation, Decrease And adjustment temperature And humidity
- Interest get From	change angles Shadow Ban I see,	the maximum Y maintenance Energy

System Hi smart	Network high air And Control Lighting With Changes outside environment	And The lowest amount Waste to go it
Use From Energy Hi Reproducible	System Hi Interest get From Energy clean Najir cell solar And Turbine the wind	fixed Become a part From Need Building energy

2.2. Features of Urban Plaza

The history of the construction of open spaces in the world dates back to more than a century ago, and today there is a building called a plaza in most of the world's cities. In ancient Iran, the important urban squares in the fabric, as vast open spaces that had a more or less defined area, included communication, social, commercial, sports, military or a combination of two or more mentioned functions. And in general, they created a space for the general gathering of citizens, or in other words, a "plaza", such as Naqsh Jahan Square in Isfahan, Imam (Topkhana) Square in Tehran, Amir Chakhmaq Square in Yazd, each of which is located in a prominent and busy urban location. have been placed so that the public has easy access to it. On the other hand, in some cities such as: Old Tehran, Nain, Kashan and Yazd, local squares and takiyehs and hosseiniyehs have functioned similar to urban plazas, which function as small communication squares in residential neighborhoods. They did that in a place that was defined as a landmark and the center of the neighborhood to be used by all the residents (Soltanzadeh, 2019).

In contemporary cities, a plaza is defined as a square formed next to a thoroughfare, which is often in the form of a U-shaped spatial opening, and commercial, administrative, or cultural buildings are placed around it, generally attracts the public. Because the main function of a plaza, in addition to the same function as its neighboring uses, is defined as a social open space so that it can be used as a place for cultural events, such as various celebrations and public ceremonies, and on the other hand Due to its flexible use as an active urban space, it can accept other uses in accordance with the way citizens function in this place, and in other words, it can be transformed into a public space as a collective hangout. Certainly, the implementation of some cultural programs will be effective in increasing the city's dynamism.

2.3. Criteria for Locating and Designing the Urban Plaza

Locating and designing urban plazas play an important role in creating attractive and dynamic public spaces in cities. Below are some basic criteria for locating and designing urban plazas:

Central location: Plazas should be located in places that are known as attractive and highly used centers in the city. The central location of the Plaza means that it is located in an area with many commercial, cultural and social activities.

Easy access: Plazas should be easily accessible. They should be located near public transport stations and have good access to walking and cycling facilities. Also, they should be easily accessible from public roads and main streets of the city.

Appropriate area and dimensions: Plazas must have enough area to accommodate various activities. The dimensions of the plaza should be such that it facilitates pedestrian traffic and the use of public space.

Spatial diversity: Plazas should have spatial diversity in order to meet the different needs and interests of citizens. It includes green spaces, open spaces, covered spaces, rest areas, children's play areas and sports facilities.

Facilities and services: Plazas must provide the necessary facilities and services for citizens. This includes public tables and chairs, water fountains, sanitary facilities, sports facilities, service stations, restaurants and spaces for cultural events and activities.

Attractive design: Plazas should attract citizens with an attractive and beautiful design. Appropriate design of green spaces, use of beautiful architectural elements, appropriate lighting, and use of sound effects and mobility experiences in the design of plazas can increase their attractiveness.

Security: It is very important to create a sense of security in the plazas. Necessary measures should be taken to increase security, such as installing CCTV cameras, proper lighting at night, proper design with an approach to responding to crimes, and creating sustainable movement and activity in the plaza.

Environmental sustainability: The design of plazas should pay attention to environmental sustainability. The use of less consumption of water resources, renewable energy, containment and recycling of pollutants and the use of recyclable materials in structures and equipment can help the sustainability of plazas.

Public participation: In the design of plazas, the participation of citizens and local stakeholders is very valuable. Appropriate opportunities should be provided for people's participation in the process of designing and making decisions regarding the needs and decoration of plazas.

In Table 2, the design elements in locating the urban plaza along with its conditions are presented:

Table 2 Design recommendations for a successful urban plaza

Design elements	Explanation	
Location	The location of a plaza in a city block can also affect the type of space. The location at the corner of two intersecting streets, which are almost at the same arterial level, allows the plaza to be an active place for meetings, a space for passing and watching passers-by.	
Size and size	Kevin Lynch commented that the 12-meter dimensions seem meaningful in terms of scale. These dimensions up to 25 meters are still a desirable human scale, and most of the old enclosed fields did not exceed 140 meters in their smallest dimension (Lynch, 2019).	
Visual complexity and diversity	The plazas that received a high score from the citizens have positive points such as: shape, color and texture, various landscape elements, trees, bushes, fountains and statues, various .artificial products, articulation of the space, corners, angles and secluded and cozy places.	
Applications and activities	**Passers-by pause**	It is most used in wider plazas and in those that help shorten the path. Plazas that do not basically act as a passage, make the audience stay in them longer (Pushkarev and Zupan, 2018).
	Male and female contacts	Often, men are more inclined to use urban open spaces, especially downtown plazas, and the number of women who use the plazas in groups or in pairs is more than men.
	Homeless and awkward people	Investors agree that plazas are organized and planned to meet the needs of users, customers, and retailers, and if they can attract certain segments of the population, while excluding other groups such as: the homeless, the poor, noisy children, street vagrants, etc. away, they will succeed (Loukaitou and Banerjee, 2013).
Service area	When designing a new urban plaza, its general use should be considered first, and then who are its real audiences. This point includes considering where these contacts will come from and what route they will take to use the plaza.	
Climate	**Sun radiation**	The plaza should be located in a place that has maximum sunlight in summer and winter. In the parts of the country that have very hot summers, the shade in the summer is desirable at least in a part of the plaza, and this shade can be provided by nearby flowers and plants.
	temperature	When the air temperature is above 14 degrees Celsius, the amount of recreation such as: walking, standing, sitting in urban plazas increases significantly. Therefore, when locating seating areas, optimal sunny environments in the evening hours and "sun-shade" patterns should be

		considered for months when the average evening temperature is 14 degrees or more.
	Reflection of the sun is disgusting	Because the surface of the plazas is covered with polished materials and also surrounded by the reflective surfaces of the surrounding buildings. In areas where most days are rainy and cloudy, dark surfaces also cause the space to be dark and depressing.
	Wind	The negative effect of wind will be significant when the air temperature is not enough to sit outdoors or when most outdoor spaces do not have direct sunlight. For the audience, being exposed to strong wind (when the condition of clothes or hair is messed up) is an undesirable thing, even though this wind does not cause the air to get cold.
Borders and crossings	A plaza should be visible and functionally accessible to passers-by, and at the same time be understood as a separate place.	
Circulation and movement	Plazas should be able to organize three categories of "movement patterns": a) passing through it; People use public plazas as shortcuts or pleasant walking paths. b) Access to restaurants, banks or other shops around the plaza. c) access to sitting platforms or viewing spaces; People enter the plaza to sit in the sun, eat lunch, see a show or listen to a concert.	
Planting plants	The variety and quality of texture, color, material, volume, ambient sound and the effects of the sense of smell created by a detailed plant planting plan can greatly increase the use of the plaza. The smaller the plaza, the more semi-dense trees in terms of branches and leaves or needle leaves.	
Level difference	The level difference can have important visual, functional and psychological consequences. For most visitors, plazas with significant level differences are more attractive than completely flat plazas without level differences. These types of plazas also have functional advantages.	
Fountain	The sound of falling water reduces stress. In a dense urban structure, a fountain should be designed in such a way that it creates the sound of falling water as much as possible and places are provided so that those who wish can sit and make the most of the sound of water.	
Flooring	People look for a direct and shorter route in their relocations, this principle should be observed in all main traffic routes; Otherwise, people take a shortcut on grass or plants to reach their destination as soon as possible.	

Source: Marcus and Francis, 2014

3. Research Method

This research has an applied nature and the descriptive and analytical method, the analysis method and logical reasoning, which is based on the structural analysis method, has been used. Mic Mac software was used to analyze the data. The interaction analysis method or the cross-over effect analysis method is an efficient and useful approach. Interaction analysis is a method for identifying mutual relationships. So that the influence of each trend on other trends is graded. In other words, CIA is a semi-quantitative method in which, instead of simple cause-effect relationships, interrelationships between different subsystems are analyzed in a matrix. In order to identify the indicators and evaluate them, the Delphi method and interviews were used to obtain the opinions of decision makers and experts. The statistical population for carrying out the Delphi model was selected through purposive sampling, which includes 15 experts: PhD in architecture (Mohammed Ayeni), PhD in urban planning (Vahid Yusuf Vand), PhD in environment (Maryam Mohtsham), PhD in urban management (Taher Parizadi), Construction Technology Engineering (Mohdi Rahimi), Ph.D. in Civil Engineering (Sabir Ahmadi), Ph.D. He is an expert in the field of municipal urban planning (Zahra Drodian), a doctorate in tourism (Amanj Rasouli), a doctorate in sociology (Yasin Wahabi) and a doctorate in civil engineering (Syed Mehdi Mahmoudi). In the descriptive part of the research, the subject literature related to the urban plaza and the ecological approach has been discussed. In the analytical part, first, 47 ecological criteria effective in promoting energy management in the urban plaza have been identified and then sent to experts and analyzed through

the Delphi method. In the third stage, according to the results of the Delphi method, using the structural analysis method and Mic Mac software, 21 influential factors were identified and then the driving forces were extracted.

4. Research Findings

In order to evaluate the criteria and analyze the data, experts and specialists in the field of ecological architecture were identified through the Delphi method through targeted sampling and semi-structured interviews, and the sample size was determined through theoretical saturation. In order to achieve the goals, 15 interviews have been prepared and analyzed in MikMak software. Based on this, the following table presents the ecological criteria of the urban plaza in order to improve energy management and preserve it in architecture:

Table 3 Ecological criteria of urban plaza architecture

Row	Criterion	Row	Criterion	Row	Criterion
1	synchronized to be With Nature And Climate	17	scale human	32	Attention To Better Designing environmental
2	adjustment Water conditions And by air	18	Interest Veri in use of clean energy	33	Decrease Effect heating Environment
3	Responsibility adaptability ecological	19	Lush And life acceptable	34	supply the light Appropriate
4	Decrease Energy and material consumption	20	protection from the eye sizes	35	Use From Materials And Materials native
5	symmetry And Proximity Nature With habitat human	21	Creation Sights Economic Stable	36	Materials With level Degree runaway little
6	keep Corridors Green And Axes Green	21	keep Variety biological	37	Thermal insulation
7	Application References Blue	22	the balance And Performance	38	Level shading
8	Use From Energy solar	23	Program Hi Compatible With Environment life	39	Continuity Spatial
9	Use From Ecological materials	24	sustainability operational	40	comfort environmental
10	merge architecture And space Green	25	access And Permeable Y	41	comfort thermal
11	Interest get From System Smart ones	26	Organizing the waters Y Superficial And Water Rain and use e again From it	42	Energy Management
12	Use From Energy Hi Reproducible	27	Continuity Network ecological	43	line the sky
13	keep Energy And References normal	28	current weather clear	44	sex and the color of the materials
14	Health References Blue	29	Reduction of islands thermal	45	Proportions And Discipline
15	Control types of pollution	30	Corridors current Water And current Air	46	Variety physical
16	orientation	31	Attention To Posh herbal		

In the first stage, a number of 47 criteria were sent to the experts and specialists, and after receiving the answers, the following 21 criteria were identified as the main factors affecting the promotion of energy management in the urban plaza based on the ecological approach:

Table 4 Main factors affecting the promotion of energy management in the urban plaza based on the ecological approach from the experts' point of view

Row	Criterion	Row	Criterion	Row	Criterion
1	synchronized to be With Nature And Climate	8	symmetry And Proximity Nature With habitat human	15	Use From Ecological materials
2	Interest Veri in use of clean energy	9	Materials With level Degree runaway little	16	comfort environmental
3	Decrease Effect heating Environment	10	keep Corridors Green And Axes Green	17	merge architecture And space Green
4	supply the light Appropriate	11	Thermal insulation	18	comfort thermal
5	protection from the eye sizes	12	Use From Energy solar	19	Interest get From System Smart ones
6	Use From Materials And Materials native	13	Program Hi Compatible With Environment life	20	Energy Management
7	keep Energy And References normal	14	Reduction of islands thermal	21	Use From Energy Hi Reproducible

4.1. Evaluating the Effectiveness and Impact of the Variables

In order to evaluate the influence of variables and their influence on each other, the cross-matrix method was used. In the cross matrix, the sum of the row numbers of each variable is the degree of influence and the sum of the columns of each variable also shows the degree of influence of that variable from other variables. Based on the analytical results of this matrix, indicators of being in sync with nature and climate, thermal insulation, energy management, use of solar energy, use of smart systems are among the indicators whose degree of influence is much higher than their degree of influence and most indicators of the aforementioned groups alone also have a high degree of influence in the system.

In contrast to the indicators of conservation of energy and natural resources, reduction of heat islands, environmental comfort and protection of landscapes can be considered as influential groups, although the dispersion of influence - influence within each group is accompanied by fluctuation, but in total they can be Dependent variables are known as influential.

4.2. System Environment Analysis

The distribution of the variables in the dispersion plane indicates the level of stability or instability of the system. In the methodology and analysis section of MikMak, two types of distribution are defined, which are known as stable systems and unstable systems. In stable systems, the distribution of variables is in the form of English L, which means that some variables have high influence and some have high influence. In stable systems, the sum of three categories of variables can be seen:

A: Variables highly influencing the system (key factors)

B: independent variables

C: system output variables (result variables).

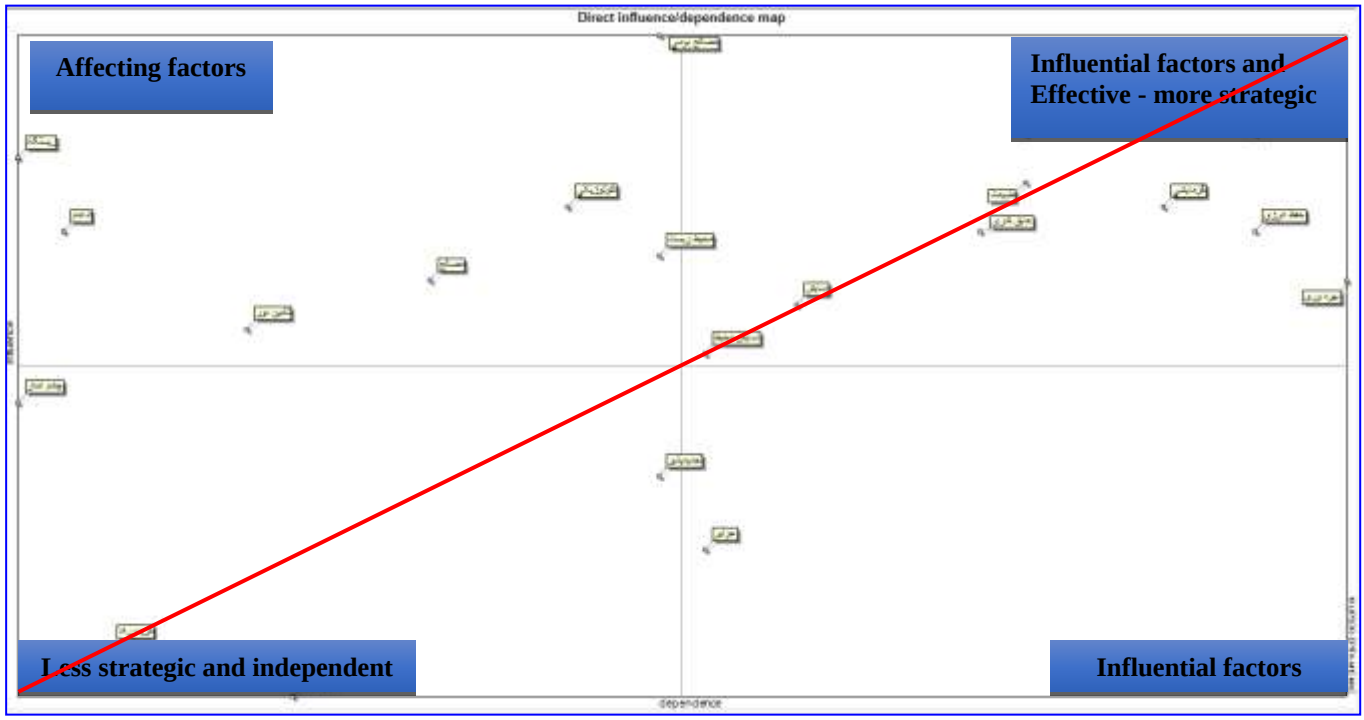

Fig 1 Map of the distribution of forces and their position in the axis of influence - influenceability

In this system, the position of each factor is clearly defined and its role can be presented clearly. On the other hand, in unstable systems, the situation is more complicated than in stable systems. In this system, the variables are scattered around the diagonal axis of the screen, and the variables often show an intermediate state of influence and effectiveness, which makes it very difficult to evaluate and identify key factors. However, in this system, ways have been drawn that can be a guide for selecting and identifying key factors (Godet, 2003). What can be understood from the state of the scatter plot of the influencing variables on the improvement of energy management in the urban plaza based on the ecological approach is the very severe instability of the system. Most of the variables are scattered around the diagonal axis of the plane, except for a few limited factors that show that they have a high influence on the system, the rest of the variables have almost the same situation with each other, only their intensity and weakness are different. In the scatterplot analysis of the variables of improving energy management in the urban plaza based on the ecological approach, the following variables can be identified in the system:

Determining or influencing driving forces: Considering the identification of the system as an unstable system, the presence of high-level influencing factors at the far end of the diagram in the northwest side seems unlikely because this place has more variables in stable systems with However, several factors are shown near this area, which indicates their ability to have a large impact on the entire system:

Table 5 Determining or influencing driving forces

Row	Factor
1	symmetry And Proximity Nature With habitat human

2	Use From Energy Hi Reproducible
3	protection from the eye sizes
4	merge architecture And space Green
5	Use From Ecological materials

Bidirectional driving forces: these variables have two common characteristics of high influence and high influence, and any action on these variables will cause a reaction and change on other variables. These variables can be divided into two groups: risk variables and target variables. Out of the total of 21 variables, 6 variables are in this group. Two-dimensional variables are divided into two categories: risk variables and target variables:

Table 6 Risk driving forces

Row	Factor	Row	Factor
1	synchronized to be With Nature And Climate	4	Energy Management
2	Thermal insulation	5	Using smart systems
3	Use From Energy solar	6	Interest Veri in use of clean energy

According to the results of the Delphi model and the structural analysis presented in the table below, 5 decisive and influential driving forces include: symmetry and closeness of nature with human habitat with a weight of 653, use of renewable energy with a weight of 588, eye protection Dimensions with a weight of 588, integration of architecture and green space with a weight of 571, and the use of ecological materials with a weight of 555 are directly effective on the promotion of energy management using ecological criteria.

Also, 6 risk driving forces include: energy management with a weight of 641, thermal insulation with a weight of 581, use of smart systems with a weight of 577, use of solar energy with a weight of 556 and efficiency in the use of clean energy with a weight of 550 They are indirectly effective on the conditions of the plaza to improve energy management through ecological criteria. In fact, for energy management in urban plazas with an ecological approach, 5 main driving forces should be considered in locating and designing the plaza, and 6 risk driving forces should be considered as secondary factors.

Table 7 Rank and weight of direct and indirect effects of forces

rank	Variable	direct effect	Variable	Direct dependency	Variable	Indirect impact	Variable	Indirect dependency
1	Symmetry and closeness of nature with human life	653	Interest Very in use of clean energy	718	Energy Management	641	protection from the eye sizes	706
2	Use of renewable energies	588	keep Energy And References normal	686	Thermal insulation	581	merge architecture And space Green	704
3	Protection of visions	588	Energy Management	686	Use From Energy solar	577	Materials With level Degree runaway little	696
4	Integration of architecture and	571	Decrease Effect	653	Interest get From System	556	Program Hi	658

rank	Variable	direct effect	Variable	Direct dependency	Variable	Indirect impact	Variable	Indirect dependency
	green space		heating Environment		Smart ones		Compatible With Environment life	
5	Use of ecological materials	555	synchronized to be With Nature And Climate	604	Interest Veri in use of clean energy	550	Use From Energy Hi Reproducible	617

The diagram below shows the relationships between the driving forces effective in promoting energy management using ecological criteria. The red lines indicate the strong influence and the blue lines are the moderating forces.

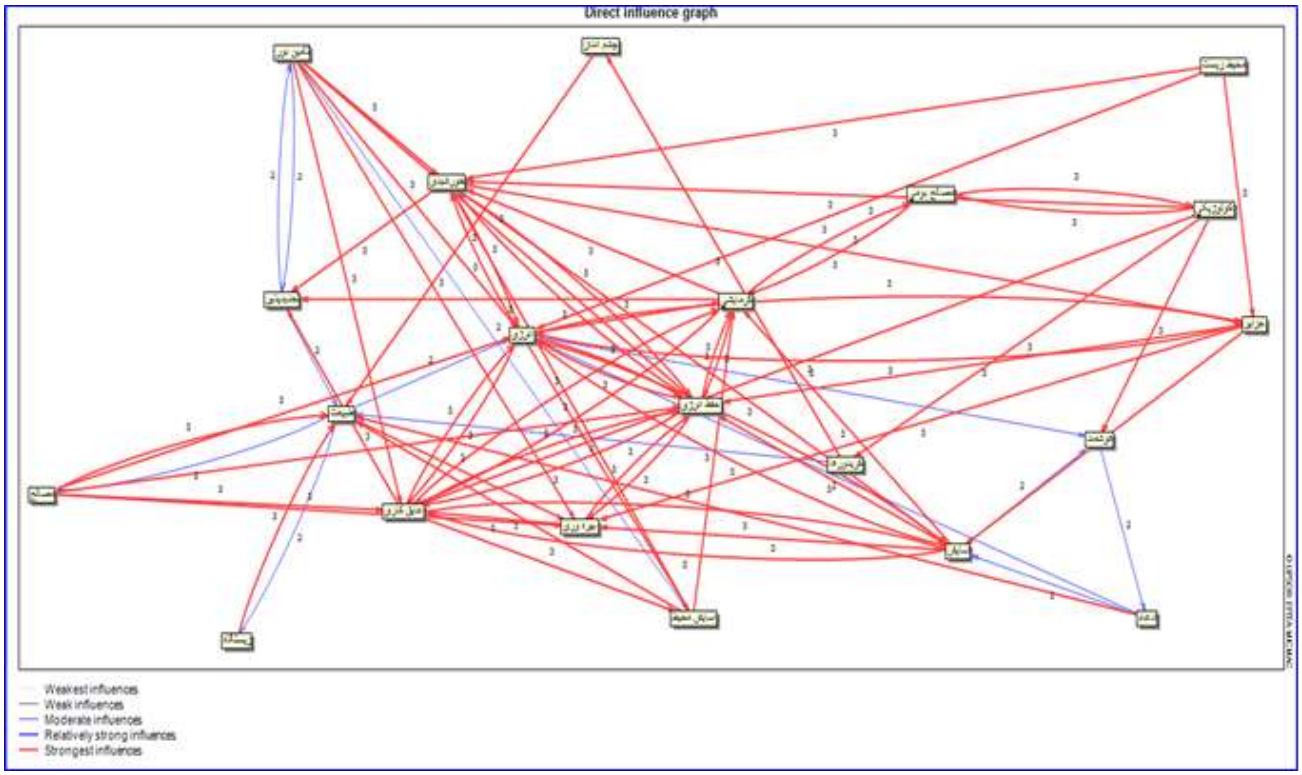

Fig 2 Rank and weight of direct and indirect effects of forces

5. Discussion and Conclusion

Ecological architecture is a method of design that places human-made structures in a healthy relationship with the natural environment and atmosphere, in a way that causes the least harm and danger to the ecosystem. The basis and centrality is also based on local and environmental characteristics. Architectural design according to ecological concepts is comprehensive and inclusive and defines the principles in ecological architecture. Solutions arise from the place itself. Ecological audit and information that reflects ecological benefits and losses are important for making design decisions. Also, natural forms and processes should be allowed to guide the design and can interfere in the formation of values and goals and change the perspective and method in architectural design. The new approach to green architecture that focuses on building design for

optimal use of energy and the use of recycled materials in building construction, architecture based on the characteristics and patterns of the shape of the land and paying attention to the native aspects of each place is one of the main concepts of application. Ecology is in architectural design, which has been developed in the foundations of architecture in the last two decades. The purpose of this research is to investigate the ecological aspects of urban plazas in order to improve energy management and preserve it in architecture. According to the results of the Delphi method, using the structural analysis method and Mic Mac software, 21 influential factors were identified and then the driving forces were extracted. The results include 5 decisive and influential driving forces including: symmetry and closeness of nature with human habitat, use of renewable energy, protection of landscapes, integration of architecture and green space, use of ecological materials and being in sync with nature and climate. Was obtained. Also, 6 risk driving forces were identified including: energy management, thermal insulation, use of smart systems, use of solar energy and efficiency in using clean energy. In fact, for energy management in urban plazas with an ecological approach, 5 main driving forces should be considered in locating and designing the plaza, and 6 risk driving forces should be considered as secondary factors. According to the results of the system analysis, it can be said that the way the variables are distributed in the scatter plane indicates the instability of the system.

According to the results of the research, it can be said that the ecological review of urban plazas in order to improve energy management and preserve it in architecture, can have significant improvements in this field. In the following, the important factors in the ecological review of urban plazas in order to manage energy and preserve it in architecture are presented:

Conceptual design: At first, it is necessary to address the conceptual design of plazas according to the principles of ecological architecture. This includes understanding local needs and patterns, using local resources, integrating with the environment and green spaces, using environmentally friendly materials and renewable energies.

Utilization of solar energy: Using solar panels to generate energy in urban plazas can be a sustainable and renewable source. This energy can be used for lighting, heating and cooling systems, charging electronic devices and other energy needs.

Using smart systems: Installing smart systems to control the optimal use of energy in urban plazas can help energy management. These systems can include automatic lighting control, heating and cooling systems, lighting timing and other energy consuming equipment.

Green space: Creating green space and using plants in urban plazas, in addition to improving beauty and connection with nature, can play an important role in energy management. Plants cool the environment, produce shade, absorb polluted gases and increase air quality.

The use of ecological materials: the use of recycled and environmentally friendly materials in the structures of urban plazas can be related to the preservation of natural resources and the reduction of harmful effects. This includes the use of recycled materials such as recycled wood, recycled stone, recyclable metals and green materials such as recycled concrete and Portland cement.

Water consumption management: In the design of urban plazas, water consumption management should also be considered. Using rainwater collection and reuse systems, using smart irrigation systems and reducing water leakage in plaza structures can save water consumption.

Education and information: For optimal energy management in urban plazas, education and information to residents and users of plazas is of great importance. People's awareness of energy saving methods, optimal use of existing equipment and tools, and encouraging sustainable behaviors can help reduce energy consumption and maintain it.

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