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Investigating the factors affecting landscape adaptation with the heritage of the oil industry to achieve urban sustainability

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ABSTRACT

BACKGROUND AND OBJECTIVES: Abadan oil industry in Iran is very significant due to its various valuable layers as a part of national memory and identity. Therefore, to protect and reuse this industrial heritage, the adaptive reuse strategy by means of the landscape is considered. The purpose of this study is to achieve urban sustainability through a landscape adaptable to the oil industry heritage.

METHODS: This research is descriptive-correlational and has been done through a survey. The statistical population of this research consists of pundits and experts of Abadan's oil industry and the sample size is 88 people. In the analytical section, while using documentary studies, a questionnaire with 21 closed questions was used for data collection. After collecting the data, its validity and reliability were measured and confirmed.

FINDINGS: In this study, the relations between nine environmental, historical, economic, social, cultural, policy, technology, physical, and infrastructure factors were measured as the factors affecting the landscape adaptable to the oil industry heritage.

CONCLUSION: The results showed that the completion and facilitation of policies lead to the creation and strengthening of opportunities for cultural and social interactions in the industrial landscape. Also, the impact of physical factors on infrastructure, economic, and environmental leads to strengthening economic factors and infrastructure reuse in urban development. Findings indicated that the impact of environmental factors on economics and policy by using landscape leads to success in the mentioned fields.

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INTRODUCTION

In recent years, researchers have considered industrial heritage as a source and an integral part of collective identity in assessing, documenting, and developing the remnants of industrial society to emphasize the need for consideration of post-industrial landscapes in urban planning, (Loures, 2008). However, Industrial heritage landscapes, still face inadequate assessment of the material, cultural, and industry stereotypes, whose design does not meet aesthetic, environmental, and functional requirements and criteria (Alanen and Melnick, 2000). The protection and recreation of industrial heritage have high significance given to its value and importance. Today, world landscape architects such as Hogg, Latz, etc., are facing new professional projects concerning ecology, in which they took the adaptive reuse approach for post-industrial landscapes. In such projects, the principles of design and planning are formed in a comprehensive and integrated system based on human-ecological interactions. Adaptive and flexible interventions are designed to interact with sudden and intermittent environmental changes; developments that are natural, but not definitively predictable and controllable (Farahmand, 2011). Abadan oil industry is one of the most important historical bases, as well as the economic center of the oil industry and a strategic region in Iran. Besides, to create a nostalgic feeling in a modern space (in the 70s), it also has many capacities due to the consequences of landscapes such as tolerance (St. Carapet Church -1958), and peaceful coexistence of different nationalities (Myanmar Rangooniha Mosque-1921) besides, remembering the collective history memories recorded in the hearts and minds of the people, it is the narrator of a century of economy and history of oil. On the other hand, due to the experience of World War II (using the "Akwan" crane - 1939,The first giant crane that played an important role in World War II, carrying thousands tons of cargo, including armored vehicles, locomotives, and train cars and other public goods.) and the imposed war between Iran and Iraq, it has a lot of potentials and creates a nostalgic feeling (of '70s). However, because of functional impairments, technological obsolescence, or infrastructural changes, it is necessary to adaptively reuse the landscape to preserve the historical-cultural landscape, economic prosperity, solving environmental problems, and ultimately urban sustainability.

The hypotheses of this research are as follows:

- The physical factor affects the infrastructure factor as a necessity of landscape adaptation to industrial heritage as the governing context.
- The physical factor affects the environmental factor as a necessity of landscape adaptation to industrial heritage as the main category.
- The physical factor affects the economic factor as a necessity of landscape adaptation to industrial heritage as an intervening condition.
- Environmental factor affects the economic factor as the main category of landscape adaptability to industrial heritage as an intervening condition.
- Environmental factor influences policy factor as the main category of landscape adaptability to industrial heritage as a strategy.
- Infrastructure factor influences policy factor as a precursor of landscape adaptation to industrial heritage as a strategy.
- Policy factor affects the social factor as a strategy of landscape adaptation to industrial heritage as a consequence.
- Policy factor affects the cultural factor as a strategy of landscape adaptation to industrial heritage as a consequence.
- Environmental factor influences the infrastructure factor as the main category of landscape adaptation to industrial heritage as the governing context.
- Environmental factor affects the economic factor as the main category of landscape adaptation to industrial heritage as facilitator/ barrier conditions.

Due to the vacuum of the adaptive landscape native model with the heritage of the oil industry, first by using the grounded theory method, the causes, contexts, intervening factors and consequences related to the adaptability of heritage with landscape were identified, and then the comprehensive model of adaptive landscape with industrial heritage was presented that can provide the basis for further studies, both quantitatively and qualitatively. the foundation data theory method is one of the methods that plays a key role as a bridge between the past and future paradigms. It was used in the qualitative part of the research. Because in the data foundation theory method, an indigenous model can be designed that is completely in accordance to the heritage conditions of Abadan oil industry and can be implemented. It is also possible to test the adaptive landscape model with the heritage of Abadan oil industry from the oil industry experts view by using the structural equation model. In this research, a small part is considered.This research seeks to find an answer to this question: What are the relations between the factors affecting landscape adaptation with the oil industry heritage?

This study is conducted in Abadan, Khuzestan, Iran in 2020.

Theoretical framework

All over the world, they have intervened in the Brownfields (Loures, 2020) to reduce the adverse effects of these developments, and the landscape architects' approach in these interventions has been to reconcile human with the context of their creation and nature (Graham *et al.,* 2000). In this regard, adaptive reuse has been presented as a sustainable development strategy (Yung and Chan, 2012), which aims to focus on redevelopment in cities and tries to reduce the undesirable urban dispersion (Cantell, 2005). Sugden (2017) considers industrial heritage buildings as part of the cultural capital of society. Mısırlısoy and Günçe (2016); Wong (2017) found industrial heritage to be very important in terms of transmitting cultural identity from one period to another. Also, according to Cho and Shin (2014) recognizing the social values of obsolete spaces and using them helps to adaptively reuse the preservation of industrial heritage and turn them into assets, which are an example of "place identity" and a source of pride for communities (Xie, 2015). On the other hand, the landscape as a factor in attracting tourists leads to the empowerment and growth of tourism (Halewood and Hannam, 2001), absorbing more companies and tourists by strengthening the territorial identity (Xie, 2015), and also leads to the creative economy (Hoyle *et al.,* 1988(, and government participation in investment for economic growth and development (Yung and Chan, 2012). Adaptive reuse of industrial buildings employing landscape leads to reduced energy consumption in heating and cooling (Langston *et al.,* 2008), lowering greenhouse gas emissions (Kirkwood, 2013; Moschella *et al.,* 2013), as well as the use of green spaces in body development leading to the formation of constructive social interactions, the improvement of cultural life (Yung and Chan, 2012) and the integration between industrial heritage through the green network along with the identity and historical dimension and adaptation to different cultural and social layers (Khan Sefid, 2008). Therefore, strengthening the aesthetic dimensions by creating combined landscapes is the result of strengthening the visual elements of the landscape by interrelationships of values in cultural, economic, and biological dimensions (Amir and Gidalizon, 1990; Sowińska-ierwierkosz, 2016). It should be noted that the purification and treatment of soil and wastewater (Douglas, 2002) from chemicals and petroleum

Table 1: Theoretical framework

Wong (2017)	Preservation of industrial heritage in terms of transferring cultural identity from one period to another
Xie (2015)	Recognizing the social values of obsolete spaces and reusing them as an example of "place identity"
Halewood and Hannam (2001)	Empowerment and tourism growth through the use of perspective in adaptability
Hoyle *et al.* (1988)	Strengthening territorial identity leads to a creative economy through adaptability
Yung and Chan (2012)	Government participation in investment for economic growth and development through the adaptability of industrial heritage
Langston *et al*. (2008)	Reduction of energy consumption in heating and cooling due to adaptive reuse of landscape industrial buildings
Kirkwood (2013)	Reduction of greenhouse gas emissions through adaptive reuse of landscape industrial buildings
Khan Sefid, (2008)	Compatibility of different cultural and social layers through the integration of industrial heritage with the green network with identity and historical dimension
Sowińska-ierwierkosz (2016)	Strengthening the aesthetic dimensions by creating combined landscapes is the result of strengthening the visual elements of the landscape with the interrelationships of values in the cultural, economic and biological dimensions.
Liduino *et al.* (2018)	In the reuse of industrial heritage, innovative technologies are used to adapt and re-coordinate the site.
Clark (2006)	Use of innovative technologies for adaptation and re-coordination of industrial heritage

products left over from industrial heritage are also done by phytoremediation (Hoyle *et al.,* 1988; Liduino *et al.,* 2018). On the other hand, the use of innovative technologies to adapt and re-coordinate the site (Clark, 2006) and the valuation and aesthetics are done by creative and innovative industries (UNESCO *et al.,*2012) in the adaptation of industrial heritage. Table 1 summarizes the theoretical framework of this research.

The study Area

Abadan Oil Industry

Abadan city in Khuzestan province with an area of 65.1 square kilometers and a population of 300,000 is located in the southwest of Ahvaz. This industrial city is one of the most important and largest cities built in the twentieth century in Iran (Figs. 1 and 2). During the Second World War with the occupation of Iran (1941), the Abadan refinery became the largest refinery in the world and the decisive point of the war (Kaabi Falahiyeh, 2015). In 1978, a strike was held due to the cooperation of Abadan oil refinery staff with the Islamic Revolution of Iran, and the Abadan refinery was closed. After the beginning of the war in Iraq from 1980 to 1988, it was unable to operate due to its proximity to the Iraqi border and the bombing and suffered extensive damage. Today, although most of the refineries and factories are operating, some parts of the Abadan oil industry have failed due to the introduction of new technology, water shortages, and sometimes depreciation and infrastructure changes (Fig. 2).

MATERIALS AND METHODS

This applied research is descriptive-correlational. The research has been done by survey. The statistical population of this study consists of pundits and experts in the Abadan oil industry. To determine the sample size, the Cochran formula was used and the sample size was 88. Since the literature review indicates the weakness of the existing theories in explaining the landscape model adapted to the

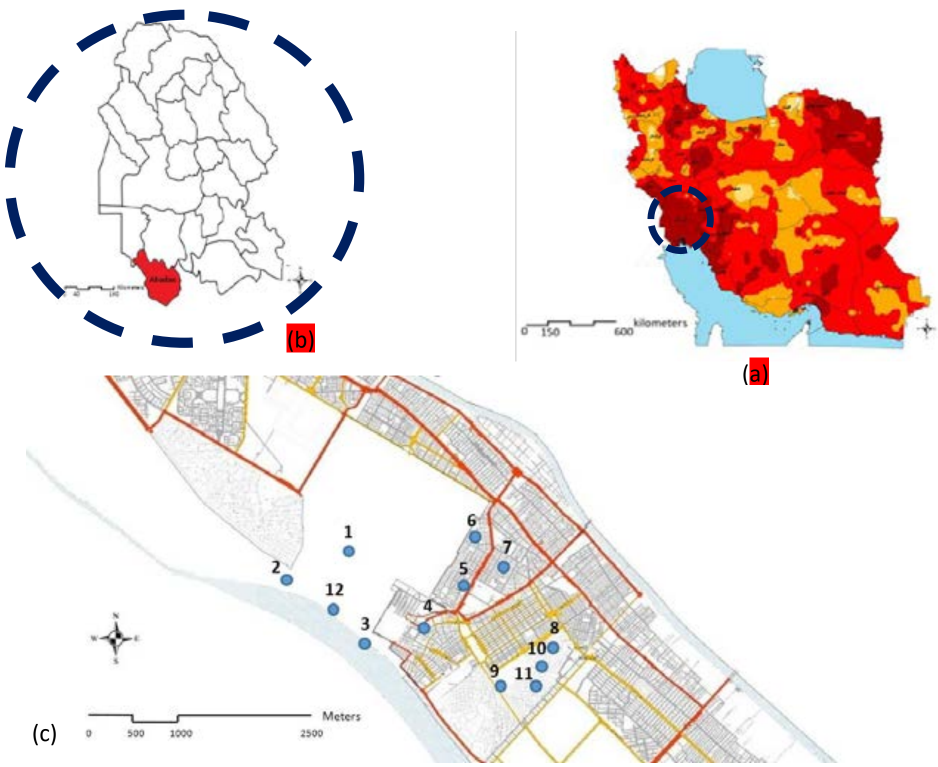

Fig.1: The study area: a) Iran map with the specified area of Khuzestan, b) Khuzestan map with the specified area of Abadan, c) Aerial map and location of Abadan industrial heritage (General department of roads and urban development of Khuzestan Province, 2020)

1: Oil Refinery ، Photo Date 1973

2: Annex open-air Club and Cinema, 1931

3: Akwan crane 1937, obsolete

4: Gas Station 1926 turned into a museum

5: Vocational School, 1933 Turned into a museum

6: Ziba bathroom ، 1934, closed

7: Children's Park, 1949 Closed

8: North Bovardeh Water Reservoir, Obsolete

9: The Petroleum University, 1939, Still working

10: Bovardeh neighborhood-2floors– at the same time with the start of Abadan Oil Company and Refinery

11: Bovardeh neighborhood-Villa – at the same time with the start of Abadan Oil Company and Refinery

12: Abadan wharf, 1912, obsolete

Fig. 2: The oil industry effects in Abadan city (1 to 12), (Iran Petroleum Museum and Documents, 2020)

industrial heritage, the grounded theory method was used to identify and extract the components, as well as designing the model. The grounded theory method is based on the construction and presentation of theory. During this method, the data were collected through interviews with experts and then divided into three stages of open, axial, and selective coding, and finally, a paradigm model was presented based on 8 main categories and 23 subcategories. In this study, a conceptual model derived from the qualitative phase was tested and the relations between factors were explained. A questionnaire was used to assess the identified factors of landscape adaptability to industrial heritage. The scoring method of this instrument was based on a seven-point Likert scale. The results of statistical analysis were presented in two sections: descriptive findings and inferential findings. In the descriptive section, demographic variables and main variables were described using statistical indicators of central tendency and variability. In the inferential section, the relationships between variables were analyzed by the Pearson correlation test, validity and reliability of the questionnaire were tested by confirmatory factor analysis test and structural equation modeling test was used for the conceptual model test by the partial least squares method. Data were analyzed using SPSS 25 and Smart PLS version 3 statistical software.

RESULTS AND DISCUSSION

Descriptive findings

Statistical Society

The statistical population of this study consists of experts in the Abadan oil industry and the sample size is 88. 73% of the participants were men and 27% were women. The frequency of respondents' fields of study includes architecture 32%, civil engineering 19%, computer 28%, and other fields 43%. Table 2 shows the frequency of executive positions of individuals.

The Kolmogorov - Smirnov test was used to evaluate the normal data distribution. The significance level of the Kolmogorov-Smirnov test for all variables in this study was more than 0.05, which indicates the natural distribution of the variables. Also, the study of the means shows that the average of all components is in the range of 5 to 6, which is relatively high. The study of the means shows that the lowest average is related to the environmental dimension with an average of 5.46 and the highest average is related to the economic dimension with an average of 6 and the social dimension with an average of 5.96. Table 3 shows the descriptive indices and variables normality test.

Checking the validity of research variables

Confirmatory factor analysis was used to evaluate the validity of the researcher variables. In Table 4, the measurement model is standardized in the form of coefficients and is extracted with combined reliability, Cronbach's alpha, and mean-variance. Also, the historical variable has only one question and its results are not reported in the table. The results showed that according to the number of factor loads that are more than 0.50 and are at a significant level less than 0.05 ($p < 0.05$) (all t-values are greater than 1.96), the construct validity of all questions is confirmed. All questions have a factor load greater than 0.50, which confirms the validity of all questions of research variables. The value of combined reliability is obtained from a minimum of 0.73 for the social variable with a maximum of 0.97 for the infrastructure variable, in which the value of combined reliability is greater than 0.70. These reliability values are confirmed and indicate that the reliability of the research variables scale is statistically confirmed. The Cronbach's alpha values of the components are obtained from a minimum of 0.61 for the economy to a maximum of 0.95 for the infrastructure, indicating that the reliability of the internal synchronization method is

Table 2: Description of the respondents' executive position

Position	Number	Percent	The Cumulative Percentage
Working in the oil industry	57	65	65
Abadan Citizen	6	7	72
Professional designer	4	4	76
Faculty member	15	17	93
Researcher	6	7	100
Total	88	100	

Table 3: Descriptive indicators and normality test of the studied variables

Variable	Average	The Standard Deviation	Significance of Kolmogorov-Smirnov	Skewness	Kurtosis
Physical	5.86	0.96	0.064	-1.82	1.38
Environmental	5.46	1.29	0.168	-0.991	0.430
Infrastructure	5.82	1.19	0.072	-1.49	1.54
Economic	6.00	0.99	0.061	-1.75	1.58
Historical	5.48	1.52	0.089	-1.29	0.705
Technology	5.75	1.06	0.133	-0.846	-0.019
Policy	5.81	1.01	0.116	-0.831	-0.298
Social	5.96	0.91	0.094	-1.04	1.58
Cultural	5.65	0.94	0.154	-0.697	0.486

also confirmed. Because the variables have a small number of questions and the questionnaire was also made by the researcher, Cronbach's alpha above 0.60 was determined as the criterion. The extracted mean-variance that measures the convergent validity is obtained from a minimum of 0.59 for

Table 4: The results of confirmatory factor analysis: Evaluation of validity and reliability of research variables

Variable	Question number	Standardized coefficient (factor load)	Mean-variance extracted (AVE)	Combined reliability	Cronbach's alpha
Cultural	2	0.80	0.70	0.82	0.63
	3	0.87			
Social	4	0.91	0.59	0.73	0.62
	5	0.59			
Economic	6	0.80	0.68	0.81	0.61
	7	0.85			
Environmental	8	0.71	0.71	0.88	0.79
	9	0.92			
	10	0.88			
Physical	11	0.83	0.68	0.87	0.77
	12	0.83			
	13	0.82			
Technology	14	0.92	0.81	0.89	0.76
	15	0.88			
Policy	16	0.85	0.62	0.86	0.79
	17	0.82			
	18	0.74			
	19	0.73			
Infrastructure	20	0.97	0.95	0.97	0.95
	21	0.98			

Note: All factor loads are significant at 95% confidence level: ($p < 0.05$) and ($t > 1.96$)

Table 5: Correlation matrix of latent variables and divergent validity

Variables	Physical	Environ mental	Infrastru cture	Economic	Historical	Techn ology	Policy	Social	Cultural	Ave root
1. Physical	1									0.82
2. Environmental	0.68***	1								0.84
3. Infrastructure	0.50**	0.34**	1							0.97
4. Economic	0.61***	0.59***	0.50***	1						0.82
5. Historical	0.19*	0.40***	0.32**	0.30**	1					-
6. Technology	0.63***	0.65***	0.46***	0.40***	0.36**	1				0.9
7. Policy	0.68***	0.66***	0.72***	0.58***	0.39***	0.61 ***	1			0.78
8. Social	0.51***	0.52***	0.34**	0.57***	0.37***	0.55***	0.48***	1		0.76
9. Cultural	0.24*	0.32**	0.29**	0.32**	0.63***	0.42***	0.34**	0.59 ***	1	0.83

Note: 0.05≥ p = * and 0.01≥ p = ** and 0.001 ≥ p= ***

the social variable with a maximum of 0.95 for the infrastructure variable. The obtained values show that the convergent validity of the social variable is a moderate value and the convergent validity of the infrastructure is a desirable value.

The correlation of latent variables is shown in Table 5. If in the correlation matrix of latent variables, the root means square of variance extracted for each structure is greater than the correlation of that structure with other structures, the divergent validity of the model is confirmed. Divergent validity is a fitness criterion of the measurement models in the partial least squares method. According to the results, the correlation of each structure with itself is more than its correlation with other structures.

Finally, based on the obtained results, the reliability, convergent validity, and divergent validity of the research are confirmed and it is determined that the fitness of the research measurement model is appropriate.

The main research model test

The conceptual model of the research was tested using the structural equation modeling technique by the partial least squares (PLS) method (The partial least squares approach is used when the statistical population and the number of items are small or the variables are hidden in two or more levels, which of course was not the last case in this study). The software employed is Smart PLS. In the following, the research model has presented in the form of standard coefficients and the significance state. Fig. 3 shows the original model in the standard coefficient mode. Fig. 4 shows the model in the state of T value or significance. If the T value is greater than 1.96, it means that the statistical relationship is confirmed at a confidence level of at least 95%. Examination of T values shows that eight relations are confirmed and four relations are rejected.

The model fitness Check

Table 6 presents the three main indicators of model fitness. The Goodness of Fit (GOF) index in the PLS model is a practical solution to solve the problem of checking the overall fitness of the model and acts

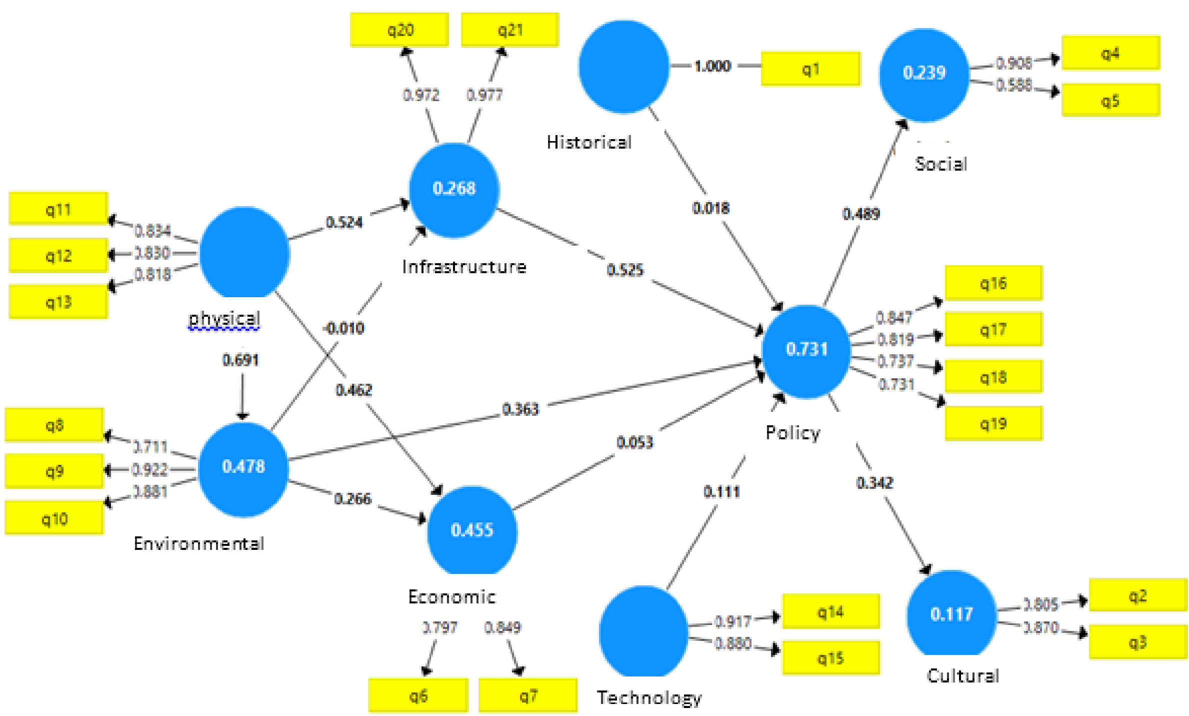

Fig. 3: Research model in the state of standardized path coefficients

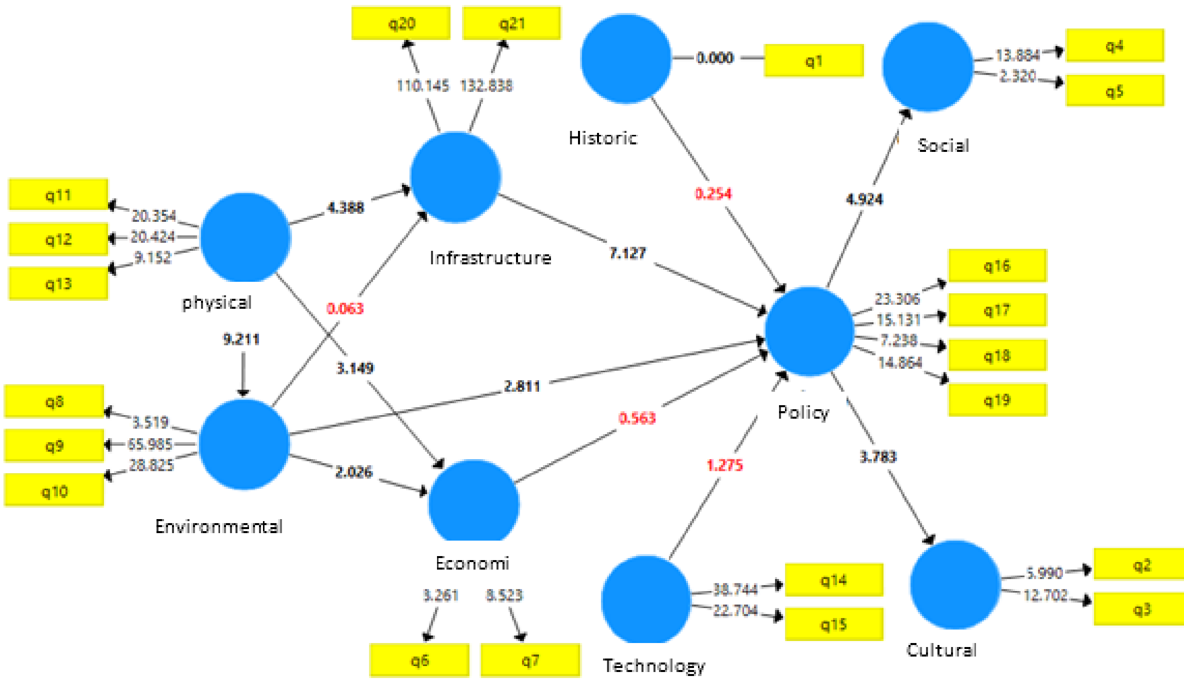

Fig. 4: Research model in a significant state (T-value)

Table 6: Indicators of research model fitness

Dependent or mediating variable	Coefficient of determination index R^2	Redundancy Credit Index Q^2	General Fitness Index GOF
Policy	0.73	0.40	0.49

as the fitness indices in covariance-based methods and can be used to check the validity or quality of the PLS model in general.

According to the results, the determination coefficient for the policy dependent variable is equal to 0.73, which is a good value and shows that this number of affective variables has been able to explain the acceptable amount of changes in the dependent variables. Based on this, the model-independent variables were able to explain 73% of the variance of the policy dependent variable. The value of the Q2 index (CV-Redundancy) for the policy is equal to 0.40, which is positive and above 0.15, so it can be inferred that this index confirms the fitness of the models. The value of the GOF index which measures the overall fitness of the research model is 0.49 which is a good value. It can be said that the GOF index is good because it is higher than the standard value. In general, the examination of the fitness indices shows that the model fitness is acceptable and the model is approved. In other words, the data could be firm support for the model and the model gave an acceptable result in the research sample.

Model relations test

Table 7 reports the results of the research model relations test. In Table 6, the value of the standardized path coefficient, the T value, and the significant level (P-value) are reported. Examination of relations and the conceptual model shows that out of 12 relations and paths in the model, 8 relations have been confirmed ($p < 0.05$).

In this study, the model test indicates the effect of the physical factor on the infrastructure factor with

Table 7: Structural model coefficient test: standardized coefficients, T value, and significance level

Impacts	Standardized coefficient	T-value	P-value	Result
Physical relation to infrastructure	0.52	4.39	<0.001	Confirmed
Physical relation to environment	0.69	9.21	<0.001	Confirmed
Physical relation to economic	0.46	3.15	<0.001	Confirmed
Environmental relation to infrastructure	-0.01	0.06	0.950	Rejected
Environmental relation to economic	0.27	2.03	<0.001	Confirmed
Infrastructure relation to policy	0.52	7.13	<0.001	Confirmed
Environmental relation to policy	0.36	2.81	<0.001	Confirmed
Economic relation to policy	0.05	0.56	0.574	Rejected
Historical relation to Policy	0.02	0.25	0.800	Rejected
Technology relation to Policy	0.11	1.27	0.203	Rejected
Policy relation to Social	0.49	4.92	<0.001	Confirmed
Policy relation to cultural	0.34	3.78	<0.001	Confirmed

an intensity of 0.52. Since infrastructure equipment is one of the basic requirements of society and plays an important role in urban development and sustainability, facilitating access is one of the most important development infrastructures. On the other hand, the body and space constitute service facilities and are necessary for urban sustainability. The results of Douet (2020); Watson and Bentley (2007); Colquhoun (1995) studies also confirm the effect of the physical factor on the infrastructure factor. It is suggested to change the old buildings use with new ones, e.g. construct a cultural and artistic campus in an industrial building. Expand public open spaces and improve the transportation network security. Build a pedestrian promenade for visitors to walk on the factory's old production path for the site's industrial archeology. The strong impact of the physical factor of the environmental factor with a relation intensity of 0.69 indicates the important role of adaptive reuse of industrial heritage buildings in reducing greenhouse gas emissions and energy consumption and an environmentally and sustainability friendly process in the urban landscape. Yung and Chan (2012); Colquhoun (1995); Douglas (2002) also achieved similar results in their studies. In this regard, it is suggested that adaptive reuse of industrial heritage bodies should be done through the landscape to reduce environmental pollution and strengthen the environment quality. It also reduces energy consumption by reusing existing materials in harmony with the industrial heritage environment. Also, the physical factor with a relation intensity of 0.46 has a moderate effect on the economic factor. In a way that the adaptive reuse of the industrial heritage body through landscape leads to the empowerment and growth of tourism and makes a creative economy, which has a significant impact on the economic level. The research results of Vardopoulos (2019); Bullen (2007); Yung and Chan (2012); Xie (2015) are consistent with these findings. The proposed solutions in this field include the use of existing capacities in the industrial heritage space to create environmentally controlled agriculture, as well as the dynamic environment for local entrepreneurs, artisans, and the community plus attracting tourists by beautifying the industrial heritage body through the landscape. The effect of environmental factor on economic factor with the relation intensity equal to 0.27 indicates that cleaning and improving environmental quality in the reuse of industrial heritage through the landscape is one of the factors affecting tourist attraction. Also, due to the existing capacities, saving energy consumption, and increasing productivity, it leads to a favorable environment for the use of national and regional investors and companies. Results of Vardopoulos (2019); Halewood and Hannam (2001) studies agree with this finding. It is suggested that expand open and green spaces for the economic prosperity of a region, increase the value of lands, and build a recreational space to attract tourists. Also, urban agriculture should be used in industrial heritage spaces to attract investors and meet society's needs. The positive and significant effect of the infrastructure factor with the relation intensity equal to 0.52 on the policy factor shows the average effect of the infrastructure factor on the policy factor. Since the maintenance and creation of infrastructure play an important role in urban development and sustainability, therefore, policy-making in the field of infrastructure with the public participation and private sectors is very vital and necessary for countries. This finding is consistent with the results of Watson and Bentle (2007); Colquhoun (1995); Tang and Ho 2015) studies. It is suggested that the private and public sectors provide services and improve infrastructure, also, cooperation and coordination should be done between stakeholders to improve the obligations and laws regarding the domestic reform policies and security (mental and environmental). The average effect of environmental factor on policy factor with a relation intensity equal to 0.36 indicates favorable environmental effects due to the industrial heritage adaptation to the landscape, but due to a lack of environmental legislation in policy, there are challenges between industrial heritage adaptability and regulatory and enforcement requirements. By addressing these challenges and shortcomings and paying attention to the environment and climate, a profound impact can be made on the adaptive reuse of industrial heritage success. The results of Romeo *et al.,* (2015); Ifko (2016); Coratza *et al.,* (2018); also confirm the impact of the environmental factor on the policy factor. It is proposed to consider the expansion, creation, and promotion of laws related to landscape and environment in the development of industrial heritage toward urban sustainability. Also, cooperation and coordination should be established between stakeholders to improve the environmental obligations and laws regarding the preservation of tangible and intangible industrial heritage. The effect of a policy factor on social factor with the relation intensity is equal to 0.49. Policy-making for the benefit of stakeholders in the adaptive reuse of industrial heritage through the landscape by creating new spaces leads to strengthening social participation. On the other hand, it brings together collective and individual memories and creates an emotional bond between stakeholders and industrial heritage. Chavez *et al.,* (2017); Hinnerichsen (2011); Sutestad and Mosler (2016) also achieved these results in their studies. In this regard, it is proposed to develop a comprehensive plan for the development of service and welfare uses, given the existing capacities in the industrial heritage to promote public participation and meet society's needs. Potential places should also be created for public participation (social communication and attention to aesthetic dimensions). The policy factor with a relation intensity equal to 0.34 on the cultural factor indicates that policymaking toward preserving the cultural factor leads to the connection, development, and strengthening the reconstruction of historical memory and place attachment dimensions. Also, paying attention to the cultural context is effective in maintaining the semantic importance and creating a coherent relationship. By employing landscape, it strengthens and presents capacities, identity, sustainable development, and reconstruction of local culture. This finding is consistent with the results of Vardopoulos (2019); Wong (2017); Sugden (2017) studies. In this regard, efforts should be made to turn industrial heritage into a national attraction and to hold annual celebrations close to the industrial heritage, Since the intensity of the relations between environmental, infrastructure, economic, historical, and technology factors on the policy factor has been less than 0.05, they are ineffective and rejected. In this regard, efforts should be made to turn industrial heritage into a national attraction and to hold annual celebrations in industrial heritage. Close to them, because the intensity of the relationship between the above-mentioned factors on the policy factor is less than 0.05, they are ineffective and rejected.

CONCLUSION

This study aims to investigate the factors affecting landscape adaptation with the heritage of the oil industry to achieve urban sustainability. The oil industry, with its historical, technological, cultural, and physical layers, is the main factor in the body of Iran's economy and has significant consequences for Iran, especially Khuzestan. In this regard, to achieve urban sustainability by means of an adaptable landscape with the industrial heritage, new strategies should be adopted and various factors should be reviewed. Destruction of industrial heritage leads to energy loss, damage to the environment, destruction of socio-cultural, economic, and indigenous values. Adaptive use of the Abadan oil industry heritage by means of landscape results in increasing the life of industrial heritage and thus reducing transportation, materials, energy, and pollution, which in turn leads to environmental sustainability. Applying the adaptive landscape with the Abadan oil industry heritage also has economic benefits, which can be referred to as energy efficiency and increasing the building price. Also, the participation of government investment in economic growth provides the development of local businesses by creating jobs, and ideal conditions for prosperity and solving the economic problems of the region. The Abadan oil industry heritage due to its historical and cultural features as tourist attractions can be the main element in the growth and development of tourism. On one hand, maintaining and exploiting its capacities leads to more income and employment in addition to attracting companies, more tourists, and social participation, and ultimately, leads to economic prosperity at the national and regional levels and sustainability. On the other hand, adaptive use of landscape and industrial heritage leads to the strengthening of traditions, indigenous values, identity, continuity of social life as a result of socio-cultural sustainability. The results of this study show that the completion and facilitation of policies also lead to more opportunities for cultural and social interactions in the industrial landscape. So this approach is innovative and much research has been done on the dimensions and characteristics affecting industrial heritage, but none of them had a structural approach regarding the landscape adaptable to the industrial heritage.

AUTHOR CONTRIBUTIONS

H. Faramarzi wrote the literature review, analyzed and interpreted the data, and prepared the manuscript. M. KhakZand helped in research methodology as well as data analysis and interpretation.

M.H. Talebian assisted in the collection and review of literature related to the oil industry heritage and preparation of the manuscript. M. Masoudinejad aided in data analysis and preparation of the manuscript.

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CONFLICT OF INTEREST

The authors announce that there is no conflict of interest regarding the publication of this work. Besides, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

ABBREVIATION

GOF	Goodness of Fit
PLS	Partial least squares
SPSS	Statistical Package for the Social Sciences

REFERENCES

Alanen, A.; Melnick, R., (2000). Preserving cultural landscapes in America. Baltimore: the Johns Hopkins University press. (**264 pages**).

Amir, S.; Gidalizon, E., (1990). An expert-based method for the evaluation of visual absorption capacity of the landscape. J. Environ. Manage. 30: 251-263 (**13 pages**).

Bullen, P., (2007). Adaptive reuse and sustainability of commercial buildings, facilities. 25 (1/2): 20-31 (**12 pages**).

Cantell, S.F., (2005). The adaptive reuse of historic industrial buildings: regulation barriers, best practices and case studies, Virginia Polytechnic Institute and State University.

Chavez, E.; Delgado Mesa, F.; Henthorne, T.; Miller, M., (2017). The Hershey sugar mill in Cuba: from global industrial heritage to local sustainable tourism development, J. Herit. Tourism. 426-439 (**14 pages**).

Cho, M.; Shin, S., (2014). Conservation or economization? Industrial heritage conservation in Incheon, Korea. Habitat. Int. 41: 69-76 (**8 pages**).

Clark, K., (2006). Capturing the public value of heritage. The proceedings of the London conference, English heritage, (**106 pages**).

Colquhoun, I., (1995). Urban regeneration: An international perspective. London: B.T. Batsford, (**176 pages**).

Coratza, P., Vandelli, V.; Soldati, M., (2018). Environmental rehabilitation linking natural and industrial heritage: A master plan for dismissed quarry areas in the Emilia Apennines (Italy), Environ. Earth Sci., 77: 455.

Douet, J., (2020). The heritage of the oil industry TICCIH thematic study, TICCIH the international committee for the conservation of the industrial heritage, (**80 pages**).

Douglas, J., (2002). Building adaptation, Butterworth Heinemann, Oxford, UK., (**680 pages**).

Farahmand, E., (2011). Post-industrial landscape: A new field of landscape architecture. A review of ideas and approaches. J. Landscape. Archit., 3 (16): 26-22 (**5 pages**). (in Persian)

General department of roads and urban development of Khuzestan Province.,(2020).

Ghanbari, A.A., (2018). Industrial heritage in the historical city landscape: The role of the sugar factory in Varamin's urban landscape, Manzar, 10(43): 26-33 (**8 pages**). (in Persian)

Graham, B.; Ashworth, G.; Tundbridge, J., (2000). A geography of heritage: power, culture and economy, London: Arnold. (**288 pages**).

Halewood, C.; Hannam, K., (2001). Viking heritage tourism: authenticity and commodification. Ann. Tour. Res., 28(3): 565-580 (**16 pages**).

Hinnerichsen, M., (2011). Reusing the industrial past by the Tammerkoski rapids discussions on the value of industrial heritage, city of Tampere, museum services, Pirkanmaa provincial museum. (**88 pages**).

Hoyle, B.; Pinder, D.; Husain, M, (1988). Revitalizing the waterfront: international dimensions of dockland redevelopment. London: Belhaven Press (**265 pages**).

Ifko, S., (2016). Comprehensive management of industrial heritage sites as a basis for sustainable regeneration, Procedia. Eng. 161: 2040-2045 (**6 pages**).

Iran Petroleum Museum and Documents.,(2020).

Jepson, Edward.J., (2001). Sustainability and planning diverse concepts and close associations, J. Plan. Lit., 15(4): 499-510 (**12 pages**).

Kaabi Falahiyeh, A., (2015). Abadan refinery: The first refinery in the Middle East. Iran petroleum museum and documents. (In Persian)

Khan Sefid, M., (2008). Study of distribution patterns in urban green spaces with the approach of urban landscape ecology and its relationship with urban sustainability. Proceedings of the national conference on green space and landscape Architecture, 27: 155-147 (**9 pages**). (In Persian)

Khosh Far, Gh.; Bargahi, R.; Karami, Sh., (2014). Social capital and urban sustainability, case study: Gorgan city, 2(8): 31-46 (**16 pages**). (In Persian)

Kirkwood, N., (2013). Manufactured sites: rethinking the post-industrial landscape. Trans. H. Irani behbahani,S.Pilaram,S. ranjbartareh.Tehran: Jahad book store. (**424 pages**). (In Persian)

Langston, C.; Wong, F.; Hui, E.; Shen, L., (2008). Strategic assessment of building adaptive reuse opportunities in Hong Kong. Build Environ, 43(10):1709-1718 (**10 pages**).

Liduino, V.; Servulo, E.; Oliveira, F., (2018). Biosurfactant-assisted phytoremediation of multi-contaminated industrial soil using sunflower (Helianthus annuus L.). J. Environ. Health Sci. Eng. Part A, 53(7): 609-616 (**7 pages**).

Loures, L., (2008). Post-industrial landscapes: dereliction or heritage? Department of landscape architecture; faculty of natural resources, 1st WSEAS international conference on landscape architecture (LA '08), Algarve, Portugal, 23-28 (**6 pages**).

Loures, L., (2020). Introductory chapter: landscape reclamation as a key factor for sustainable development, landscape reclamation - rising from what's left, (**10 pages**).

Mirkatoli, J.; Manifiazar, R., (2009). Introduction to spatial economy. Gorgan: Golestan University Press (**402 pages**). (In Persian)

Mısırlısoy, D.; Günçe, K., (2016). Adaptive reuse strategies for heritage buildings: a holistic approach, Sustain. Cities Soc. 26: 91-98 (**8 pages**).

Moschella, A.; Salemi, A.; Lo Faro, G.; Sanfilippo, M.; Detommaso, M.; Privitera, A., (2013). Historic buildings in Mediterranean area and solar thermal technologies: architectural integration vs preservation criteria. Enrgy. Procedia, 42:416-425 (**10 pages**).

Portney, K., (2003). Taking sustainable cities seriously: economic development, the environment, and quality of life in American cities. Cambridge: MIT Press, (**312 pages**).

Romeo, E.; Morezzi, E.; Rudiero, R., (2015). Industrial heritage: Reflections on the use compatibility of cultural sustainability and energy efficiency. Energy Procedia, 78: 1305-1310 (**6 pages**).

Seidai, E.; Hedayati Moghadam, Z., (2010). The role of security in tourism development, Soc. Sci. Q. Islamic Azad University - Shushtar Branch, Fourth Year, 8: 97-110 (**14 pages**). (In Persian)

Sowińska-Świerkosz, B., (2017). Review of cultural heritage indicators related to landscape: types, categorization schemes and their usefulness in quality assessment, Ecol. Indic. 81: 526–542 (**17 pages**).

Sugden, E., (2017). The adaptive reuse of industrial heritage buildings: a multiple-case studies approach, Waterloo, Ontario, Canada, (**148 pages**).

Sutestad, S.; Mosler, S., (2016). Industrial Heritage and their Legacies: Memento non mori: Remember you shall not die. Procedia-Social and Behavioral Sciences, 225: 321-336 (**16 pages**).

Tang, B.; Ho, W., (2015). Land-use planning and market adjustment under deindustrialization: restructuring of industrial space in Hong Kong. Land use policy, 43: 28-36 (**9 pages**).

Türkyılmaz, Ç., (2016). Interrelated values of cultural landscapes of human settlements: case of Istanbul, procedia - social and behavioral sciences, 222: 502-509 (**8 pages**).

UNESCO.; ICCROM .; ICOMOS .; IUCN., (2012) . World heritage resource manual: managing natural world heritage. the United Nations educational, scientific and cultural organization, (**101 pages**).

Vardopoulos, I., (2019). Critical sustainable development factors in the adaptive reuse of urban industrial buildings. A fuzzy dematel approach, Sustain. Cities Soc. 50: 101-684 (**583 pages**).

Watson, G.; Bentley, I., (2007). Identity by design, Elsevier, Oxford, (**298 pages**).

Wong, L., (2017). Adaptive reuse: extending the lives of buildings. Basel: Birkhäuser, (**264 pages**).

Xie, P., (2015). A life cycle model of industrial heritage development. Ann. Tour. Res., 55: 141-154 (**14 pages**).

Yung, E.; Chan, E., (2012). Implementation challenges to the adaptive reuse of heritage buildings: towards the goals of sustainable, low carbon cities, Habitat Int., 36: 352-361 (**10 pages**).

Zeren, M., (2015). Modernization and reuse of cultural heritage building: a Turkish case study from the Izmir city. J. Civ. Eng. Archit., 9: 16-27 (**12 pages**).

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