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Recognizing the components of building industrialization and its effect on the cultural and social identity of Ahvaz metropolis

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Abstract

This study employed a questionnaire as a data collection tool. A total of 16 questions were designed for the identity questionnaire, focusing on two main components: social and cultural. Additionally, 47 questions were created covering six main components: economic, social, technical and executive, cultural, internal architecture of housing, and external architecture of housing, and these were administered to residents of different districts of Ahvaz. The investigation of correlation coefficients and regression analysis between building industrialization variables and urban identity in Ahvaz yielded significant results. The regression analysis between identity and building industrialization indicators in Ahvaz city revealed a significant relationship (Sig = 0.000), indicating that changes in industrialization can significantly impact urban identity. As industrialization increases, urban identity improves, particularly in cultural and social aspects. The AHP method was used to prioritize components based on their importance, with scores ranging from 1 to 9. After normalizing the pairwise comparison matrix and calculating the geometric means, consistency was assessed using the Consistency Ratio (CR). A CR under 0.1 indicates a consistent matrix. The AHP results showed that environmental and social components were most important, while architectural aspects were least significant. The Cultural index was prioritized with the highest score of 0.38. A correlation coefficient of 0.806 indicates a strong and positive correlation between building industrialization and urban identity. This suggests that as the level of building industrialization increases, urban identity indicators also rise in different areas of Ahvaz. Moreover, a significance level of 0.000 indicates that this statistical relationship is highly significant, with the likelihood of its occurrence being very low based on chance. The prioritization results of the components using the AHP method indicated that for the component of industrialized construction, the environmental sub-index was prioritized, while for the component of identity, the environmental sub-index took precedence in terms of construction and architecture. These findings suggest that paying attention to environmental components in the design and implementation of industrialization projects can enhance the alignment between urban development and the preservation of cultural and social identity. Implementing design standards based on sustainability principles and compatibility with local cultural identity can mitigate the negative impacts of industrialization. Furthermore, the development of public infrastructure, such as green spaces and cultural centers in industrialized areas, contributes to creating a balance between industrial development and cultural identity preservation.

***Keywords*:** Building Industrialization; Urban Development; Cultural Identity; Social Identity; Ahwaz

1. Introduction

In today's world, industrialization is recognized as one of the fundamental pillars and indicators of development (Taheri Jabali, 2021; Mardani et al., 2022; Mansouri et al.,2024). Societies that have been pioneers in development prioritized the construction of industrial buildings, and industrial architecture emerged as a significant historical element in cities, with an emphasis on its preservation as industrial heritage (Cubuk et al., 2023; Anjomshoa et al., 2023, Frampton, 2020). Industrial buildings in Iran play a notable role in shaping the identity of Iranian cities (Delgado et al., 2020) and, if preserved, can serve as an identity-enhancing element within these cities (Kedir and Hall, 2021; Alaimo et al., 2020). The weaknesses in theoretical foundations have diminished the architects' roles in designing industrial buildings, leading to serious challenges within the country's industrial structures (Canepa, 2020). Consequently, contemporary industrial architecture in Iran has seen a decline in authenticity and value compared to other fields, largely due to prevailing social and cultural conditions (Bazazzadeh et al., 2021) .In the process of evolving the construction industry, modern industrial practices now integrate execution methods, structural engineering design, facilities, and architectural art (Contini et al., 2022). The minimal application of industrial housing in the country has led many builders and managers to overlook this necessity in recent decades (Kheirabadi, 2019; Zhuoxuan et al., 2024). It has often been reduced to mere prefabrication of buildings or building components and specific methods of large-scale housing (Mensah, 2019). Accordingly, the entire chain of design, execution, and supervision takes into account the nature of an engineering system in industrial construction (Pourahmad et al., 2021; Shamai and Jafarpour Ghalehteimouri, 2024). The increasing population demands large-scale housing in minimal time, and the mobility of construction equipment and completed buildings for reuse in new locations, even in different cities, is steering the construction industry towards lightweight industrial buildings with quick installation and relocation

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capabilities. (Power, 2021) Industrialization is, on one hand, focused on modern construction and the use of new technologies, and on the other hand, it represents one of the most fundamental aspects of life in societies, reflecting the cultural, traditional, and religious convictions of people (Carmona, 2021; Pozzi, 2021). Therefore, reconciling these two seemingly discordant elements in a broad and diverse social fabric, such as Iran, necessitates a change in perspective and the adoption of a new view concerning the construction industry (Savini, 2019; Seelow, 2018; Zhang et al., 2020). Today, cities are shaped based on fabricated norms rather than the desires and values of the people .The formation of cities based on thoughtless imitations of modern patterns, without regard for original values and local identity, has led to a decrease in residents' attachment to the city and their sense of belonging, thereby disrupting urban social life. Generally, identifying and prioritizing cultural and social components plays an important role in understanding the identity of a city. In this context, Ahvaz is undoubtedly one of the cities that has constantly faced challenges in short-term planning, alongside various political, social, cultural, and executive conflicts, leading to significant changes across generations and many years, to the extent that it is often referred to as lacking identity in colloquial conversations. The influx of Western modernism in Khuzestan and the technical and infrastructural initiatives of builders in the framework of contemporary architecture and urban planning have easily attracted a large population, transforming their original identity into a new one within these developments. The city of Ahvaz, which is the focus of this study, does not relate to favorable environmental conditions, economic considerations, or the lifestyles of local tribes and communities; rather, it is regarded for its strategic location. Over time, in a city like Ahvaz, the significant social and political consequences of these residential complexes have been forgotten, which is why this study aims to investigate the effective components of contemporary industrial housing. Hence, the analysis will delve into the aforementioned examples in detail. The issue of contemporary industrial housing is interconnected with cultural and social identity. Therefore, this research will elaborate on the internal and external organizing concepts in housing design, taking into account the indicators and criteria of industrialized building and its impact on housing components. It aims to extract the factors that influence the cultural and social identity of Ahvaz, ultimately striving to develop a model to enhance the quality of living conditions in contemporary industrial residential complexes, which is rooted in the social and cultural identity of this city.

2. Research Method

In this study, to evaluate the component of industrialization of housing within the cultural-social identity developments of the metropolis of Ahvaz, interviews were conducted using a questionnaire with individuals residing throughout the city. The number of participants was determined to be 171 using Cochran's formula. Additionally, a questionnaire was utilized for data collection, containing 16 questions designed around two main components, social and cultural, as shown in Table 1. Conversely, as outlined in Table 2, 47 questions were developed with six main components: economic, social, technical and executive, cultural, internal housing architecture, and external housing architecture, and these were distributed among residents of various areas of Ahvaz.For data analysis, reliability coefficients were used to ensure the reliability of the data, thereby enhancing the validity of the results. In this research, all tools for data collection complemented each other, allowing for the validation of other methods or a deeper investigation into the motivations of respondents and the reasons provided for their answers. Consequently, following the examination of housing indicators and industrialization, the relevant criteria were established and introduced based on the significance, level of presence, impact, resident satisfaction, and the extent of emphasis placed by experts during observations, sources, studies, and interviews. Questionnaires and expert observations (the researchers' direct observations) were also included in this process .For data analysis, SPSS software was used; initially, Pearson correlation tests and regression coefficients were employed to identify the impact of housing industrialization components on cultural and social identity, thereby determining the significance of these indicators. Subsequently, the components of each of the industrialization and identity indicators were prioritized using the AHP multi-criteria decision-making method. The conceptual model of the research is presented in Figure 1.

Table 1
Calculation of Cronbach's alpha coefficient for the reliability of industrialization and identity questionnaire.

Questionnaires	item	Cronbach's alpha coefficient
Industrialization	47	0.997
Identity	16	0.986

Table 2
The components of the identity questionnaire.

Types of identity	Indicators	Sub-indexes	
Cultural identity	Prescriptive approach	language	written
			speech
		your religion	the field of religion
			the field of religion

		social system	educational system
			family system
			Economic system
			Cultural system
			Political-legal system
		History and cultural memory	Material heritage
			Spiritual heritage
		Cultural geography	
Social identity	ethnic identity		
	national identity		
	Religious identity		
	Global identity		

Table 3
The components of the identity questionnaire.

Industrialization Components	**Indicators**	**Sub-indicators**
Environmental Factors	Energy Conservation	In the production and execution phase During the building's lifecycle
	Compatibility	With the natural environment With the artificial environment
	Waste	Materials Resources Energy
	Recycling and Reducing Destructive Effects	Recycling of materials Reuse of building elements
	Pollution-related Criteria	In the production and execution phase In the consumption phase
	Use of Natural Resources	Consumption of materials and resources Water consumption
Economic Factors	Cost Criteria in Construction	Resources and materials Human resources Maintenance and repair Reconstruction and demolition
	Investment Criteria in Construction	Return on investment Initial capital Exports and imports (foreign currency generation)
	Time-related Criteria	Construction time
	Implementation Issues	Durability Constructability Continuity of execution phases Flexibility Access to materials and equipment
Social Factors	Social Factors	Social participation
	Labor Market	Human resources
	Safety and Health	Work safety Employee health
	Design and Architectural Factors	Personalization Desired spatial physicality Aesthetic appeal
Technical and Executive Factors	Access to Implementation Factors	Human resources Equipment Materials and components
	Standardization and Modulation	Modular Standards
	Quality Enhancement	Design quality Execution quality
	Sustainability	Building longevity
Cultural Factors	Symbols and Signs	Utility Concept
	Identity Factors	Privacy Decorations and embellishments Place-based and contextual approaches

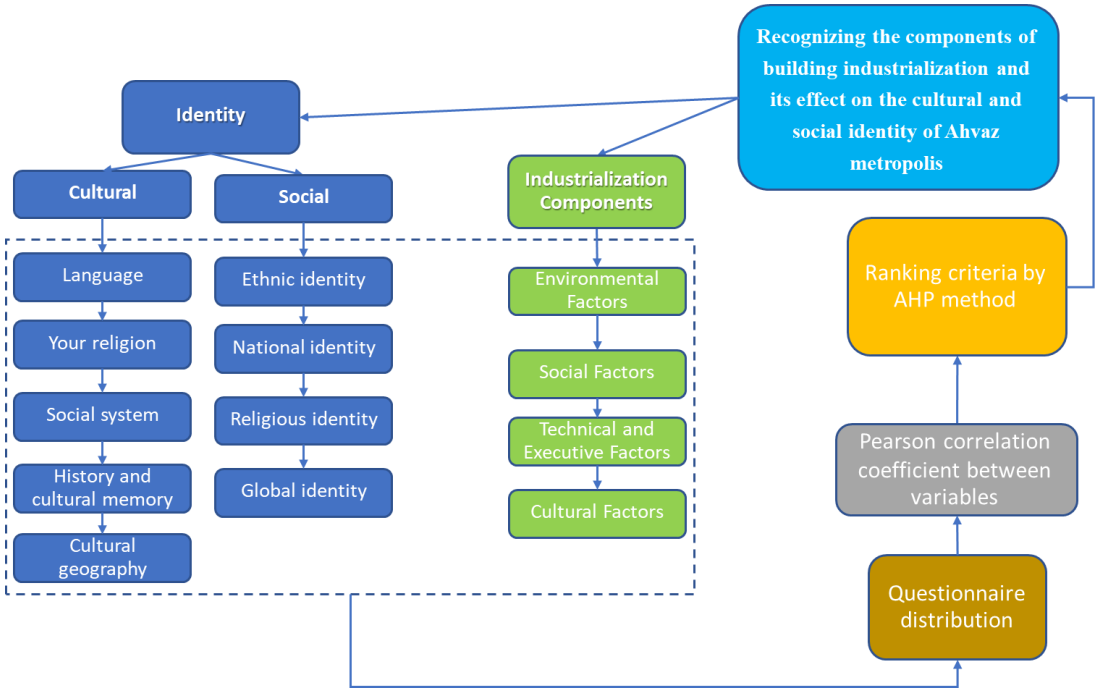

Fig. 1. Conceptual model of research.

2.1. Study area

The city of Ahvaz, as one of the most important and populous cities in Iran, has experienced significant changes due to rapid urban transformations and industrialization. These changes have had notable effects not only in economic and technical fields but also on the cultural and social identity of the city. Industrialized construction, recognized as a key factor in urban development, alters processes and techniques of building. However, its impact on the cultural and social identity of Ahvaz requires more in-depth examination. Assessing the influence of industrial construction components on the cultural and social identity of Ahvaz can simultaneously present both opportunities and challenges. While industrialization may contribute to improving construction quality and accelerating urban development, it is essential to pay special attention to preserving and reinforcing the cultural and social identity of Ahvaz during the renewal processes. This balance can be achieved by integrating traditional design principles with modern technologies and addressing local needs (Fig 2).

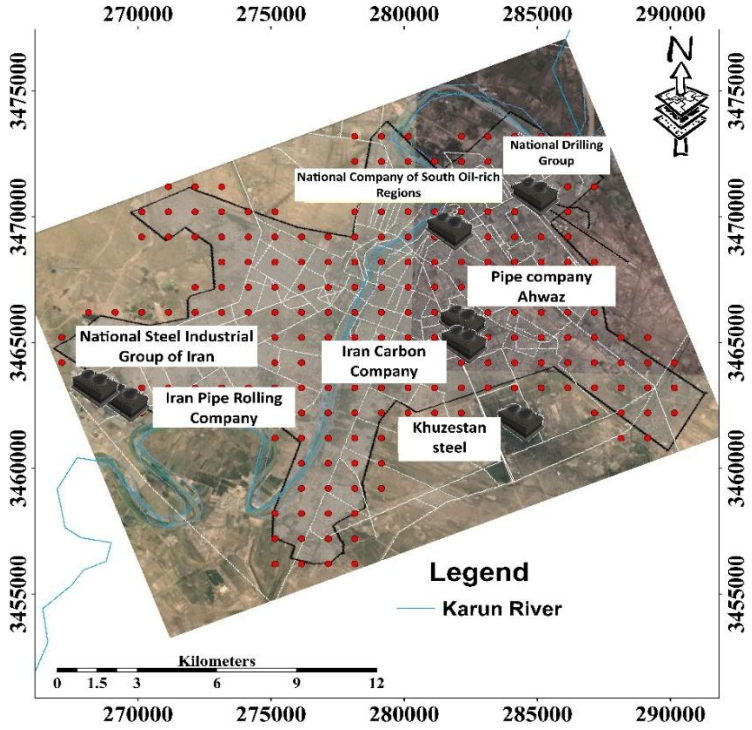

Fig. 2. Satellite image of the urban divisions of Ahvaz. Analytic Hierarchy Process (AHP).

This method was developed by Saaty in 1980 under the title of Analytic Hierarchy Process (AHP). The foundation of weight determination in this method is based on pairwise comparisons of criteria. In pairwise comparison, the relative importance of criteria is divided into 9 levels of intensity. This process incorporates various options in decision-making and allows for sensitivity analysis on criteria and sub-criteria. Furthermore, the basis of pairwise comparison is designed in such a way that it facilitates judgment and calculations. It also indicates the degree of consistency and inconsistency of decisions, which is one of the significant advantages of this technique in multi-criteria decision-making (Saaty, 1990).

In this method, after determining the criteria, the weight and relative importance of each criterion in relation to the desired goal must be established. The AHP process is a mathematical approach to determine the importance and prioritization of criteria in the evaluation and decision-making process. To determine the weights, the following steps need to be carried out (Saaty, 2008):

1. Define and organize the criteria into a hierarchy (constructing the criteria matrix).
2. Conduct pairwise comparisons of the relative importance of the criteria to create the weights.
3. To ascertain the accuracy and validity of the weighting, a consistency index is used, which is calculated based on the eigenvector approach from graph theory. If the consistency index is equal to 0.1 or less, the weighting is considered accurate.

3. Research Findings

The demographic characteristics of respondents to the identity and building industrialization questionnaires in the residential areas of Ahvaz city indicated that there were 107 males and 64 females. Additionally, 59 respondents were single, while 112 were married. The age variable showed that the age group of 30 to 45 years had the highest frequency distribution among respondents (Figures 2 to 4). Descriptive statistics of the industrialization questionnaire are presented in Table 4. According to this table, the environmental component had the highest rank with a mean of 3.65, while the cultural component had the lowest rank with a mean of 2.75 among the industrialization components. Descriptive statistics for the identity questionnaire are detailed in Table 5; according to this table, the environmental component had the highest rank among identity components with a mean of 3.10. The results of the correlation coefficient between the variables of building industrialization and identity indicated a significance level (Sig) of 0.000, indicating a significant relationship among the studied indicators in different areas of Ahvaz city. Furthermore, the significance coefficient for this variable was found to be R=0.806, which indicates a significant, positive, and strong correlation between the identity and building industrialization indicators. Based on these results, it can be concluded that an increase in the level of building industrialization is associated with an increase in identity indicators in various areas of Ahvaz city. In other words, building industrialization positively affects cultural and social identity, and this impact is strong enough to be significant .These results indicate that building industrialization acts as an effective factor in strengthening cultural and social identity. In fact, industrialization, by employing modern technologies, enhancing construction quality, and improving efficiency and economic viability of construction projects, can contribute to the formation of a stronger and more positive identity for various areas of the city (Table 1).

Table 4
Statistical results of the industrialization components questionnaire.

Component	Minimum	Maximum	Average	standard deviation
Environmental	1.00	5.00	3.65	1.38
Economic	1.00	5.00	3.01	1.41
Social	1.00	5.00	2.98	1.43
Technical and operational	1.00	5.00	3.23	1.40
Cultural	1.00	5.00	2.75	1.41

Table 5
Statistical results of the industrialization indentity questionnaire.

Component	Minimum	Maximum	average	standard deviation
Cultural	5.00	3.10	1.37	5.00
Social	5.00	2.96	1.39	5.00

The regression analysis between identity indicators and building industrialization in Ahvaz city provides a comprehensive understanding of the dynamic relationship between urban development and cultural, social identity. The statistical significance of the relationship, with a p-value (Sig) of 0.000, indicates that the connection between building industrialization and urban identity is not due to random variation but reflects a meaningful and dependable pattern. This means that changes in the independent variable—building industrialization—have a direct and measurable impact on the dependent variable—urban identity, which includes the cultural, social, and

psychological aspects that shape a resident's sense of belonging and attachment to the city. The positive relationship suggests that as the level of industrialization increases, urban identity strengthens, leading to a cityscape that is perceived as more modern, dynamic, and cohesive. This is especially significant because urban identity is not just about physical landmarks or infrastructures but also about how residents connect with their environment on a deeper, social level. The regression coefficient plays a crucial role by quantifying the relationship; for example, if the coefficient is positive, it implies that for every unit increase in industrialization, urban identity improves by a specified amount. This quantification offers urban planners and policymakers a concrete understanding of the scale of industrialization's influence on social and cultural identity, helping them to make data-driven decisions about urban growth. These findings suggest that industrialization can do more than just promote economic development—it can actively contribute to strengthening the social fabric of the city. By integrating cultural and community-focused aspects into industrial projects, planners can create spaces that foster a sense of belonging and pride, promoting social cohesion. Moreover, industrialization can serve as a catalyst for introducing new cultural influences, enhancing the city's diversity and broadening its social landscape. As the city's physical environment evolves, industrialization can lead to new opportunities for employment, public spaces, and social interaction, all of which play a role in shaping a collective identity that reflects both economic progress and social vitality. In this context, the study highlights that industrialization's influence on urban identity goes beyond mere physical transformation; it has the potential to positively impact the cultural and social dimensions of urban life, contributing to a more integrated and cohesive urban experience. Therefore, the analysis underscores the importance of considering cultural and social factors when planning for industrial growth, ensuring that the economic benefits of industrialization are complemented by enhancements to the city's overall identity and the well-being of its residents.

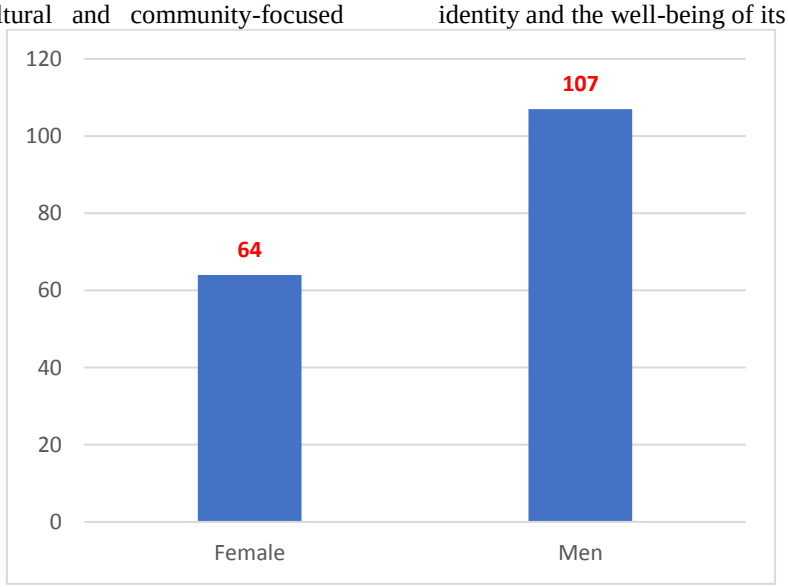

Fig. 3. Frequency distribution of gender variable.

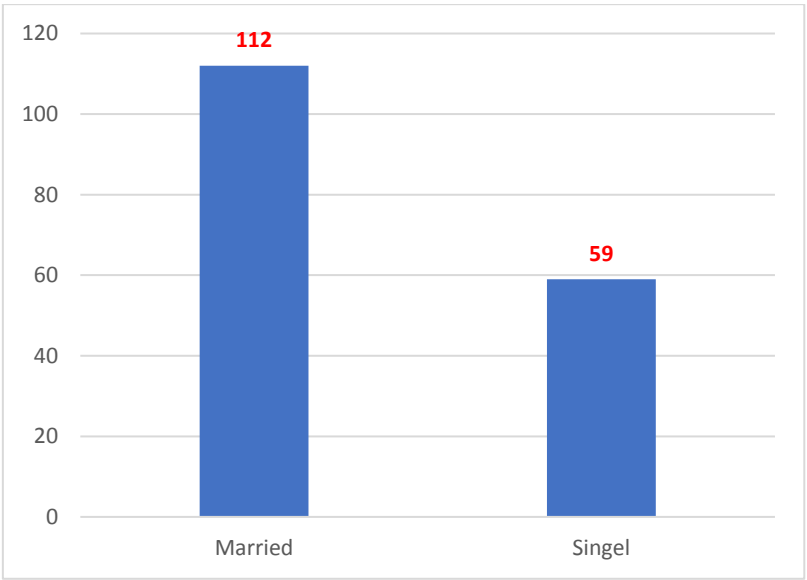

Fig. 4. Frequency distribution of marital variable.

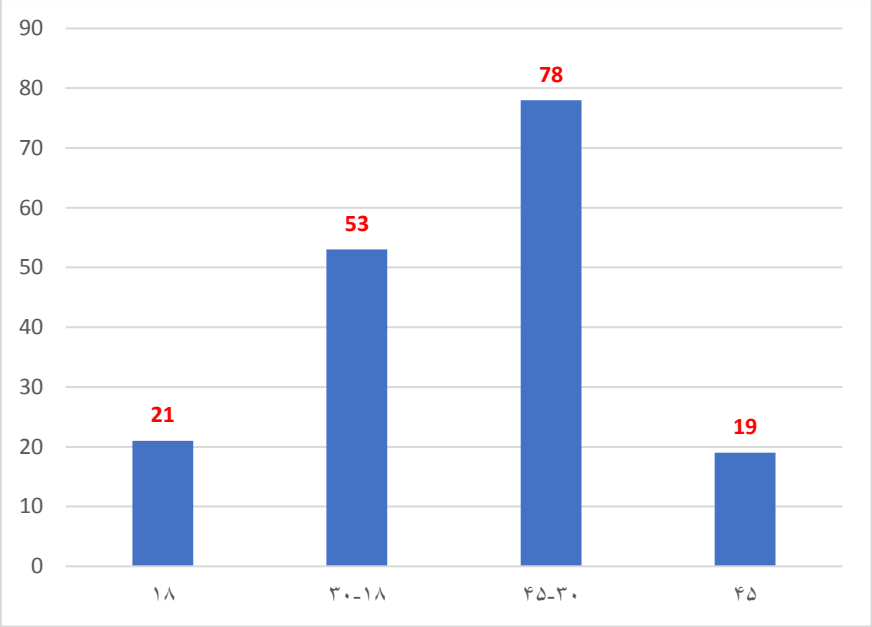

Fig. 5. Frequency distribution of age variable.

Table 6
Correlation coefficient between indicators of building industrialization and identity

Correlations			
		Identity	**Industrialization**
Identity	Pearson Correlation	1	.806**
	Sig. (2-tailed)		.000
	N	171	171
Industrialization	Pearson Correlation	.806**	1
	Sig. (2-tailed)	.000	
	N	171	171
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 7
Regression analysis between indicators of building industrialization and identity.

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	22243.512	1	22243.512	313.748	.000[b]
	Residual	11981.435	169	70.896		
	Total	34224.947	170			
a. Dependent Variable: **identity**						
b. Predictors: (Constant), **industrialization**						

3.1. Ranking of Sub-indices Using the AHP Method

In this stage of the analysis, the AHP (Analytic Hierarchy Process) method is employed to compare and rate the importance ratios of each pair of components against one another. The comparison scale ranges from 1 to 9, where 1 represents equal importance between the two components being compared, and 9 indicates that one component is significantly more important than the other. This pairwise comparison allows for a structured and quantitative assessment of the relative importance of the various components under consideration. Once the pairwise comparisons are made, the next step involves normalizing the comparison matrix to ensure consistency and calculating the geometric mean for each row. The geometric mean is used to derive the relative weight of each component, providing an objective measure of the importance of each factor in relation to the others.

A key aspect of the AHP method is the evaluation of consistency within the comparison matrix, as inconsistencies can distort the results and lead to faulty decision-making. To evaluate this consistency, the Consistency Index (CI) and Consistency Ratio (CR) are calculated. The CR, in particular, is a critical measure, with a value of less than 0.1 indicating that the pairwise comparison matrix is consistent and logically sound. If the CR exceeds this threshold, the comparisons may need to be

revised to ensure greater consistency and reliability in the results.

In the case of prioritizing the components of industrialized housing sub-indices, the results of the AHP method revealed that environmental and social components hold the highest weight, emphasizing the importance of these factors in the overall prioritization process. On the other hand, internal architectural aspects of housing were found to be of lower significance, reflecting the lesser priority assigned to these elements in comparison to environmental and social concerns. This finding underscores the broader societal focus in housing development, where the external and community-oriented aspects are seen as more crucial than the specific architectural details within individual homes.

Additionally, the AHP method was applied to prioritize the identity components, with a CR of less than 0.1, indicating a high level of consistency in the pairwise comparisons. The results revealed that the Cultural index was rated as the most important component of identity, receiving a score of 0.38. This finding highlights the central role of culture in shaping urban identity and suggests that, when designing and developing industrialized housing, cultural factors should be given the highest priority. The prioritization of cultural aspects aligns with broader trends in urban planning and development, where fostering a strong cultural identity is seen as key to enhancing residents' sense of belonging and attachment to their community. Thus, the results of the AHP method provide valuable insights for urban planners and policymakers in determining where to allocate resources and focus efforts when it comes to the development of industrialized housing and the shaping of urban identity.

.Table 8
Matrix of construction industrialization components by AHP method

Component	Environmental	Economic	Social	Technical and operational	Cultural
Environmental	0.4	0.42	0.4	0.41	0.4
Economic	0.13	0.14	0.1	0.25	0.2
Social	0.2	0.28	0.2	0.33	0.3
Technical and operational	0.08	0.05	0.05	0.08	0.05
Cultural	0.1	0.14	0.07	0.16	0.1

Table 9
Prioritization of construction industrialization components by AHP method.

Component	Relative weight
Environmental	0.41
Economic	0.2
Social	0.28
Technical and operational	0.09
Cultural	0.16

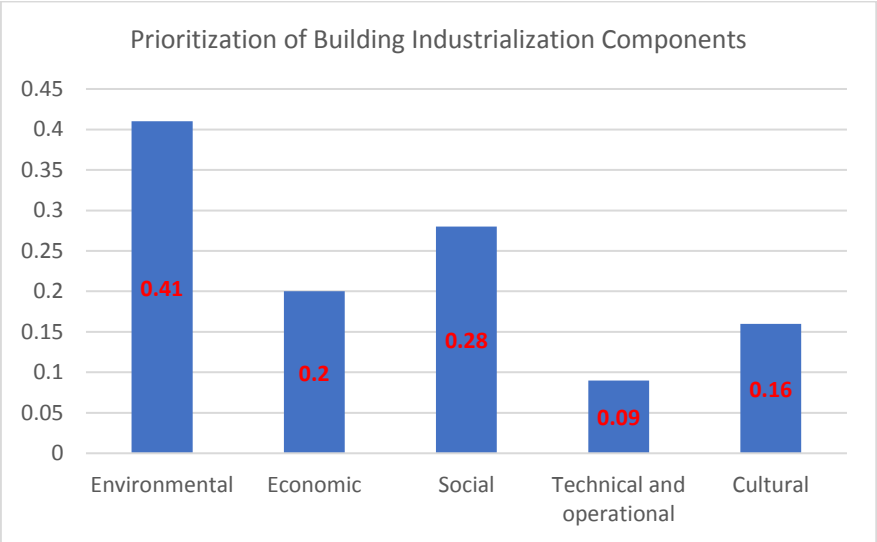

Fig. 6. Chart of prioritization of building industrialization components.

Table 10
Matrix of identity components by AHP method.

Component	Cultural	Social
Cultural	0.4	0.42
Social	0.13	0.14

Table 11
Prioritization of identity components by AHP method.

Component	Relative weight
Cultural	0.38
Social	0.24

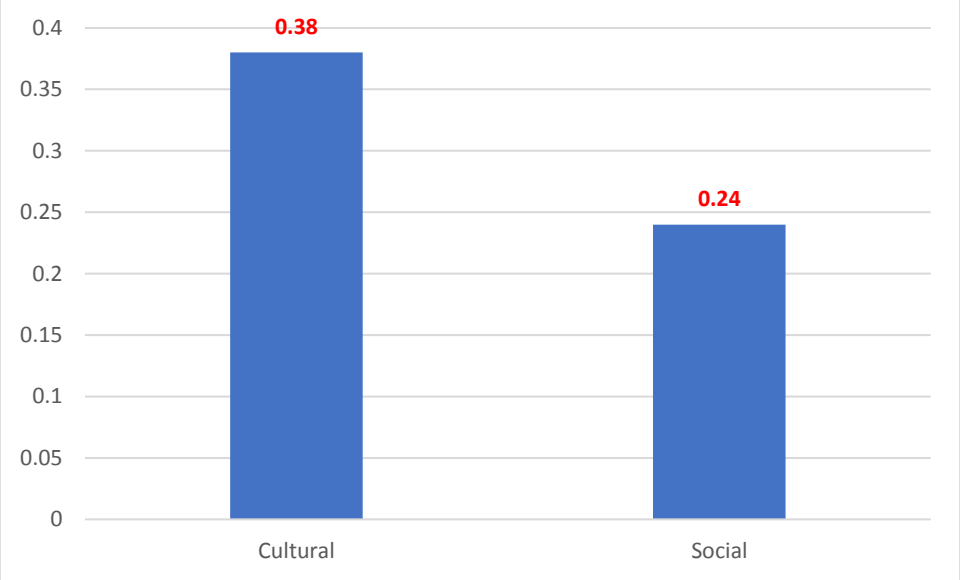

Fig. 7. Chart of prioritization of building industrialization components.

4. Conclusion

The present study, utilizing statistical methods and detailed analyses, aims to demonstrate how industrial innovations in construction can either strengthen or weaken the cultural and social identity of urban areas. The results of this research may serve as an effective tool for policymakers, urban planners, and architects in creating a balance between technical development and the preservation of cultural and social values in the city of Ahvaz. This balance not only contributes to improving the quality of life for citizens but can also lead to sustainable and balanced urban development .

With advances in technology and the increasing demand for resilient and optimized buildings, industrialization in construction has emerged as a new and efficient approach. Ahvaz, as one of the important and strategic cities in the country, has witnessed significant transformations in this regard. In the process of industrializing construction, the use of modern technologies, pre-fabricated materials, and contemporary construction techniques has resulted in faster execution, reduced costs, and improved quality of final projects. This approach not only optimizes time and resources but also helps minimize negative environmental impacts in line with ecological standards.

Furthermore, images of various industrial construction projects across the city of Ahvaz will be presented, showcasing notable advancements and the application of modern technologies in this field. These visuals effectively represent the efforts made to enhance urban infrastructure and improve the quality of life for the residents of Ahvaz.

Fig. 8. The process of building industrialization in Ahvaz city.

The analysis of the correlation coefficient and regression analysis between building industrialization and cultural and social identity in the city of Ahvaz has yielded significant results. A correlation coefficient of 0.806 indicates a strong positive correlation between building industrialization and cultural and social identity. This suggests that as the level of building industrialization increases, identity indicators also rise in various areas of Ahvaz. Additionally, a significance level of 0.000 demonstrates that this statistical relationship is highly significant, with a very low probability of occurring by chance.

Regression analysis further reveals that the dependent variable of identity is significantly related to the independent variable of building industrialization. This analysis confirms that any changes in the level of building industrialization can lead to significant changes in identity. In other words, an increase in building industrialization directly contributes to the enhancement of cultural and social identity. These findings are invaluable for policymakers and urban planners, as they can invest in building industrialization and the use of modern technologies to improve construction quality, increase efficiency and productivity, and enhance the economic viability of construction projects—all contributing to the formation of a stronger and more positive identity for various areas in Ahvaz.

The use of the Analytic Hierarchy Process (AHP) method for prioritizing identity components has also yielded noteworthy results. Environmental and social components rank highest and, with a score of 0.38, indicate that attention to these factors will have the greatest impact on strengthening identity (cultural and social). This implies that improving environmental and social conditions should be prioritized in urban planning. In contrast, the internal components of housing architecture hold the least significance, showing that compared to environmental and social factors, internal architectural elements have a lesser impact on identity. Furthermore, the calculated consistency index and consistency ratio indicate that the pairwise comparison matrix is consistent, and decisions made based on this matrix are logical and valid.

The results of this study indicate that the industrialization of buildings in the metropolis of Ahvaz has had diverse impacts on the cultural and social identity of the city. On one hand, the improvement of urban infrastructure and facilities due to industrialization has led to increased public satisfaction and an enhancement in the quality of life for residents, which has contributed to strengthening their social identity. On the other hand, rapid changes in urban structure and architecture may lead to a devaluation of traditional values and local culture, and in some cases, it has caused feelings of alienation and a generational gap.

Industrialization has also created new opportunities for cultural interaction and exchange. Modern urban facilities and new public spaces have provided people with the chance to become acquainted with different cultures and enjoy cultural diversity. However, the introduction of new technologies and modern building materials has resulted in changes to architectural styles and building design, which may affect residents' lifestyles and the preservation of local architectural identity.

To optimize the impacts of industrialization on cultural and social identity, it is essential that urban planning be conducted in a way that balances modernization with the preservation of local culture. Attention to local needs and community participation in the decision-making process can aid in preserving cultural identity. Additionally, to address the cultural challenges of industrialization, it is necessary to develop appropriate educational and cultural programs to strengthen the cultural identity of the community. Overall, the findings of this study suggest that with proper management and appropriate planning, it is possible to enhance the positive impacts of industrialization on the cultural and social identity of the metropolis of Ahvaz and mitigate its negative consequences.

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