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Explaining the Adaptability Model of Industrial Heritage with Landscape

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ABSTRACT: Industrial heritage includes remnants of an industrial period with historical, technological, social, architectural, or scientific value and is therefore worthy of protection. The adaptability of industrial heritage is one of the conservation approaches that will lead to sustainability while preserving heritage and preserving social and cultural values. Accordingly, the purpose of this study is to provide a comprehensive model in the field of industrial heritage adaptability with the perspective that covers as much as possible the components affecting adaptability and empowers stakeholders in this field to answer the questions. This research is of a mixed type, which is done in two qualitative and quantitative phases and two stages of model presentation due to comparative studies and model validation. The components of the proposed research model were identified through a comparative study of 5 successful examples in the field of industrial heritage adaptability to the landscape. In order to validate, the final model was presented to 180 experts, and the model's validity was confirmed using structural equations in the confirmatory factor analysis phase. The results showed that nine economic, historical, physical, social, cultural, infrastructural, technological, environmental, and policy factors affect the adaptability of industrial heritage to the landscape. This research presents an improved model that can be useful in adapting the industrial heritage to the landscape in the country.

Keywords: *Adaptability, Industrial heritage, Landscape, Comparative study, Structural equations.*

INTRODUCTION

The industrial landscapes, which were once considered the economic pulse of the city and a sign of an important movement in human life, declined and were abandoned by lowering the passion of the industrial age (Amini Khanimani, 2015). However, these scenes, with all that has happened to them, form part of the city's identity; and they are also a valuable heritage that, by revitalizing and recreating, it is possible to achieve identity cohesion and cultural enrichment in addition to all the related benefits (Rafati & Haghighatbin, 2015).

Today's post-industrial landscapes are a wide range of abandoned or contaminated industrial sites (Berger, 2006, 17). Scenes that reflect the fusion of history, memory, cultural and organizational concepts. In post-industrial landscapes, socio-economic and cultural consequences are integrated (Rodrigues da Silva, 2012).

The industrial remains of each country are evidence of historical activities and achievements that are motivated to identify and protect them (Fassler, 2013). While developing respect for cultural capital, the opportunity to reuse industrial heritage provides social stability and conditions for the participation of local communities in the protection and preservation of this heritage (Nili et al., 2017).

Adaptability and adaptive reuse are the most common and sustainable effective strategies for the protection and development of industrial heritage, which provides a platform for preserving urban identity and increasing a sense of place (Rezaei Ghahroudy & Mahdavi Nejad, 2019) and includes a series of measures that cause a compromise between the body and the ancient space with today's needs by creating appropriate conditions in the space-physical organization (Habibi & Maghsoudi, 2003, 56).

Adaptive reuse has been proposed as a tool to preserve threatened values and as a sustainable development strategy (Louw, 2016). Adaptive reuse of industrial heritage in urban regeneration can lead to a wide range of benefits, including cost reduction, construction time, environmental improvement,

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payback period and energy savings, creating and strengthening a sense of place, creating skills and jobs, local economic growth, land use efficiency, heritage conservation, cultural diversity and cultural identity preservation (Myers & Wyatt, 2004; Tang & Ho, 2014; Cho & Shin, 2014).

Post-industrial landscapes can create new landscapes based on the day's needs and sustainable development and balance economic, social, cultural, and ecological issues. On the other hand, due to the rapid growth of the city towards the suburbs and the rapid growth of urban construction, the existence of flexible spaces seems more necessary that provide new and diverse cultural and recreational activities for citizens who are tired of the sluggishness of urban life. Therefore, this desolate area, which has the history of the city's industrial identity at its heart, can be considered as a driver of urban development in defining a multi-functional project. Identifying the capacities and potentials in the mentioned sites makes it possible to revive and inject urban life into them and turn a space without proper functions into a living and dynamic space with various desirable urban functions while protecting the existing industrial heritage.

The main issue in protecting and revitalizing industrial heritage remains, including how the industrial heritage is compatible with the landscape? Furthermore, what is the appropriate model for the adaptability of industrial heritage to the landscape?

Theoretical Foundations

Industrial heritage provides practical manifestations of industrial identity. They represent the culture, historical situation, processes, technologies, and outstanding achievements of each region. Nevertheless, industrial heritage has been challenged by the advent of new technology, the depreciation of infrastructure, and sometimes poor planning by the authorities. In today's world, international committees have stated the basic principles to protect them, such as the Docomomo International Committee for the Preservation and Documentation of Modern Architectural and Urban Heritage, the International Committee for the Protection of Industrial Heritage (TICCIH), the International Council on Historical Buildings and Sites (ICOMOS), the Nizhny Tagil Charter, the Dublin Principles, the Taipei Declaration, and the Madrid Document.

Modern conservation theory refers to adaptability as one of the conservation strategies. Protection of unused industrial buildings is one of the most compelling reasons for the emergence of adaptability projects that can maintain and strengthen the sense of industrial location through the benefits of available conversion and more attention to the industrial building in the period of reuse (Rafiei et al., 2014). In other words, the reuse of industrial buildings leads to the creation of an economic resource. It leads to the stability and adequate protection of the heritage building and its environment while protecting the capital and the attention that is inevitably given to the historic building during reuse (Mısırlısoy & Günçe, 2016).

In recent conservation activities, the need for the reuse process has given rise to various dimensions of sustainability, and it varies from maintaining the originality and integrity of the building by minimizing interventions and their reversibility to optimizing energy consumption (Heidari et al., 2019). In addition to introducing the skills and efforts of previous builders, it effectively preserves the historical, cultural, and architectural values of heritage buildings. These values have a scientific impact on decisions to change the building and indicate a two-way relation between adaptability and values (Yazdani Mehr et al., 2017).

Romeo et al. (2015) consider the reuse of industrial heritage as a companion to cultural sustainability and energy efficiency. According to Yung and Chan (2012), changing the use of old buildings means reviving the protection of cities by increasing the useful life of the building and reducing waste from demolition. So it has a different concept of sustainability.

Meanwhile, some postmodern thinkers, including Guy Debord and Giorgio Agamben, consider this dramatic feature of recreated heritage a feature of capitalist society. In their view, spectacle capitalism has reduced everything to drama, and the best manifestation of this drama is in heritage museums. They believe that the museum separates art and history from people's lives and imprisons them in the play frame (Mirniam et al., 2017).

Then in the 1990s. There were criticisms of redevelopment and real estate development plans in the 1980s. Efforts have been made to preserve historic sites, and the participation of local communities and citizens in the conservation and regeneration process is recognized. Also, expectations regarding the quality of rehabilitation programs are improved. Physical renovation is no longer enough, but other aspects should be considered, such as increased employment, poverty reduction, social deprivation, social facilities and educational arrangements, and local community and citizen's participation in the conservation and regeneration process (Hanachi & Fadaei Nejad, 2011).

In a review of previous literature, Magrini and Franco (2016) used the environment and landscape to achieve greater environmental productivity. For example, in their research, Ling et al. (2007) considered the need to review ecological quality, preserve the industrial heritage, and improve the quality of life to achieve an attractive landscape and a competitive environment for people and investors. On the other hand, Oevermann (2015) considered the reuse of industrial heritage as a driver of urban economic development. Louw (2016) also considered the socio-cultural values of industrial heritage and their preservation and strengthening necessary. Aynehchi (2014) also mentioned the most important strategies to encourage the private sector to invest, create the culture and educate people on tourists to avoid any conflict between tourists. From the perspective of Hashimoto and Tefle (2017), the use of industrial heritage is a turning point in paying

attention to different segments of the population and tourists to this old and abandoned building. Bottero et al. (2019) consider the following important in the adaptive reuse of industrial heritage: private car access strategies, pedestrian or public transport access, interior design flexibility, commercial and sports activities/facilities, public services, accommodation, and hospitality.

MATERIALS AND METHODS

The current research process is a kind of mixed research (qualitative-quantitative) with an exploratory approach. The research process in this study consists of two stages: In the qualitative stage, the comparative study research method was used, and a suitable model for adaptation of industrial heritage to the landscape was presented by examining successful examples of the adaptation of industrial heritage to landscape in the world. According to experts, the conceptual model was validated. In this research, data collection has been done in a library and field.

Comparative research is one of the qualitative research methods. It is a kind of study that uses its tools and methods by presenting concepts and scales derived from a broader perspective and increasing our ability to describe and understand various phenomena, including work and scientific processes. After a comparative study and model presentation, a questionnaire based on the initial model was designed to determine the components or pillars of the model. Experts' opinions were received on the impact of each item on the adaptability of industrial heritage to the landscape in the form of a five-point Likert scale (very low = 1, Low = 2, medium = 3, high = 4, and very high = 5). The statistical population in the quantitative part of the research consists of experts in industrial heritage. Since in modeling structural equations, the minimum sample size is determined based on the number of factors, according to the nine factors studied, 180 people were selected by purposive sampling.

The instrument's validity was content validity approved by the panel of relevant experts, and Cronbach's alpha coefficient was used to determine the instrument's reliability. The alpha value obtained for all variables was above 0.7, which indicates the high reliability and stability of the instrument for measuring the components affecting the adaptability of industrial heritage to the landscape. The structural equation modeling was used in the confirmatory factor analysis phase to measure the validity of the designed model and data analysis. Data processing and calculations of this research have been performed using SPSS21 and Lisrel software.

RESULTS AND DISCUSSION

In this part of the research, nine successful and landmark examples were examined designed by successful landscape architects. For this purpose, Duisburg –Nord, Bethlehem Steel Stacks, Domino Park, Gas Park, High Line, Zeche Zollverein, Saarbrücken, Parco Dora, and Buda Mill and Grain were selected. The reason for choosing these samples was that the system was formed based on human interactions and ecological context. Besides, economic, cultural, ecological, landscape and energy aspects are considered design and planning goals. Table1 introduces the studied adaptability samples. The results of comparative studies of selected samples are also given in Table2.

In the following, the components extracted from the studied samples are discussed.

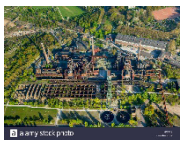
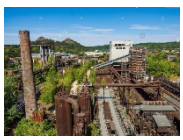
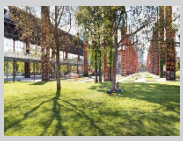
Physical factors: Physical factors play an essential role in developing the landscape adaptable to the industrial heritage. Proshansky et al. (1983), by emphasizing the role of the physical belonging sense in the environment as part of spatial identity, considers it part of individual identity and ultimately the social identity of individuals in different environments. Also, physical elements are derived from users' memories and mental images and play their role as a symbol, resulting from cultural and social values (Javan Foruzaneh & Motalebi, 2011). Thus, strengthening the aesthetic dimensions and objective perceptions of physical elements, including strengthening visual features (Sowińska- Śierwierkosz, 2107) by creating combined landscapes and using the landscape as a combination of culture and nature

(ICOMOS, 1999) from factors influencing the integration of industrial heritage, which leads to strengthening the sense of authenticity and preservation of industrial heritage, such as its body, meaning, structure, and function in the natural environment.

Environmental factors: One of the most critical factors in achieving a comparative perspective with industrial heritage is the "reduction of environmental and visual climate pollutants" (Kirkwood, 2013,83). This is due to the reduction of industrial waste and material consumption (Valdenebro & Gimena, 2018), recycling construction materials and reuse of existing structural components and resources (Yung & Chan, 2012), reduction of greenhouse gas emissions (Magrini & Franco, 2016), the use of institutionalized energy (Louw, 2016). It is also important to note that in the reuse of industrial heritage using landscape, the environment is purified by plants, which leads to the purification and treatment of soil and wastewater leftover from industrial heritage (Kirkwood, 2001,56), improving the quality of the environment and increasing environmental viability (Coratza et al., 2018).

Historical factors: The historical context of a region provides the main ground for the application and development of an adaptable landscape of industrial heritage. Preserving the historical values of industrial heritage (Douet, 2019) introduces the promotion and reuse of contaminated industrial heritage sites through the landscape, which is vital in accelerating the recovery of infected sites and their reuse for public use in cities (Martinat et al., 2018). Also, paying attention to the historical context and using the original patterns, and creating new uses with links to its history through the use of landscape, strengthens and presents the capacities and interaction of

Table 1: Selected examples of comparative study

Sample	Place	Designer	Design Year	Year of recon-struction	Previous use	Current use	Image	Image source
Duisburg –Nord	Germany, Duisburg	Latz and Partners	1995-1994	2002-1999	Iron and steel plant	Park		(Alamy, 2021)
Bethle-hem Steel Stacks	U.S.A, Pennsyl-vania	WRT	2013-2009	2015	Steel plant	Cultural and Artistic Campus		Architectmaga-) (zine, 2021
Domino Park	U.S.A, New York	James Corner	1856	2018	Sugar plant	Park		(Dezeen, 2021)
Gas park	U.S.A, Washing-ton	Richard Haag	1988-1971	1975	Gas plant	Park		Green.uw.edu,) (2021
High Line	U.S.A, New York	James Corner	1934	2002	Freight train route	Park		Streetfurniture,) (2021
Zeche Zoll-verein	Essen, Ger-many	Metro-politan Archi-tecture Office	1847	2003-2006	Central Coal Min-ing Plant	Socio-cultural center		Breitengrad66,) (2021
Saar-brücken	Saar-brücken, Germany	Latz and Partners	1985-1989	-	Coal port	Port Park		(Alamy, 2021)
Parco Dora	Turin, Italy	Latz and Partners	1899	2004-2012	Michelin Tire Fac-tory, Fiat	Park		Latzundpartner,) (2021
Buda Mill and Grain	United States, Texas	Cushing Terrell	1914	2019	Buddha Mill and Grain Com-plex	Socio-cultural complex		Budamilland-) (grain, 2021

historical protection policies with sustainability (Martinat et al., 2018). Therefore, it should be considered as a platform for creating a comparative landscape in industrial heritage.

Infrastructure factors: Improving infrastructure and creating security (mental and environmental) is the prelude to achieving sustainable reuse of industrial heritage through the landscape. These factors create the improvement and development of infrastructure by tourism and lead to the necessary measures to facilitate access to industrial heritage (Arbab & Alborzi, 2019). On the other hand, due to these facilities, reducing development costs and reducing the economic gap between classes will increase the welfare and quality of life for the community around the industrial heritage (Vardopoulos, 2019) and will lead to the unfavorable reduction of urban

Table 2: Results of comparative studies of selected samples

Factors	Duisburg-Nord	Bethlehem SteelStacks	Domino park	Gaz park	High line	Zeche Zollverein	Saarbrücken	Parco Dora	Buda Mill and Grain
Sociocultural	Create a space for public entertainment and recreation	Create a place for annual festivals, art events, and music performances	Contact people with the remains of the main refinery and establish a close relationship with them	Create the perfect place for significant events like annual celebrations	Active participation of people in preserving and reviving the tissue and finding its potentials	The international place for design, dance, and fine arts	Public place for recreational and sports activities	Leisure and cultural events host	A multi-faceted destination focused on community and culture
	Using the information layers of the platform and combining them syntactically	Pay attention to the identity of the site and integrate it with the neighborhood	Expand the nature of the site and create a meaningful interpretation	Strive to become a national attraction	Paying attention to the identity of the site and maintaining the identity of the community	A place for regional cultural identification	Creating a space for social interaction	Recreational use/presence of people is a condition for the survival of the park	Creating a space for social interaction
Historical	Linking historical layers and revitalization technologies for contemporary uses	Preserving the history and integrity of the place and reconstructing the places for contemporary uses	Provide a profound and meaningful interpretation of Brooklyn's historic industrial waterfall	Demonstrating the inversion of the belief in the ugliness of industrial buildings until they were recognized as a potential ability for urban development	Respect for the former uses of the context and increase their continuous presence in the lower part	Protected by UNESCO	A structuralist approach to history	Providing a view of the industrial destruction time	Use of industrial building waste
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Physical	Paying attention to aesthetic aspects and optimal lighting and using bright colors	New design of lighting inside and near stacks and various colors to create a powerful image	Connecting Hanover diffusers with a combination of durability and color and providing new lighting	Using old buildings with new use	Creating a space for movement and pause, paying attention to pedestrians, and turning the old context into a 24-hour public park	Providing exciting visual and spatial experiences	New design for the development of the city using existing urban structures to reconnect them	Demonstrating the interaction of sacred and industrial architecture	Cohesion and balancing of existing structures and new facilities
	Using the color variety of plants as a sign of the possibility or impossibility of accessing paths	Floating the promenade visually from the top of the structure	Create a dynamic urban landscape to activate the neighborhood	The contradiction between the grandeur and permanence of structures and the temporary nature of the landscape	Paying attention to the aesthetic aspects and optimal lighting of the area, especially at night	The importance of aesthetics and the power to stimulate creativity in the project	A fantastic network of gardens and walkways enclosed between walls	Connect and talk to the city/night lights	Preserving the facade of the cotton denim building

Continiue of Table 2: Results of comparative studies of selected samples

Technology	Use of green technology to rehabilitate and restore the industrial site	Marking devices and setting interpretive paths throughout the project, including an interactive digital app for audio tours, .oral history	Renovation of the reducing platform by replacing the concrete structure with the old wooden structure	Preserving industrial waste as a reminder of the genius of human technology development	Use of modern vehicles and projects related to light reflection, laser, and other lighting techniques in the upper and lower parts	Having technological structures	Water system to collect surface water and drainage	Initiation and maintenance of ecological laws by technological processes	Using the necessary materials for drainage
Economic	Design based on reducing maintenance costs and using existing structures	New economic stimulus for the community and surrounding neighborhoods	New economic stimulus for the community and surrounding neighborhoods	Attention to financial economics in removing, filling, or covering contaminated soils to create public places	A new economic stimulus for society and an opportunity for the equitable development of property and market assets	Free efforts to commercially use newly discovered resources	attracting investment in design	Land-use change due to economic exhaustion	Establishing retail stores
Infrastructure	Reducing traffic and change traffic routes from the site	Strengthening existing urban services in the region	Improving overall access and east-west connections	Restoring access to Lake Union and strengthening existing urban services in the area	Injecting urban services into the region and improving the security of the transportation network	Discovering the power of utility beauty	Connecting different neighborhoods of the city with the help of site infrastructure	Water management system	Pedestrian safety using the facility and the area around the site
Policies and laws	Obligations and environmental laws are the only and most crucial deterrent to site development	-	-	Application of the new federal law: Statements of environmental impact for developments	Public sector participation in financing and managing safeguards	A movement in urban planning focused on symbolic cultural initiatives	-	Emphasis on the evacuation of post-industrial areas in urban planning regulations	Approving the symbolic structure by the Buddha History Conservation Commission
environment	Covering contaminated surfaces with compatible and resistant vegetation (phytoremedia-(tion	Increase of local biomass and use of local vegetation (phytoreme-(diation	Use of native plants and flexible vegetation (phytoremedia-(tion	Creating large lawns in parks and vegetation reflecting the subsoil environment (phytore-(mediation	Preservation of plant species in the region along with enrichment of them (phytore-(mediation	Creating green spaces	Using gardens to prevent noise pollution of surrounding highways/ material recycling	The ecological and social life of the site / environmental sustainability	Insulation using steel shells
	Respect for the ecological pattern of the site and the process of ecological evolution of it	The novelty of this project in terms of environmental impact	The park includes a sustainable plant palette to help the coastal resistance	not using giant trees due to chemical saturation and use of minimalist vegetation pallets	Organizing the context ecologically and paying attention to the existing natural substrate	-	Using plants on the abandoned site and several public gardens	Water is an essential element in the design / lush vegetation of an artificial environment	Planting palm trees in front of the cotton denim building to provide shade

development and strengthening endogenous development (Li et al., 2018). Also, the results of Mahdavinejad et al. research Mahdavinejad et al., 2019) state that the definition of borders and areas for industrial heritage sites is a guarantee of complete protection of these sites.

Economic factors: Focusing on industrial heritage sites as a new tourist destination can play an essential role in economic prosperity to reuse industrial heritage (Samavati, 2019).

Maintaining and exploiting their capacity along with the placement of facilities and services, initiative, innovation, enrichment, and diversification of tourism products (Oevermann & Mieg, 2016) has led to income and job creation and has attracted more companies and tourists and ultimately social participation (Xie, 2015; Yang, 2017).

Also, reuse and utilization of industrial heritage capacities by reducing construction costs and time and repair and repayment period (Louw, 2016) and stakeholder support and action for exploiting industrial heritage (Samavati, 2019) can lead to economic prosperity.

Technological factors: The protection of industrial heritage has increased significantly due to the rapid technological and social developments of the twentieth century)Urban & Vukoszavlyev, 2014). One of the approaches used for conservation is the adaptive reuse of industrial heritage through the landscape, which has been done by using innovative technologies to adapt and reconcile the industrial structure with the proposed use (Vardopoulos, 2019). Innovative technologies are done to strengthen industrial heritage's biological and ecological system, including refining, revitalizing, reducing soil and water toxins from chemicals and petroleum by plant cultivation (Liduino et al., 2018), treatment plants, and artificial systems (Kirkwood, 2001,172). In his book, Kirkwood considers plant-based industrial heritage refinement an essential factor in reviving and succeeding in industrial heritage adaptability.

Policies and laws: Creating and promoting laws to use landscape and environment in the development of industrial heritage, by supporting decisions related to socio-economic requirements according to landscape potentials, can be a facilitator in achieving industrial heritage sustainability (Wiggering et al ., 2006). Also, with the cooperation and coordination between stakeholders (Ifko, 2016), the barriers can be removed to improve commitments and laws on domestic policy reform (Al-Tokhais & Thapa, 2019), attention to public sector participation in meeting financial needs (Misirlisoy & Günçe, 2016), management in the direction of protective measures (Oevermann, 2015). In this regard, by compiling and presenting a comprehensive plan for the development of service and welfare uses, the adaptive landscape of industrial heritage can be obtained due to changes in the heritage of structures, places, and areas (ICOMOS, 2017), delimitation (Mahdavinejad et al., 2019) and land protection (Vardopoulos, 2019).

Socio-cultural factors: Paying attention to the socio-cultural context as a common heritage effectively maintains semantic importance and creates a coherent relationship symbolically and physically (Webb, 2017) and leads to the reconstruction of indigenous and local culture and increased public awareness (Vardopoulos, 2019). On the other hand, awareness, capacity building, and encouragement of stakeholder participation (Samavati, 2019) lead to the dynamism and success of industrial heritage adaptability. Also, sharing and emphasizing collective and local memories (Vardopoulos, 2019) strengthens emotional and cognitive ties (Rodrigues da Silva, 2012) to industrial heritage, which brings the solidarity of communities and stakeholders in the reuse of industrial heritage through the creation of new spaces. Table 3 lists the components and indicators of each component obtained from comparative studies. Figure 1 also presents the proposed model of industrial heritage adaptability with the landscape.

Model Validation

To check the validity of the model introduced above, the confirmatory factor analysis method is used. In confirmatory factor analysis, the researcher aims to confirm the specific factor structure supposed to describe, explain or justify the experimental data based on a relatively few parameters. Necessary data for this study were obtained through a questionnaire from 180 experts in industrial heritage and landscape. In the mentioned questionnaire, the opinion of experts was obtained on the extent to which each of the

Table 3: Components of comparative studies

Component	Indicator
Historical	Preservation of industrial heritage historical layers
	Strengthen oral history
Provision of infra-structure	Establish necessary measures to facilitate access to industrial heritage
	Inadequate reduction of urban development and strengthening of endogenous and sustainable development
Economic	Empowerment and tourism growth
	Creative economy growth
Technology	Application of innovative ICT technologies to adapt and re-coordinate the site
	Innovative refining and regeneration technologies
environmental	Outdoor and semi-open space development
	Plant purification of the environment
	Reduce greenhouse gas emissions and environmental pollutants

Continiue of Table 3: Components of comparative studies

Component	Indicator
Physical	Strengthening the aesthetic dimension by creating mixed landscapes
	Strengthen objective perceptions, including valuing visual features
	Utilizing the development and expansion of green space for the integration between industrial heritage and the dependent landscape
	Strengthen the sense of originality
	Preserving the semantic importance and character of industrial heritage
Socio-cultural	Strengthen mental imagery by emphasizing the concepts of soul and the meaning of place
	Strengthen social participation by creating new spaces
	Sharing collective and individual memories and creating an emotional bond between stakeholders and industrial heritage
Policies and laws	Establish and promote laws for the use of landscape and environment in the development of industrial heritage
	Cooperation and coordination between stakeholders to improve obligations and laws
	Develop and present a comprehensive plan for the development of service and welfare uses

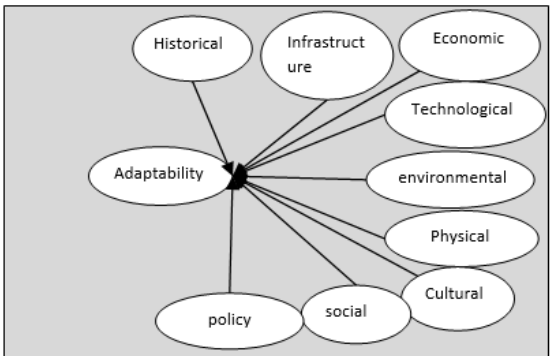

Fig. 1: Adaptive model of industrial heritage adaptability to landscape

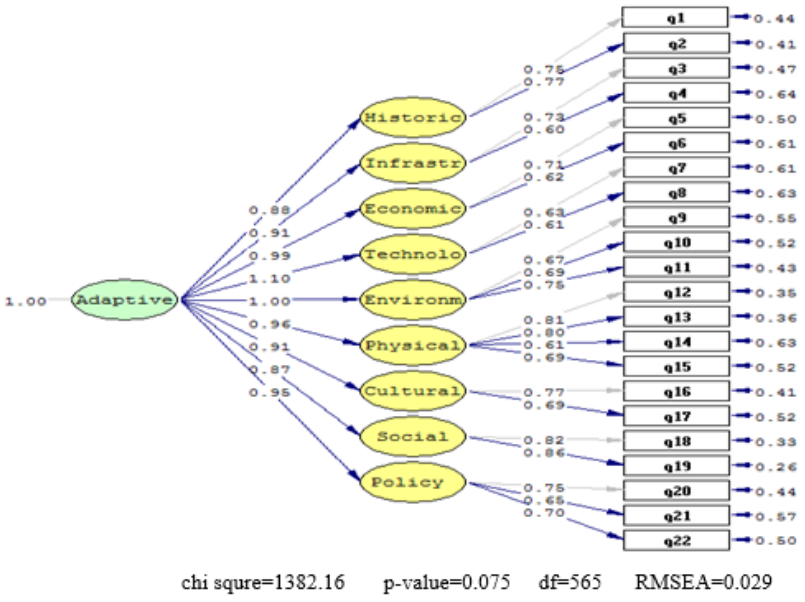

Fig 2: Research model based on standard factor load

Table 4: Results of confirmatory factor analysis

Relations		Path coefficient	T Statistic	Result
Historical	Adaptability	0.88	7.24	Confirmed
Infrastructure	Adaptability	0.91	7.35	Confirmed
Economic	Adaptability	0.99	7.93	Confirmed
Technological	Adaptability	1.10	7.74	Confirmed
environmental	Adaptability	1.0	7.46	Confirmed
Physical	Adaptability	0.96	9.05	Confirmed
Cultural	Adaptability	0.91	7.83	Confirmed
social	Adaptability	0.87	7.99	Confirmed
Policies and laws	Adaptability	0.95	7.95	Confirmed
x^2:1382.16 df:565 p-value: 0.075 GFI: 0.89 CFI: 0.92 NFI: 0.82 RMSEA: 0.029				

variables can be one of the factors influencing the adaptability of industrial heritage to the landscape. Confirmatory factor analysis is used to determine the contribution of each structure to the adaptability of industrial heritage to the landscape. Figure 2 shows the research model based on the standard factor load.

The results showed that historical, infrastructure, economic, technological, environmental, physical, cultural, social, and policy-making components and laws affect the adaptability of industrial heritage to the landscape. The calculated values of T for each of the structures in the meaningful model showed that it is above 1.96 for all structures. Therefore at the 95% confidence level, the relation between the structures with the concept of industrial heritage adaptability is also significant. Path coefficients and the significance of the components' relations to the adaptability of the industrial heritage through the landscape based on the tested conceptual model are shown in Table 4. As the fitness characteristics of the table show, the data of this research have a good fit with the factor structure and theoretical foundation of the research, which indicates the validity of the research findings from the structural model.

CONCLUSION

Due to its unique features and the role it plays in the regeneration of cities, the industrial heritage has been the focus of architects and conservationists to develop the Economic productivity, revitalization, and satisfaction of the complex by injecting a specific use. Landscape adaptation of industrial heritage is a type of urban sustainability strategy; This prolongs the life of buildings and encourages the prevention of waste generation due to demolition and reuse of energy. Also, the opportunity to reuse the industrial heritage, while economic prosperity, job creation, revitalization of unused industrial areas, provides social stability and conditions for the participation of local communities in the protection and preservation of this heritage.

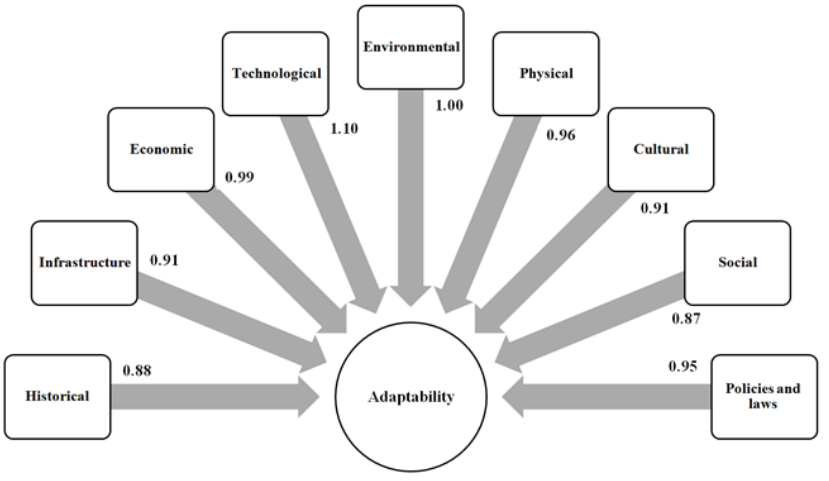

Fig.3: Experimental research model

Hence, protection is not the ultimate goal today; instead, it serves as a mediating strategy for achieving comprehensive and all-encompassing goals and encompasses various dimensions of sustainability.

This study aims to provide a comparative and comprehensive model in the field of industrial heritage adaptability through the landscape. After identifying and selecting five successful case studies of industrial heritage adapted to the landscape, the selected samples were studied to understand the adaptability process and learn from them. Then, industrial heritage through the landscape was presented in the form of a model by extracting the indicators used in the adaptation process in each of them. The model was tested and validated by experts in this field. Based on the results, historical, infrastructural, economic, technological, environmental, physical, cultural, social, policy-making components and laws affect the concept of industrial heritage adaptability through the landscape with path coefficients of 0.88, 0.91, 0.99, 1.10, 0.1 0.96, 0.91, 0.87 and 0.95, respectively. Finally, based on the research findings, it can be said that the factors affecting the adaptability of industrial heritage from the perspective of experts are historical, infrastructural, economic, technology, environmental, physical, cultural, social, policy-making components, and laws that significantly affect the concept of industrial heritage compliance.

In order to adapt and re-equip industrial sites, it should be noted that not all factories can be equipped solely in the role of their industry museums, which has led to the formation of re-conservation goals. Protection is no longer a goal in itself to justify a readjustment project, but it should be increasingly integrated into the multi-functional system of the intervention program. A modern regeneration project aims to achieve economic prosperity, create jobs, revitalize unused industrial areas, build a new community with a dynamic atmosphere while encouraging innovation and creativity. Therefore, today, Conservation is not the ultimate goal and is a mediating solution to achieve broad goals and balance economic interests and historical values. In order to implement development programs in cultural-historical contexts, those in charge of development with the managers of the protection sector should formulate standard policies based on a balanced, comprehensive, and integrated approach while considering economic, social, technological, environmental, and physical criteria. Furthermore, base their plans on the outcome of the "Conservation Protection Recreation Policy." Figure 3 shows the Experimental research model.

The result shows that all the components in the model of industrial heritage adaptability through the landscape are of vital importance and validity. Of course, the technological component has the most significant impact. Therefore, the model can be used as a process-functional model to start adapting industrial heritage through the landscape in each industrial remains. The reasons for the superiority of this model over the models studied during the research process are, on the one hand, its comprehensiveness and, on the other hand, the approval of domestic experts according to local criteria. Although the relations in the model have been validated separately by

experts in industrial heritage, the model presented in this study is a proposed model. Any judgment about the results of the implementation of this model requires the implementation to identify its potential strengths and weaknesses.

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