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Evaluating the Quality of Revitalization of Lost Spaces with an Emphasis on Abandoned Factories (Case Study: Zanjan Match Factory)

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ABSTRACT: Identifying and reviving lost spaces to reduce them is one of the duties of contemporary architects and urban planners; in the meantime, paying attention to the quality of revitalization and users' and beneficiaries' satisfaction is an issue that determines the success rate of this critical issue. The aim of this study was twofold. First, it has assessed the quality of revitalization of lost spaces using the Analytic Hierarchy Process (AHP) method. Second, it has investigated Zanjan Match Factory's revitalization success rate, converted into a museum of industry and mining after renovation and reconstruction. The present article's conceptual model is based on the exploratory analytical research method based on Bradbent's theory and the introduction of his five principles as assessment parameters. Each component in the case study is considered, prioritized, and assessed by a survey of 15 participants in two groups of experts and users. Findings show that the criteria of human protection and economic productivity have a greater score in the proper revitalization of this heritage. In contrast, space proportions with a pattern of behavior have the lowest score (preferences). Furthermore, this space's revitalization shows revitalization's success is the proper coordination between revitalization experts and users of this space regarding fulfilling their desires and needs.

Keywords: *Regeneration, Industrial Heritage, Zanjan Match Factory, The Quality of Revitalization, Lost Spaces.*

INTRODUCTION

Today, one of the problems the city and its citizens face is abandoned and unused spaces in different urban areas and neighborhoods; they often have caused instability in environmental, social, and economic aspects and have faced urban areas with serious challenges (Kordestani, 2017). Examples of these abandoned spaces are industrial complexes, factories, and warehouses outside the city. However, now they are located within the city's boundaries with the development of the city. Therefore, they are close due to various problems such as traffic and air pollution.

Due to environmental pollution, industrial buildings and other structures' demolition cannot be justified in the current era. Thus, strategies to reclaim derelict industrial sites have been devised, focusing on the sustainability, quality, and multi-functionality of the space, focusing on historical, socioeconomic, and cultural aspects (Luis & Panagopoulos, 2007).

These buildings, which are often in a unique location in the heart of cities, are exceptionally compatible with various uses due to their large open spaces. When there are no alternatives to industrial operations, an adaptive reuse method is used, and this proposal should take precedence over demolition and reconstruction. Protecting these buildings and improving the quality of the surrounding sites is only possible by reusing industrial buildings due to their flexibility, compatibility, and multi-functionality, as well as their economic aspects; therefore, these complexes provide an excellent opportunity to establish the uses which the urban context needs and can be reused to create vibrant and dynamic urban spaces.

Reusing obsolete structures is not an emerging phenomenon. Its scientific and academic roots connected with contemporary mechanisms can be traced back to at least the 1970s (Lotfi & Sholeh, 2017). However, it can be stated that diversifying the functional area of the buildings and creatively adapting the buildings to the new designs has a much shorter history. From the reinforcement and addition of new arrays to historic buildings by Ludwig[1] (Giuliani et al., 2018), suggestions for the revitalization of old buildings by the injection of modern

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uses by Boito[2] (Tanguay, 2012) to the transformation of a large structure such as the London Power Plant into the modern Tate Gallery[3] (Dewdney et al., 2013, 79), the use of existing building reserves and obsolete buildings has been accelerating. In the middle of the nineteenth century, with revitalization to protect Boito buildings, the buildings' survival was guaranteed by accepting new functions. Initially, the purpose of giving new functions to these spaces was to restore these buildings so that they can receive attention and care (Falahat et al., 2017). Therefore, the changing use to protect the building and reclaim the culture with the development of architectural, historical, environmental, visual, and aesthetic features was at the forefront of revitalization solutions. The process can be considered as a link between historical assets and today's needs. This process requires attention to the biggest architectural concern that is the component of quality in space because the quality of the environment is part of the quality of life and includes all factors that are part of people's satisfaction, and ultimately indicates the success rate of the revitalization process.

Regarding the fact that the industrialization of life has necessitated the people of cities to spend their time in urban public spaces in order to reduce environmental stress, it is crucial to adapt and design these spaces. Besides, considering the historical values of the architectural and urban contexts both in cultural and industrial terms, these contexts are regarded as an invaluable heritage for future generations Considering the importance of the quality of restoration of lost spaces and their role in increasing the satisfaction of the residents of the surrounding area, the main motive of writing the present article is assessing the quality of revitalization of Zanjan Match Factory Revival, which is one of the lost spaces of this city. Regarding the fact that the industrialization of life has necessitated the people of cities to spend their time in urban public spaces to reduce environmental stress, it is crucial to adapt and design these spaces. Besides, considering the historical values of architectural and urban contexts both in cultural and industrial terms, these contexts are regarded as invaluable for future generations. Considering the importance of the quality of restoration of lost spaces and their role in increasing the residents' satisfaction, the main motive of writing the present article is Assessing the quality of revitalization of Zanjan Match Factory Revival is one of the lost spaces of this city.

Lost Spaces

Lost spaces are undesirable urban areas with no positive relationship with the surrounding environment and users in redesigning spaces. These spaces give many opportunities to designers in order to develop, create and discover many hidden urban sources in cities (Memarian & Niazkar, 2013). Based on the other definition, lost spaces are physical and social spaces that have not been managed well and properly and damaged that district from the residents' perspective. Lost spaces are spaces without clear definitions and boundaries, which have no relationship with urban elements. Lost space are also the abandoned waterfronts, train yards, vacated military sites, and industrial complexes that have moved out to the suburbs for easier access and perhaps lower taxes. They are the vacant blight –clearance sites- the remnant of the urban –renewal days- that is, for many reasons, never redeveloped. They are the residual areas between districts and composed commercial strips that emerge suddenly. Lost spaces are deteriorated parks and marginal public housing projects and have to be rebuilt because they do not serve their intended purpose (Sadeghi Moghadam et al., 2013).

Lost spaces are classified into two groups of "material (superficial)" and "semantic (conceptual)" in an overall classification:

Material Lost Spaces (Superficial), as Roger Trancik points out, this classification of spaces includes those kinds of spaces which occupy subjective spaces and are visible in three groups: A: Physical (low-quality building), a building which is available but is lost due to the lack of appropriate use. B: The fields with public possession and are the remaining urban land among low-quality buildings and fields and do not have determined boundaries. C: The fields, which lack appropriate use despite having public or private possession, determined boundaries and being capable of recognition.

Semantic Lost Spaces (Conceptual) Trancik also remarked that they are related to space's spatial characteristics. Although they are not evident and apparent, they exist uniquely in the unconscious mind of the human without any doubt and have a specific place in the collective memory of citizens, which itself consists of two classifications:-Forgotten values: Actually, they include characteristics, qualities, and important buildings which existed in the old city and no trace has been left from those evocative elements nowadays, and they changed into indicators for naming that places and there are a lot of these cases in cities. Hidden values: Trancik briefly mentioned this subject in human spaces that whenever physical qualities acted poorly or incompletely in response to human needs, space is considered a lost space (Trancik, 1986:13).

Analysis of Evaluation Tools

Today, with the intensification of development and renovation issues and the need for adaptive reuse of declining industrial buildings, the tendency to reclaim restoration projects is of great importance. Evaluating design quality in the early conceptual stages is a complicated process, but even more for the quality of restoring a building. If we succeed in determining the parameters of design products, we assess them. This is what we shall attempt to do in what follows.

Given the complexity of the issue and the multi-criteria nature of the assessment for the four design producers (employer, designer, user, and legislator), all quantitative and qualitative factors compatible with the material and spiritual needs of

users and the industrial heritage itself must be considered (Lawson, 2005,120). In this regard, Volker[4], while introducing the POE[5] (Post Occupancy Evaluation), believes that the spatial quality of architecture can be compared with the level of user satisfaction. If the idea of living space meets the audience's needs, a successful effect (a successful piece of work) has been produced (Volker, 2010). Emphasizing the POE method's strategic goal, he considers the improvement of this quality to be directly related to the aesthetics and quality of architectural construction, which provides principles in renovating dilapidated (declining) buildings in addition to providing a comprehensive design guide. However, this study aims to assess the quality of revitalization and renovation using comparison, Analytic Hierarchy Process (AHP). Based on these analyses, the principles and parameters that can be examined before reclaiming and renovating this heritage can be presented.

Literature Review

As mentioned in the previous sections, abandoned industrial factories are considered a part of lost spaces. Although these places, unlike other cultural heritages, suffer from environmental, economic, and other problems, and their survival is associated with many problems in industrial operation, preservation of their original and primary function, which are still a priority because these places reflect the demands and expectations of human beings from a place, e.g., Walter Gropius' Fagus shoe factory in Alfeld, Germany, which is still operating industrially, was inscribed on the World Heritage List in 2011 due to its rich industrial values and, most importantly, the preservation of its industrial function. The favorable physical condition and continuous function of this building have provided the necessary grounds for the emergence and selection of its values. In other words, the interaction of its three physical, functional, and semantic aspects has best displayed this work's cultural status.

In the background of the present research, it has been found that studies conducted on lost spaces as case studies often emphasized the investigation of a selected criterion in a specific context or neighborhood of cities, e.g., spaces under bridges. In the field of abandoned industrial factories, the approach selected by the researchers was adaptive land-use change or protection of historical-cultural values hidden in the building. So far, several books and articles have been presented on evaluating the quality of space revitalization, some of which are more closely related to the subject of the present study.

Even though attention has been paid to the qualitative aspects of spaces in scientific circles for several decades, most recent research experiences show little attention to this category and much attention to the body and performance in the relevant planning. Some researchers currently have focused on the quality of space, and the present research has attempted to use a summary of concepts and applications appropriate to the subject. For instance, Kiani and Amirinejad (2013), in their research on the Zandieh collection, evaluate the suitability of the old texture of Shiraz. The results of their studies show that the land use around the Zandieh complex is not suitable, and the main reason is the location of some incompatible uses within a few meters radius of the Zandieh complex. Using the GIS makes it possible to provide suitable conditions for analyzing the current status of the uses around the Zandieh complex.

In other research, Nili et al. (2017), with the hierarchical analysis method's help, have examined the necessary criteria to evaluate the quality of restoration of abandoned industrial heritage. The studied case is Tehran Linen Warehouse, which has been changed to a furniture exhibition after renovation and reconstruction. The conceptual model of this research is an analytical-exploratory research method. For this purpose, by indexing the five Bradbent principles' sub-criteria, each of the components is illustrated in the case study has been evaluated by surveys of experts and users. The evaluations show that the criteria of human protection and economic productivity have a higher score for proper restoration of this heritage. The fit of the space with the behavioral pattern is the least preferred.

Pahlavanzadeh et al. (2019), in their research, protect the Risbaf factory in Isfahan using a hierarchical planning model to determine the most appropriate uses for this work. Examining the five general criteria of this research shows that it is better than the current situation in the factory's priority situation. The cultural use with particular attention to industrial culture should be the criterion for protecting the Risbaf factory.

Due to the need to assess the quality of revitalization in the process of renovation and revitalization of spaces, the authors in the present study, while introducing an approach based on the Analytic Hierarchy Process (AHP), identified criteria and factors affecting the quality of the environment so that they could provide principles to improve the quality of revitalization of industrial heritage. In this regard, using Bradbent's theory, his pentagonal parameters are introduced as a measurement criterion. In what follows, the extent to which the users' satisfaction has been assessed on possessing space components with the change of use occurred in Zanjan Match Factory.

Given the need to study the revitalization quality in space revitalization and recreation, the authors in the present study introduced an approach based on the analytic hierarchy process (AHP). They identified criteria and factors affecting the environment's quality to finally present principles for constructing and revitalizing industrial heritage. This method based on the three principles of simplification, prioritization, and harmonization can be used to research land use determination. In the present study, considering the nature and new land-use of the sample, this method is used only to measure and evaluate the success of revitalizing the building under study. The difference between the present study and previous studies is in their different views toward the samples as lost urban spaces with historical-cultural values and their emphasis

on measuring the harmonization principle in the process of assessing their revitalization. Assessing means evaluating whether the revitalization process is good or bad, accepted or rejected. In this regard, using Bradbent's theory, his pentagonal parameters are introduced as the measurement criteria. To check the users' satisfaction with the land-use change in Zanjan Match Factory, the extent to which this space includes these components is evaluated.

Quality in Design and Revitalization

The term quality is used in various contexts related to product or process assessment. In recent decades, when the concept of quality has focused on the architecture literature and urban planning, good architecture and good space are measured by the concept of their desired quality. To study the quality and measurement of spaces, criteria and indexes have been proposed during the previous decades. The more favorable environments the cities can provide to encourage better social interactions for residents, the higher quality urbanization and mental health the cities have.

In the context of the present study, which assesses the revitalization process and renovation, Nelson[6], in his book "Managing Quality in Architecture," defines quality as fully meeting the essential needs and equating essential needs with rights, dignity, guidelines, and regulations. Therefore, he believes that quality assessment is possible only by meeting the essential needs (Nelson, 2006, 17). Therefore, beneficiaries can assess the implementation and rationality of the idea by evaluating these parameters. In line with the issues raised, the quality criterion is a crucial component that can be depicted in the Vitruvius[7] criteria. By modernizing the principles of Vitruvius in three principles of construction and quality, performance and effectiveness can be one of the proposed models (Harputlugil, 2014).

Meanwhile, the Bradbent's[8] model is another proposed model for architectural assessment (Nadimi, 2010). Bradbent introduces the five functions of space appropriateness to a pattern of behavior, human protection from adversity, cultural significance, economic productivity, and lack of inappropriate human effect on the environment as criteria for assessing the design process and at the same time reviving. Table 1 describes the factors influencing the production of good architecture from the architectural experts' perspectives. Accordingly, the relationship with texture, quality, meaning, form, quantity, and structure is one example and title that, if observed in the building's creation, according to experts, the architect shows

Table 1: A report of how 20th-century architects view and define Bradbent's indices (Source: Capon, 1999a, 102-158)

Researchers	Bradbent's Indexes				
	The space appropriateness to the pattern of behavior	Human protection from adversity	Cultural signification	Economic productivity	Lack of inappropriate human effect on the environment
Scott (1914)[9]	Comfort in space	Providing security	Cultural aesthetics	Suitable structure	Structure in harmony with the environment
Perret[10] (1923)	Traditional spatial look	Easy to use and readable	Beautiful form	Material and environmental materials	Environmental compatibility
Le Corbusier[11] (1923)	Meeting essential needs	Increasing social interaction	Community image harmony	Economic productivity	Structure
Gropius[12] (1924)	Performance in line with contemporary needs	Superior technology	Form Aesthetics	Technology	Form-fitting the background
Van der Rohe[13] (1938-1928)	Form consistent with performance	Increasing mental health	Identity and Culture	Native material	Technology along with lack of environmental takeover
Norberg-Schulz[14] (1963)	Form-fitting the meaning	Physical protection	Accountability for social and cultural identity	Performance consistent with the environment	Structure and building
Venturi[15] (1966)	Form Aesthetics	Proper planning	Cultural experience	Economic feasibility	Environmentally friendly technology
(**Jencks**[16] (1969	Responsive design	Performance and meeting needs	Homogeneous style and reading	Superior activity	Suitable physical properties

good work.

Bradbent's Evaluation Model

In measuring and assessing the design and its process, various methods and tools have been adopted, each of which is useful and efficient in its scope. In this study, the author conducts the method to assess the qualities assessed from layers measured and read by computers. Therefore, Bradbent's assessment method can be measured according to the architecture's quality aspects by stating the sub-parameters. Since assessing the quality of the design and revitalization is very complex, to deal with this problem, the criteria must be broken down into subsystems, so in this method, the criteria are provided to decision-makers as principles or parameters to make them explicit.

The present study analyzes and assesses the quality of renovating industrial heritage design, which is done in a modern interpretation of Bradbent's five aspects (indexes). In this proposed method, the sub-criteria of each of the five mentioned criteria are stated. The space appropriateness to a pattern of behavior and subsets of material and spiritual needs is introduced. Simultaneously, in human protection, factors such as security, comfort and perception, and the environment's feeling are essential. Objective and subjective significance is the elements of a reference to culture in Bradbent's principles. Also, economic productivity is aligned with the titles of investment and economic renovation. In the absence of human adverse effects on the environment, paying attention to the existing nature, reducing human harms in assessment and measurement is the criterion. Table 2 reviews Bradbent's indices regarding rehabilitation strategies for industrial heritage based on other researchers' viewpoints.

MATERIALS AND METHODS

Identifying and prioritizing the main criteria using the Analytic Hierarchy Process started the framework of the present research. To analyze the data obtained from the questionnaire, SPSS software based on the AHP method was used. Since the questionnaires' inconsistency rate was within the acceptable range (less than 0.1), the calculations' correctness was confirmed.

In this exploratory study, the workflow is summarized in three stages. In the first stage, the criteria for assessing the quality

Table 2: Reconsidering Bradbent's indices concerning sub-indices and presenting rehabilitation and presenting rehabilitation strategies for industrial heritage based on viewpoints of other researchers (Source: Nili et al., 2017)

Features of good architecture (Bradbent's)	Sub-characteristics with the ideal feature of heritage revitalization (the views of other researchers)	Proposed strategies and solutions in the body (To lay the groundwork for a responsive environment)
The space appropriateness to a pattern of behavior	Providing material and physical requirements and needs Encouraging public participation Creating vitality and happiness in the person Increasing mental health Improving users' connection with green space and nature	Creating shelter with proper urban access to it Spatial aspect with the feature of personal privacy Allocating collective space to provide social and physical dimension Strengthening neighborhood relations A design that fits the dimensions and height proportions Hierarchy aspect and arena from public to private
Human protection from adversity	Providing regional security Paying attention to the principle of the quality of building Providing thermal and moisture comfort Management of environmental perception (light and sound), observing the readability of the environment Eliminating annoying sounds and playing relaxing sounds	Creating a sense of security and belonging by observing the scale and proportions Balance and structural strength Rider and pedestrian's secure access Lack of volumetric density of the building in the yard Natural ventilation with proper openings Paying attention to lighting and optimal use of natural light
Cultural significance	(Objective significance (color, light, texture Preserving cultural and historical value Enhancing visual quality (Mental significance (Nostalgia Emphasis on history and national pride Development of tourism industry concerning preserving cultural value Improving social and cultural characteristicS	Using the same material in the revitalization process Preserving the appearance of the work Minimal intervention The minimal distinction between the old revived part and the new additional part Holding cultural activities Creating spaces for gatherings and group meetings Enjoying a sense of history and connection with the development of current technology in the facade of the building The possibility for displaying and selling handicrafts and promoting the local culture of the region

Continiue of Table 2: Reconsidering Bradbent's indices concerning sub-indices and presenting rehabilitation and presenting rehabilitation strategies for industrial heritage based on viewpoints of other researchers (Source: Nili et al., 2017)

Features of good architecture (Bradbent's)	Sub-characteristics with the ideal feature of heritage revitalization (the views of other researchers)	Proposed strategies and solutions in the body (To lay the groundwork for a responsive environment)
Economic productivity	Encouraging investment to revive Supporting the existing economic foundations New economic reconstruction related to the building Creating new economic incentives The prosperity of handicrafts, indigenous activities, and creating job opportunities	Improving local access and expanding business activities along with the accesses Relocating previous spaces and allocating a new function to attract the audience Optimal use of the ruined area of an industrial building Creating multipurpose uses Preserving and displaying equipment and tools of industrial activities in the reclaimed building Allocating more valuable and efficient functions to the previous building Organizing commercial units in the new building Assessing the needs of government institutions and guiding them for investment
Lack of inappropriate human effect on the environment	Paying attention to the existing nature and development of green areas on a local scale Elimination of environmental pollutants Waste management Reducing human harm to the environment Moderation in riding	Revitalization and restoration based on organic texture and previous performance Expanding green spaces and public open spaces Using common native materials Modern (mechanized) waste collection Creating footpaths and riding routes Immunity from a public transport network

of architecture are formulated along with their sub-criteria. It should be noted that the five criteria proposed by Bradbent are the main components of the method. Then, in the other step, as mentioned earlier, in the three-dimensional Analytic Hierarchy Process (AHP), the goal, criteria, and sub-components on the one hand, with effective generators in the renovation path which includes four indicators (employer, designer, user, and legislator) on the other hand are tested and measured.

The survey is conducted on 15 participants in two groups of decision-makers and users who have sufficient theoretical and empirical knowledge about Zanjan industrial heritage and Zanjan Match Factory. The design team (architects, civil engineers, mechanical and electrical installations) and managers (municipality, head of cultural heritage, and deputy

Table 3: Characteristics of the statistical community

Indicator	Sub- Indicator	Sub-generators
Decision Makers	**Designer**	Architect
		Civil Engineer
		Mechanical Engineer
		Electrical Engineer
	Legislator	Deputy of Cultural Heritage
		Municipality
		Deputy of Urban Reconstruction
Users	**Employer**	Zanjan Chamber of Commerce, Industries, Mining, and Agriculture
		General Directorate of Cultural Heritage, Handicrafts and Tourism
		Deputy of Municipal Cultural Affairs Department
	User	Management
		Staff
		Visitor
		Workers

of regeneration) who are in the position of legislators and users selected by the snowball method from the audience and working staff constitute the statistical population of this study. Table 3 shows the characteristics of the statistical population.

Case Study

The 80-year-old match factory located in the north of Zanjan is an example of abandoned spaces. This building, which belongs to the first Pahlavi era, was built as the first industrial unit in Zanjan after establishing the power plant a few years before World War II and Mahmoud Shalchi's authority Zanjan (Davoodi & Ghaemi, 2015).

The passage of time and the city's development - led to the establishment of the building in the central part of the city and the development of industry - reduced the need for such factories; the building lost its industrial use and became an abandoned space due to its intrinsic values. Meanwhile, this building's ownership was why no action was taken to restore this building until 2002. The municipality gradually destroyed the factory walls, and part of the factory's open space joined the adjacent park. In 2002, with this building's registration as one of Iran's national monuments, restorers' (builders) and experts' attention in industrial heritage protection was turned to this building. Finally, after several studies and adapting the proposed use to the building and the existing conditions around it in 2011, the chamber of commerce, under the supervision of the general secretary of cultural heritage, handicrafts, and tourism of Zanjan Province, repaired and renovated this factory with a new renovation as the Museum of Industry and Mining.

Enjoying the public reputation due to the existing old devices and its unique brick chimney, registering this factory in the list of national monuments, and analyzing and examining its revitalization in specialized newspapers and magazines caused it to be standard selected as a case study (a study cohort). The revitalization process began with the renovation and reconstruction of old components and building materials. Its beautiful entrance was rebuilt after partial demolition, preserving its traditional feature. The new additions are harmonious and compatible with the old structure, and the building retains its industrial character with a high roof and spaces with a brick wall. Figure 1 shows the location of this building in the city of Zanjan.

RESULT AND DISCUSSION

In this study, by examining the audience's priorities and the respondents, the extent to which the case study possesses each of the components of good architecture in Bradbent's perspective is evaluated. Table 4 and figure 2 show the scores of each producer in the analysis of Bradbent's criteria.

According to Table 4, on average, among design producers, legislators have made human protection and security a priority in overseeing the recreation of industrial heritage. Employers consider allocating appropriate performance to improve proper economic productivity as the most crucial reason for reclaiming and renovating the building. In contrast, as the audience and users of the building, users prioritize historical and cultural records. In this regard, the significant results obtained from each of the criteria are expressed as the main parameters, and the preferences related to each of the sub-criteria can be summarized as follows:

Space appropriateness and a pattern of behavior:

Architects prioritize observing access hierarchy and privacy in the reclaimed building, while users prefer accessibility. Legislators prefer appropriate access, proportions, and creation

Fig. 1: Location of match factory (Source: Google map)

Table 4. Contribution of Bradbent's criteria following responses from generators researchers

Design producers	The appropriateness of space to a pattern of behavior	Human protection from adversity	Cultural significance	Economic productivity	Lack of inappropriate human effect on the environment
Designer	0.15	0.25	0.15	0.25	0.20
Employer	0.10	0.30	0.14	0.34	0.12
Legislator	0.14	0.24	0.24	0.18	0.20
User	0.18	0.33	0.20	0.14	0.15

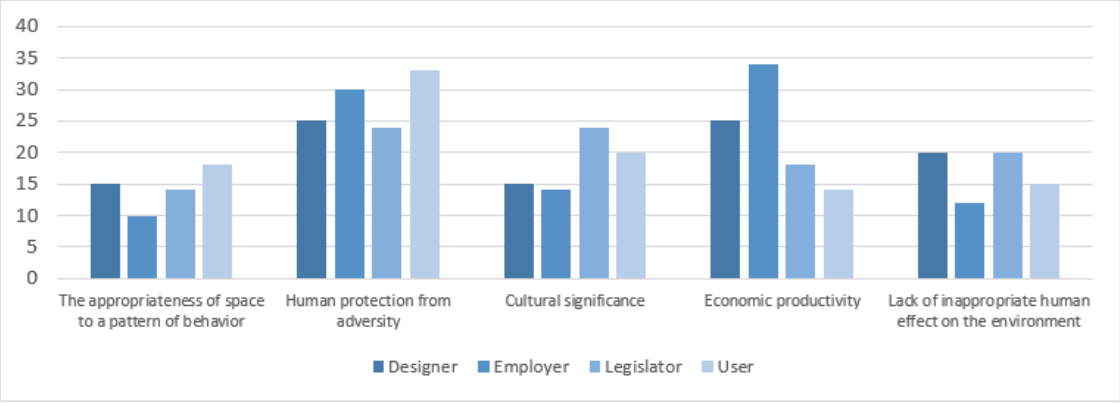

Fig. 2: Comparing scores of Bradbent's sub-criteria

of interactive and collective space. Table 5.

Human Protection from Adversity

Most participants' average expectations and preferences are related to thermal and moisture comfort and the structures' balance and strength. Fixation and belonging to a place are the essential elements for architectural engineers due to the establishment of proportions. Table 6.

Cultural Significance

Allocating a particular space for holding gatherings and interactions is one of the architect's priorities to improve the harmony of the design with the component of cultural and social context, which can induce the harmony of the design with the context of existence. Minimal intervention, the use of similar materials, is a short phrase to specify the civil engineers and other installation engineers' areas of interest. Table 7.

Economic Productivity

By using scoring, it was found that employers, organizations, and governmental organizations disagreed with exhibitors and

Table 5: Contribution of sub-criteria of the suitability of space for the behavior pattern in preferences

First indices	Sub-indices	Designer	Employer	Legislator	User
The appropriateness of space to a pattern of behavior	Creating shelter with proper urban access to it	0.16	0.27	0.20	0.28
	personal privacy	0.13	0.05	0.12	0.13
	collective space	0.15	0.19	0.17	0.15
	Strengthening neighborhood relations	0.12	0.17	0.14	0.10
	Dimensional and height proportions	0.25	0.22	0.18	0.16
	Arena from public to private	0.19	0.10	0.19	0.18

Table 6: Contribution of sub-criteria of human protection against adversities in preferences

The third indices	Sub-indices	Designer	Employer	Legislator	User
Cultural significance	Using the same material	0.15	0.14	0.15	0.14
	Preserving the appearance of the work	0.15	0.13	0.13	0.13
	Minimal intervention	0.15	0.12	0.14	0.12
	Minimal distinction between old and new parts	0.16	0.13	0.15	0.13
	Holding cultural activities	0.10	0.12	0.08	0.09
	Creating spaces for gatherings and group meetings	0.11	0.12	0.10	0.14
	Combine history and technology	0.10	0.10	0.11	0.11
	The possibility for selling handicrafts	0.07	0.14	0.14	0.14

Table 7: Contribution of sub-criteria of cultural symbolic in preferences

Second indices	Sub-indices	Designer	Employer	Legislator	User
Human protection from adversity	Creating a sense of security and belonging	0.09	0.08	0.06	0.17
	Balance and structural strength	0.24	0.24	0.26	0.24
	Rider and pedestrian's secure access	0.18	0.24	0.15	0.25
	Lack of volumetric density of the building	0.10	0.08	0.19	0.09
	Natural ventilation with proper openings	0.19	0.19	0.18	0.13
	Paying attention to lighting and natural light	0.20	0.17	0.16	0.12

Table 8. Contribution of sub-criteria of economic performance in preferences

The fourth indices	Sub-indices	Designer	Employer	Legislator	User
Economic productivity	Improving local access	0.14	0.14	0.13	0.18
	Relocating previous spaces	0.11	0.12	0.12	0.11
	Optimal use of the ruined area	0.09	0.10	0.13	0.11
	Creating multipurpose uses	0.15	0.14	0.13	0.16
	Preserving and displaying equipment	0.08	0.08	0.09	0.12
	Allocating more useful functions	0.16	0.17	0.14	0.13
	Organizing commercial units	0.15	0.16	0.14	0.12
	Assessing the needs of government institutions	0.12	0.09	0.13	0.07

the private sectors. While the audience of the first part believes in attracting capital from governmental organizations, the second part believes in turnover and self-sufficient management, such as organizing more business units. Table 8.

Lack of Inappropriate Human Effect on the Environment

Reclaiming organic tissue and previous performance in evoking nostalgia is a noticeable percentage of participants' preferences under the design generator. Clearly, it explains the reason for choosing to increase the mentioned score. Table 9.

CONCLUSION

The failure of modern experiences and the development of various semantic and behavioral concepts in the environment show that the existence, promotion, and maintenance of identity and quality in spaces are not random phenomena.

Table 9. Contribution of sub-criteria of proper influence of human on the natural environment in preferences

Fifth indices	Sub-indices	Designer	Employer	Legislator	User
Lack of inappropriate human effect on the environment	Revitalization and restoration based on organic texture	0.14	0.14	0.16	0.19
	Expanding green spaces	0.15	0.15	0.17	0.18
	Using common native materials	0.17	0.12	0.15	0.08
	Mechanized waste collection	0.15	0.16	0.14	0.10
	Creating footpaths and riding routes	0.19	0.18	0.19	0.22
	Immunity from public transport network	0.21	0.23	0.19	0.24

Creating high-quality spaces requires being appropriate to today's human needs and the audience's satisfaction with the spaces' performance. With the increase in population and cities' development, the need for responsive spaces has also increased. Economic conditions and the high cost of land, on the one hand, and the existence of unused spaces in cities, on the other hand, double the need to identify lost spaces. In the meantime, industrial spaces and abandoned factories with their latent values and large changeable land areas are an opportunity for adaptive revitalization and reuse. However, the precondition for reclaiming industrial heritage is protecting and preserving its valuable elements: tangible and intangible cultural and industrial heritage.

This vital point is converting several industrial heritage sites into museums and cultural sites inconsistent with their industrial spirit. Although these places, like the Modern Tate Building in England, have made a prosperous cultural space, they have not been successful in this regard due to a neglect of their dominant industrial culture and spirit. This prompted the authors of this study to evaluate the revitalization and recreation of Zanjan Match Factory.

By recognizing and assessing the case study, the process of revitalization and recreation of the Zanjan Match Factory was evaluated to determine the extent to which it overlaps with Bradbent's criteria. Identification and evaluation of the case study were made by emphasizing the harmonization principle in the AHP method and Bradbent criteria to determine its degree of overlap with the selected research criteria.

According to the analysis, in figure 3, for each of the indexes, the most desirable situation is related to the component of human protection from adversity with an average of 0.28, and the most unfavorable situation is related to the space appropriateness index to the audience's pattern of behavior with an average of 0.14.

The analysis results show that personal privacy is a sub-criterion of Bradbent's first index (space appropriateness, a pattern of behavior) with a score of 0.05, gets the least attention from Employer, and conversely, having proper access with a

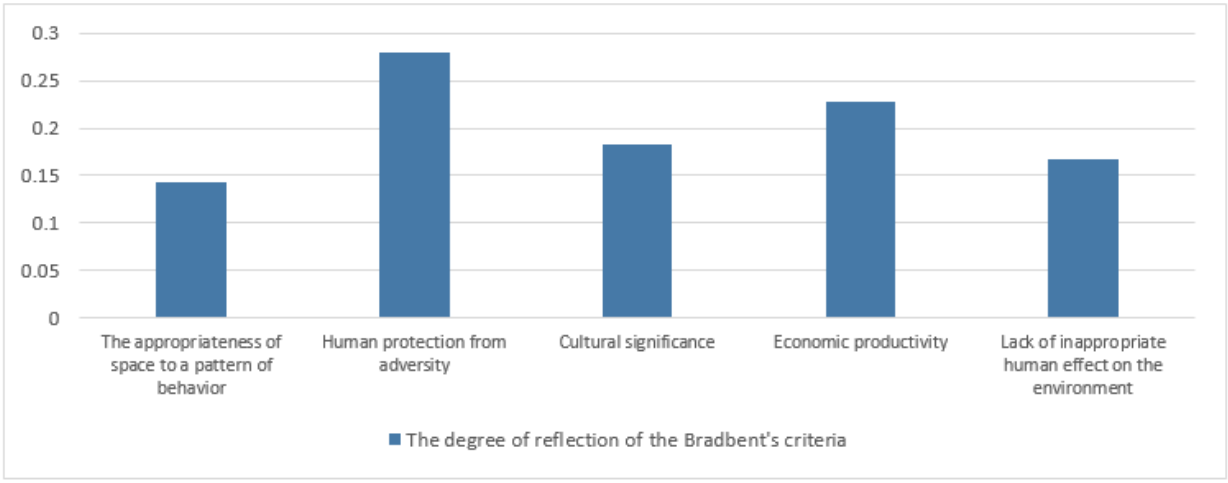

Fig. 3. Contribution of Bradbent's criteria following responses from generators researchers

score of 0.28 has the highest score from User. Bradbent's second index (human protection from adversity), creating a sense of security with an average of 0.06, has the lowest score. In contrast, Balance and structural strength with an average of 0.28 have the highest score from legislators. Similarly, the lowest score of the third index (cultural significance) is related to the possibility of displaying and selling handicrafts, and the highest score is related to the Minimal distinction between old and new parts in the design. In economic productivity, paying attention to governmental organizations' needs with a score of 0.06 is the least preferred, and Improving local access is the most preferred by participants. Finally, Bradbent's fifth index (Lack of inappropriate human effect on the environment), common native materials has the lowest, and immunity from the public transport network has the highest score.

The analysis of the findings generally indicates the success of the revitalization and reconstruction of this building. Therefore, the revitalization's success is the proper coordination between experts and users of this space regarding fulfilling the users' needs and desires for the revitalization and change of use in this building.

Transformation of the abandoned factory of Zanjan Match into a museum of industry and mining, which represents the function of the first building, shows that as considering the physical, functional and semantic aspects is necessary in heritage protection, the physical, functional, and visual (semantic) aspects of the place must be considered simultaneously because the success of any work depends on all these three aspects. What confirms the revitalization's success is the proper harmonization of the experts' and users' views on meeting users' needs and desires in the revitalization process and land-use change in this building. It should be noted that it is not possible to treat different aspects of industrial heritage and even different cases of one branch of industrial heritage similarly because each case has its complexities. In some of these places, any change, even on a minor scale, will be deadly. In others, creative art and architecture-based interventions can be made with the ultimate goal of returning the industrial heritage to its natural life cycle. This is possible when any protective measures are taken expertly and adequately. As emphasized in Bora Charter, in case of any conflict or inconsistency between these measures with the places' primary nature, their physic and value may be damaged seriously.

ENDNOTES

1. Eugène Viollet-le-Duc (1814-1879)
2. Comille Boito (1836 - 1914)
3. Tate Modern, Bankside, London
4. Leentje Volker
5. Post Occupancy Evaluation
6. Charles Nelson
7. Marcus Vitruvius Pollio (80–70 BC - 15 BC)
8. Geoffrey Bradbent (1929)
9. Geoffrey Scott (1884-1929)
10. Auguste Perret (1874- 1954)
11. Le Corbusier (1887- 1965)
12. Walter Gropius (1883- 1969)
13. Mies van der Rohe (1886 - 1969)
14. Christian Norberg-Schulz (1926- 2000).
15. Robert Venturi (1925- 2018)
16. Charles Jencks (1939- 2019)

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