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DEVELOPMENT DRIVERS FOR URBAN REGENERATION AND LIVABILITY IN WORN-OUT NEIGHBORHOODS

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Abstract. Development driver projects are recognized as tools for revitalizing and regenerating worn-out urban fabrics. Recent studies emphasize the importance of development driver projects for regeneration across three scales: macro, medium, and micro. However, research has lacked an examination of the impact of indicators at all three scales. To fill this research gap, the present study investigates the effect of development driver indicators on the regeneration of the worn-out fabric of Semnan, one of Iran's historic and significant cities. This research initially identifies 16 indicators across the three scales. Data were collected from 385 residents and analyzed using the Phi coefficient and structural equation modeling. The results of the Phi test indicated that development projects could act as "nuclei for urban transformation of the worn-out fabric of Semnan". Furthermore, the structural equation modeling analysis revealed that development driver indicators at the macro scale, such as parks (0.71) and landscape design (0.66), have a significant impact on regeneration. This study emphasizes the importance of a comprehensive approach to regeneration and suggests that active stakeholder participation in various stages of regeneration is essential. The findings of this study can serve as guidance for policymakers and urban planners in Iran and other countries.

Keywords: worn-out issue, regeneration, development drivers, livability, urban development, neighborhood.

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1. Introduction

The share of the world's urban population has reached more than 55%, and this rate is anticipated to rise to 68% by 2050 (Chen et al., 2023; Paul & Sen, 2020). This means two-thirds of the population will live in urban places (He et al., 2021). Therefore, the world has witnessed a growing trend of urbanization as a global phenomenon in recent years (Paul & Sen, 2020). Nearly 90% of the increased urban population settled in Asian and African cities (Hanberry, 2022; Yadav & Ghosh, 2019). This rapid acceleration of urbanization seems quite incompatible with the provision of basic services for city dwellers in developing countries, so major challenges have been posed in urban spaces, especially on historical and worn-out textures.

The formation of these textures dates back many centuries. Their structure has remained relatively unchanged and is not compatible with today's socio-economic conditions, which are the factors of urban development (Hashemkhani Zolfani et al., 2024; Mirzakhani et al., 2021). Many types of research show different problems, such as the deterioration of the physical environment. Complications are visible, such as social exclusion, racial segregation, displacement of the deprived citizens, low-quality housing, undesirable accessibility to public transportation, destruction of historic buildings, low quality of air, and waste disposal (Falanga & Nunes, 2021; Sharma & Abhay, 2022; Sukovata, 2022; Salehi & Jafari, 2024; Dubey, 2024).

At the international level, special attention has been paid to creating opportunities to address this inequality in different regions and neighborhoods. According to the striking combination of socio-economic inequalities and spatial gaps in contemporary cities, urban decision-makers have become more convinced to come up with innovative plans to improve declining environments (Francin, 2015). For this purpose, many urban regeneration projects have been designed in various countries, including Iran (Falanga & Nunes, 2021; Ekemode, 2020), but most of them have not focused on new policies or orientations for the reproduction of urban landscapes involving local association

and involvement (Chen et al., 2020). In the best scenario, ultimately, the implemented projects lead to limited physical development, which does not significantly influence the eroded textures' economic and social structures (Awad & Jung, 2022; Mirzakhani et al., 2021). Therefore, many researchers (Li, 2023; Wang, 2022) stressed the importance of urban driver projects to update the regeneration approach, as they seek the most effective drivers that are compatible with the historical context for restoration (Klingmann, 2023; Sun & Chen, 2023).

In terms of the features and methods of work, development drivers are able to produce marked changes in the cultural, social, and economic fields, and in fact, they are urban artifacts that are not always physical but structural and measurable. These drivers are the essential elements in the process of urban development and renovation in a non-developed space (Berthold, 2015). The urban driver projects have been implemented on three scales: macro, medium, and micro (Doucet, 2007; Bohannon, 2004). These projects were initially considered large-scale projects that concentrated only on economic aspects and did not consider the social ones. Further to reduce the economic, social, and physical costs, Intermediate and micro levels were also considered. According to experts, in these scales (macro, medium, micro), all social and economic dimensions are considered equally, and revitalization in the city and improvement of living conditions are brought about. Since the successful completion of projects can positively impact the provision of housing and services and eliminate social inequalities through economic development, they are highly likely a practical and effective solution for the regeneration of worn-out areas (Vafaei, 2020).

There are studies with regard to the use of development incentives for regeneration. For the first time, in the late 1980s, architects such as Attoe and Logan developed the concept of development drivers from Aldo Rossi's theory in relation to urban and rehabilitation. They presented the theory of urban drivers in their book "American urban architecture" (Attoe & Logan, 1989). Attoe and Logan demonstrated that urban drivers can play a significant role in improving and transforming the urban environment. Therefore, in their research, they placed special emphasis on the concept of development stimulus projects and their role in the urban design process. However, they did not address the impact of these projects on different scales and how they interact with other environmental, social, and economic factors.

The studies on urban regeneration through development drivers reveal significant insights and gaps in the existing literature. For instance, Shemirani et al. (2021) examined the impact of catalytic projects on urban centers. Their findings highlighted improvements in connectivity, public space enhancement, increased public presence, strengthened social interactions, better economic conditions, and reduced pollution. They proposed various development drivers, such as the restoration of historical fabrics and the construction of pedestrian pathways; however, their analysis lacked a detailed examination of the functional scale and categorization of these drivers. This oversight is common in many studies (Heesche et al., 2022; Dixon, 2005), which often provide broad solutions without considering the varying impacts based on scale. The functional scale macro, medium, and micro of development drivers is crucial for understanding their influence on urban regeneration. This research aims to fill this gap by proposing a novel classification of development drivers and conducting a comparative examination of their effects on urban regeneration and livability. Additionally, considering a multi-scalar approach helps to avoid the implementation of projects that are not compatible with the social, economic, and physical characteristics of the targeted fabric. For example, in deteriorated areas where there is insufficient space for macro-scale projects, focusing on micro and medium drivers can be a more effective strategy. Based on the concept of urban drivers, the present study aimed to investigate the development incentives on three scales in a significant historical city in Iran.

As an ancient civilization, Iran has over 40,000 hectares of worn-out urban fabric (Sarvari et al., 2021). Semnan, one of the country's most important and historical cities, with more than 450 hectares of worn-out urban fabric, faces numerous problems (Hasanzade Tavakoli et al., 2020). These fabrics face serious problems such as crime, violence, insecurity, segregation, and physical problems. As mentioned, global urbanization trends, particularly in developing countries, have led to the unbalanced expansion of cities and increased pressure on urban infrastructures. In the case of Semnan, these trends have manifested as exacerbated problems in historical and worn-out neighborhoods. For example, widespread migration from rural areas to the city of Semnan has resulted in increased population density in these neighborhoods. This issue has intensified problems such as insecurity, crime and violence, reduced housing quality, and inadequate access to urban services. Consequently, the historical and worn-out neighborhoods of Semnan are not only physically deteriorating but also face social and economic deprivation and inequality. Therefore, research has been conducted on Semnan's worn-out fabric in recent years. The Semnan Municipality carried out a study in 2007 that was a strategic plan for the cultural-historical sections. However, this plan was unsuccessful, as it only focused on the current state of the physical structure related to renovating and rehabilitating historical and worn-out fabrics. Therefore, this study investigates the feasibility of using urban development drivers to revitalize the worn-out fabric of Semnan City.

2. Regeneration

Over the past fifty years, various policies have been proposed to solve the predicaments of worn-out textures; different governments have attempted to fill the gap resulting from the collapse of these tissues (Lees & Melhuish, 2015). The initial policies (the 1950s) were related to regeneration. Generally, the term "regeneration" came into

being after World War II due to the destruction and damage of the war (Gökşin & Müderrisoğlu, 2005). In this period, the primary efforts focused on the physical reconstruction based on projects such as public housing (Temelová, 2007). In the 1960s, issues like public welfare were raised (Mehan, 2016), which caused reviving as a new policy was replaced with regeneration (Gökşin & Müderrisoğlu, 2005). During this period, political orientation shifted towards a greater balance between the public and private sectors, social improvement, and welfare. In the 1970s, new decisions called modernization of cities' internal policies began to focus on social, economic, and environmental issues. Also, the need for new methods of intervention at the city level became more important than traditional approaches, which brought the physical structure of cities into more focus; hence, the attention to social and economic matters became more visible (Francin, 2015). With the increasing difficulties of the worn-out urban fabric and urban centers in the 1980s, major redevelopment programs that mainly supported the advancement in the urban economic and cultural competition took the place of previous policies (Gökşin & Müderrisoğlu, 2005), thereby regeneration by the private sector (Mehan, 2016). In this decade, the development of various large-scale projects and the redevelopment of inner and outer city projects on a macro scale were the focal points; moreover, the role of the private sector and the growth of companies were given special attention (Francin, 2015). Finally, in the 1990s, the requirement for a more comprehensive policy, including urban regeneration, was presented the notice of executive policies increased, and more emphasis was placed on integrated measures (Gökşin & Müderrisoğlu, 2005). The integrated actions include a set of interventions that are able to cope with challenges such as physical degradation and socio-economic problems of eroded fabrics (Nesticò et al., 2020), and in terms of the historical context of the textures, these interventions should be implemented in such a way to preserve the landscape and environment of the tissues and optimize their land through applying the principles of sustainability and participation (Dipace, 2014; Fasolino et al., 2016; Morano & Tajani, 2018). Thus, urban regeneration is a grand strategy of social and economic development worldwide, gradually changing from the concentration of physical alterations on a large scale to diversity, sustainability, equality, and livability in the city (Chen et al., 2020). In general, it seemed that at the beginning of the 21st century, a comprehensive and integrated policy was introduced that resolved many of the crises of urban decay (Mehan, 2016).

3. Development-inducing projects in regeneration

The utilization of urban catalysts goes back to the existence of a situation in its urban fabric that necessitates making fundamental changes due to the degradation, exclusion,

Table 1. Advantages of using development incentives in regeneration

Authors	Advantages	Scale		
		Macro	Medium	Micro
Inam (2002)	Development drivers can contribute urban renewal by cooperation, long term employment, investment attraction in poor areas and increase business and tax	*	*	*
Shen (2013)	Development drivers have the potential to bring about change in the economic, social, cultural and aesthetic contexts of the elements around them	*	*	*
Attoe and Logan (1989)	Stimulus elements cause constructive changes in social, economic, legal, political, or even architectural contexts	*	*	*
	In the design process, development-driven projects are flexible so that they can adapt to future changes			*
	Developmental stimuli can reinforce valuable elements in the tissue and help them develop			*
	Development-driven development projects are selected according to the context, thus helping to strengthen the spatial structure and increase identity		*	*
Doucet (2007)	Development incentive projects lead to economic development (state improvement, increase of land price, making investment, job creation, etc.) tourism (increase of visitors), social (population increase)	*		
Francin (2015)	Development driver projects cause the increase of residents' partnership and the companionship between the public and authorities			*
	Development incentive projects cause the creation of job, the improvement on physical quality according to aesthetic point of view also the increase in visitors and the creation of livability	*	*	*
	Development drivers as effective patterns can contribute the expansion of using them in future developments of regeneration	*	*	*
	Development incentive projects make a connection between the past and the present, developing identity and construction programs		*	*

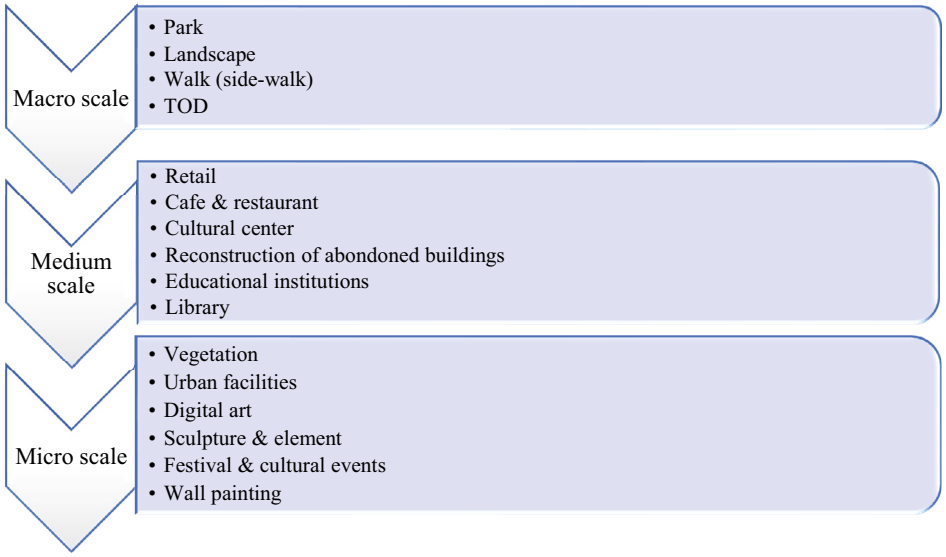

Figure 1. The most important indicators of development driver in the literature review

insecurity, and instability of an urban zone (Sarkheyli & Zakerhaghighi, 2021). According to Attoe and Logan (1989), the catalyst is an urban element that is formed by a city and then, in turn, provides its context, and its goal is basically the gradual and continuous regeneration of the urban tissue so that the subsequent developments are stimulated and guided. Eventually, these development drivers are able to create a new and recovering identity for an urban texture and promote its desirability (Sarkheyli & Zakerhaghighi, 2021).

The major objective of development incentive projects is to result in rapid changes in the context, accelerating the pace of changes and enhancing the quality of life and livability in the tissue (Francin, 2015). Accordingly, the benefits of development drivers in regeneration are stated in Table 1.

Different types of physical and non-physical interventions may be termed urban stimuli, which undoubtedly have different characteristics and effects while pursuing similar goals, such as accelerating urban development and regeneration (Sarkheyli & Zakerhaghighi, 2021). In fact, they cover a wide range of activities and ongoing spatial features related to cities' public life.

In this regard, considering the literature review, the indicators of development driver projects are presented in Figure 1.

4. Methodology

4.1. Case study

Semnan is located in the northern part of Iran, which has an arid and semi-arid climate. This city is historically two thousand years old. In terms of physical divisions, Semnan is divided into three districts and 40 neighborhoods. Among the districts of Semnan City, District 1 is the historical center of the city, which encompasses the entire worn-out fabric and includes 16 neighborhoods (Figure 2). This district has an area of 1,088 hectares, with more than 450 hectares recognized as worn-out (Korkehabadi et al., 2019). It has a 55,538 population, which consists of 30% of the total population of Semnan (Statistical Center of Iran, 2019). Residential land use has the main share among the others; barren, unused lands and ruined spaces include the largest area of existing land uses after residential (Table 2). Furthermore, the land uses of the eroded fabric of Semnan have three characteristics: 1) includes blocks with more than 50% of properties less than 100 square meters, 2) blocks that more than 50% of them are eroded, 3) blocks with more than 50% of pathways that their width is less than 6 meters (Arman Shahr Consulting Engineers, 2015).

Since the implementation of projects requires wasteland and unused open spaces, it can be said that it is possible to implement stimulating development projects due to the existence of barren lands and gardens by doing the physical-spacial survey of area 1 in Semnan City (Table 2). As residents are under the most influence of interventions, their opinion is critical, and this results from active participation in finishing the regeneration measures. Therefore, a questionnaire was prepared to survey the residents' points of view. The following steps of research were conducted:

Step 1: Extracting the indicators of development drivers according to the world literature on urban catalyst projects for regeneration (this step is presented based on the conceptual model in Table 3).

Step 2: Monitoring questionnaire reliability.

Step 3: Surveying the relation between development incentive projects and regeneration of worn-out urban texture.

Step 4: Prioritizing the projects of development-driven projects based on the resident's point of view.

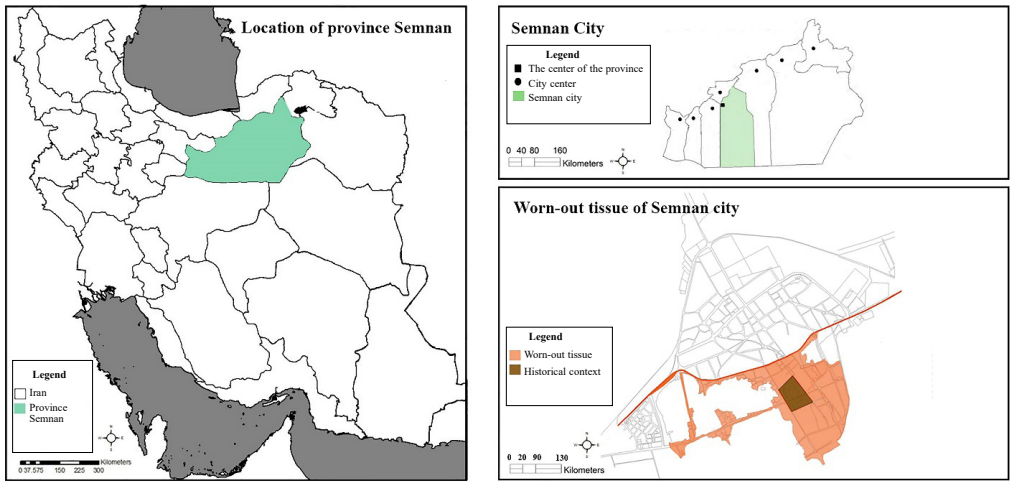

Figure 2. Spatial location of Semnan in Iran; and spatial location of Semnan in Semnan Province; and Spatial distribution of worn-out texture in Semnan

Table 2. Land use of the current situation of the worn-out urban texture of Semnan City (source: Arman Shahr Consulting Engineers, 2015)

Land uses	%	Land uses	%
Residential	42.75	Transportation & parking	0.86
Wasteland	15.39	Non-residential complex	0.75
Run-down	10.97	Warehouse	0.15
Commercial	9.58	Green space	0.13
Religious	6.30	Health-care	0.07
Gardens & agriculture	3.63	Workshop	0.04
Storeroom	3.26	Residential complex	0.02
Educational	2.26	Municipal facilities and equipment	0.16
Cultural	2.09	Tourism & accommodation	0.16
Historical heritage	1.07	Sum	100

The statistical population included residents of Semnan who had an eroded texture. According to the population of worn tissue (55538), Cochran's formula was used to determine the sample size of 385 individuals.

4.2. The main research procedures

At first, 15 questionnaires were distributed to assess the reliability of the residents' questionnaires. Cronbach's alpha method was used to estimate the initial reliability. After that, 370 questionnaires were circulated among the residents of the eroded neighborhood and then processed using SPSS Software. Therefore, according to the purpose of the research, the following tests were used:

Chi-square in SPSS was used to examine the relationship between development incentive projects and the regeneration of worn-out texture (Second stage).

Structural Equation Modeling in Amos Software was utilized to identify and prioritize the contributing factors of development driver indicators for urban regeneration (Fourth stage).

4.3. Phi coefficient

The phi coefficient is used to examine the connection between two nominal variables, each of which has two levels. This test's numerical value is from negative to positive (–1 to +1). Therefore, if the resulting number is zero, it indicates no relationship, and if it is between zero and half (0.5), the connection is weak, and if it is more than half, it expresses the high intensity of the relation.

The following equation is used to calculate the correlation coefficient (Ovwigho, 2013).

$$\Phi = \frac{(bc)-(ad)}{\sqrt{(a+b)(a+c)(b+d)(c+d)}}.$$

4.4. Structural equation modeling

Structural Equation Modeling (SEM) consists of two components: a structural model defining the causal structure between latent variables and a measurement model specifying the connection between latent and observable

Table 3. Research indexes and items

Indicator	Items	Kana (2012)	Francin (2015)	Shen et al. (2021)	Hlaváček et al. (2016)	Ferilli et al. (2017)	Aitani (2017)	Della Lucia et al. (2017)	Pourzakarya and Bahramjerdi (2019)	Tihanyi (2016)	Colorni et al. (2017)	Kim (2015)	Branco et al. (2024)	Della Spina (2019)	Chen et al. (2020)	Aitani and Sathaye (2018)	Zheng (2017)	Mohammadi and Fakharzadeh (2022)	Samara (2020)	Awad and Jung (2022)
Development driver at macro scale (open space)	Park	*	*								*					*				
	Landscape design between open spaces and landscape design			*	*				*				*	*		*				
	Pavement				*															
	TOD		*		*				*				*							
Development driver at medium scale (building)	Store, retail & commercial center	*	*		*		*													
	Café & restaurant	*	*																	
	Cultural center		*																	
	Regeneration of abandoned art buildings (school, university, etc.)							*	*	*	*							*		
	institution		*									*								
	Library		*				*													
Development driver at micro scale (public art)	Vegetation										*				*					
	Furniture and lighting equipment									*					*					
	Digital art									*					*					
	Sculpture & Element									*					*		*		*	
	Exhibitions, festivals & cultural events	*		*	*	*		*		*		*	*		*					*
	Mural									*					*					*

variables (Stein et al., 2017). Structural equation models can be analyzed using Amos software, in which the default model measures the model's significance and validity. This test is obtained by applying the Chi-square index to the current data set through the structural model. The index of Chi-square is defined to evaluate the model's overall fit and determine the magnitude of the discrepancy between the estimated and observed covariance matrix. However, it is replaced with other indicators (like Chi-square to the degree of freedom) due to its limitation (sensitive to sample size) (McIntosh, 2007). Also, accepting a model that is created by theoretical assumptions relies on the goodness of fit test in SEM.

Assessing the model's fitness in the SEM is not as simple as in other statistical analyses in which variables are measured without error. Since there is no significant test to show whether the developed model is consistent with the obtained experimental data, many goodnesses of fit indexes should be considered depending on the type of data in the model in order to decide whether the model

Table 4. Goodness-of-fit indicators for the evaluation model

Index	Full index name	Ideal value	Source
χ^2/df	Chi-square/Degree of freedom	χ^2/df < 3	Ting et al. (2019), Kline (2011)
P (Chisq)	Chi-square associated *p* value	*P* ≥ 0 / 05	Kula (2011)
RMSEA	Root Mean Square Error of Approximation	RMSEA < 0.08	Kline (2011)
PCLOSE		PCLOSE ≥ 0 / 05	Kula (2011)
GFI	Goodness of Fit	GFI ≥ 0 / 9	Ting et al. (2019)
NFI	Normed Fit Index	NFI ≥ 0 / 9	Ting et al. (2019)
PNFI	Parsimonious Normed Fit Index	PNFI > 0 / 5	Ting et al. (2019)
CFI	Comparative Fit Index	GFI ≥ 0 / 9	Ting et al. (2019), Kline (2011)

has fitness or not (Schermelleh-Engel et al., 2003). According to Schermelleh-Engel's (2003) and Hu and Bentler's (1998) statements, there is no consensus on which goodness of fit index should be considered when evaluating the model. However, the report of all indicators should be avoided. To evaluate the model, researchers offer recommendations for fit indicators. For example, Kline (2011) put forward the Normed Fit Index (NFI), Comparative Fit Index (CFI), Non-normed Fit Index (NNFI), and Standardized Root Mean Square Residual (SRMR). On the contrary, Hu and Bentler (1998) emphasized the Chi-square, Root Mean Square Error of Approximation (RMSEA), Relative Fit Index (RFI), Incremental Fit Index (IFI), Tucker-Lewis Index, and Comparative Fit Index (Kula, 2011). The following table shows the most widely used fit indices and the desired numerical value of each indicator (Table 4).

5. Findings

This section comprises 3 of 4 stages of research. The first step was performed in the conceptual model and in Table 3. The second step is to check the reliability of the research questionnaire to make certain that the research questionnaire provides the same results under the same conditions. Fifteen questionnaires were distributed to carry out the evaluation of the questionnaire, and then the reliability of the questions was calculated by computer. As can be seen in Table 5, Cronbach's Alpha for all questions was 0.771, indicating the high reliability of the questionnaire. Therefore, 370 questionnaires were circulated among the residents of worm-out tissue after they were passed into SPSS Software.

In the third step, an investigation was conducted into the relationship between development incentive projects and the regeneration of eroded urban fabric. The Phi coefficient was used for this survey. This test's numerical value is from negative to positive (–1 to +1). Therefore, if the resulting number is zero, it indicates no relationship, and if it is between zero and half (0.5), the connection is weak, and if it is more than half, it expresses the high intensity of the relation. As can be seen in Table 6, there is a strong relationship between development driver variables and the regeneration of worn-out urban fabric. Among the criteria, the macro-scale criterion is more related to the regeneration of worn-out texture.

Table 5. Alpha of whole questions related to the questionnaire

Questionnaire type	Question numbers	Alfa for questions
Residents	15	0/771

Table 6. Results of Chi-square for drivers of development standards in worn-out texture

Criteria	Question number	Standard deviation	Phi coefficient
Macro-scale	385	0/702	0/82
Mediocre-scale	385	0/623	0/79
Micro-scale	385	0/743	0/68

The fourth step is related to the prioritization of development incentive indexes according to the residents' point of view. Firstly, the goodness of fit indices was assessed to test the model's validity. The goodness of fit indicators was within the acceptable range, and the model was well-suited. According to Table 7, all goodness of fit indicators were higher than the recommended values:

χ^2/df = 0/987, P (Chisq) = 0/816, RMSEA = 0/049, PCLOSE = 0/619, GFI = 0/945, NFI = 0/919, PNFI = 0/568, CFI = 0/999.

Table 7. Goodness of fit indexes of model

Fit index	Ideal value	Result	Conclusion
χ^2/df	χ^2/df < 3	0.987	Acceptable
P (Chisq)	P ≥ 0/05	0.816	Acceptable
RMSEA	RMSEA < 0/08	0.049	Acceptable
PCLOSE	PCLOSE ≥ 0/05	0.619	Acceptable
GFI	GFI ≥ 0/9	0.945	Acceptable
NFI	NFI ≥ 0/9	0.019	Acceptable
PNFI	PNFI > 0/5	0.568	Acceptable
CFI	GFI ≥ 0/9	0.999	Acceptable

Table 8. Calculated coefficients of variables and indicators of development drivers

Latent variable	Calculated coefficient	Visible index	Calculated coefficient	Meaningfulness	Priority
Macro scale	0.63	Park	0.71	***	1
		Landscape design between open spaces	0.69	***	2
		Pavement	0.52	***	7
		TOD	0.42	***	10
Medium scale	0.52	Cultural center	0.57	***	6
		Institution	0.41	***	11
		Retail	0.65	***	3
		Café & restaurant	0.61	***	4
		Library	0.31	***	15
		Reconstruction of abandoned art buildings	0.57	***	6
Micro scale	0.41	Sculpture & element	0.36	***	14
		Digital art	0.40	***	12
		Festival & cultural events	0.46	***	9
		Mural	0.38	***	13
		Vegetation	0.59	***	5
		Urban facilities	0.49	***	8

Secondly, after the significance and evaluation of the goodness of fit model at the desired level, the results of testing the structural equation model for development incentive indicators by the residents were presented in Table 8. Factor loading between zero to one (0–1) shows the importance of each of the indicators from the residents' opinions. The results show that the park indicator with a coefficient of 0.71 had the highest scores as it was related to the large-scale development driver. Then, the other indices were prioritized, including landscape design between open spaces (0.66), retail (0.65), café (0.61), and planting trees (0.59). Also, the indexes of the library (0.31), sculpture (0.36), and wall painting (0.38) were given the last priorities in the table, revealing their lesser importance (Table 8).

6. Conclusions and discussion

The relatively large area of worn-out tissue in the city of Semnan has caused many problems in terms of livability. Socio-economic decline and functional-physical disorders, along with the low quality of the urban environment, have contributed to the depopulation of the texture, and no project has been done to regenerate the worn-out tissue in the city. Therefore, it is necessary to use new approaches, such as developmental drivers, to reconstruct the texture. As new urban redevelopment strategies, urban development drivers include projects that are carried out on three scales. Accordingly, the present study aimed to examine development drivers' projects on three scales, including macro scale (park, landscape design between open, pavement, TOD), medium (cultural center, institution, retail, café & restaurant, library, reconstruction of abandoned art buildings), and micro (sculpture & element, digital art, festival & cultural events, mural, vegetation, urban facilities) in order to evaluate the potential and capabilities of urban development drivers in the regeneration of the worn-out texture in the city of Semnan. The results indicated a strong relationship between development driver variables and regeneration of the worn-out tissue based on Chi-square. Hence, the driver projects can act as "nuclei of urban reformation of the worn-out tissue of Semnan" and could be an essential tool to rebuild life and livability to this texture. However, the main purpose of this study was to identify the contributing factor of development driver in the regeneration of worn-out tissue. Structural equations were used for this aim. The results of the structural equation model signify that the development driver at the macro scale had the greatest effect on the development of regeneration with the calculated coefficient (0.63), while the development driver at the medium scale with the coefficient (0.52) and development driver at micro-scale with the coefficient (0.41) had the least impact on development and regeneration. The most contributory factors on a large scale were indicators such as a park (0.71) and landscape design between open spaces (0.69).

Examining the previous study, we concluded that the results of our study are in line with the outcomes of the investigation (Awad & Jung, 2022; Samara, 2020; Mohammadi & Fakharzadeh, 2022; Kim, 2015; Palermo, 2014; Dixon, 2005) as they put emphasis on the role of development drivers in regeneration, but the critical point is the type of indicators and the effectiveness of development drivers' indicators which are different in various types of research. For further explanation, we can refer to the following examples:

In the Coventry Phoenix Initiative on a macro and medium scale, Palermo (2014) used indicators like pavements, spaces, squares, and public gardens on a large scale to encourage people to stay in the city center, and he also assessed a number of cafes, bars, and shops on a medium scale. In the urban regeneration of the Samlye Art Village, Kim (2015) used indicators such as a library, cultural café, seminar room, etc., on a medium scale, as indicators like exhibitions, tradition, and digital arts on a micro-scale that, finally, the village regeneration was carried out by stakeholders. As can be seen, the level of scales and the type of indicators are different in the two studies. In addition, Awad and Jung (2022) worked on the cultural sector on a micro-scale, Samarra (2020) did a study on local creative industries on a small scale, and Mohammadi and Fakharzadeh (2022) placed emphasis on the establishment of an art college on a medium scale. Dixon (2005) has emphasized the importance of retail in the regeneration of worn-out urban fabrics. Many of these studies have highlighted the role of cafés and restaurants in the economic revitalization of affected areas. Thus, these spaces not only create job opportunities but also act as catalysts for economic growth by attracting visitors and stimulating local businesses.

Like the other research, the present study found that development driver projects have the potential to regenerate worn-out tissue, but the forgotten issue in the previous study, which was considered in this paper, is the simultaneous attention to development driver indicators in three scales, including macro, medium, and micro also the effectiveness of each of the scales and indicators. The findings of this study indicate that development drivers at various scales, including retail businesses and cafés/restaurants at the medium scale and greenery, urban furniture, and lighting equipment at the small scale, play a critical role in the regeneration of the historical and deteriorated fabric of Semnan.

Establishing cafés, restaurants, and retail businesses can enhance the tourism appeal of the worn-out neighborhoods, facilitate visits to historical and cultural landmarks, and provide opportunities for the public to engage with the area's cultural and historical values. These interventions also have the potential to attract domestic and foreign investors, ensuring financial resources for urban regeneration and improvement projects. Furthermore, the development of these spaces can create new employment opportunities, improve the financial and social conditions of the residents in these neighborhoods, and ultimately contribute to reducing inequalities. Additionally, the study highlights the pivotal role of small-scale interventions, such as greenery, urban furniture, and proper lighting systems, in improving the livability of these neighborhoods. Introducing greenery not only reduces air pollution and enhances environmental quality but also increases the visual appeal of the area, instilling a sense of tranquility and freshness among visitors. Urban furniture, such as benches and shaded seating areas, further enhances visitor comfort and fosters spaces for social interaction and recreational activities. Moreover, the implementation of adequate lighting systems, particularly during nighttime, can significantly improve the sense of security and enhance nighttime vibrancy. Thoughtfully designed lighting can also highlight the aesthetic features of historical landmarks, facilitating visits outside daylight hours and contributing to increased visitor numbers and economic prosperity in these neighborhoods. For the successful implementation of these measures, forming public-private partnerships and continuously monitoring project progress through performance indicators is recommended. This comprehensive approach can lead to the revitalization of historical fabrics and reduce social and economic inequalities in Semnan.

Considering these findings and the innovative framework of this study, which evaluates development drivers based on their functional scale, it can be concluded that the proposed strategies not only improve the quality of life for residents and enhance the livability of these neighborhoods but also offer a sustainable and replicable model for the regeneration of deteriorated urban fabrics in other cities. Nonetheless, it is necessary to examine the physical, economic, and managerial feasibility in future research because the utilization of development driver projects requires the active participation and comprehensive approach of managers, citizens, and other stakeholders in the physical, economic, cultural, social, and managerial contexts.

Considering the findings of this study and emphasizing the importance of stakeholder participation in the regeneration of worn-out neighborhoods, it is essential to design practical mechanisms for attracting and effectively collaborating with them. One proposed solution is to establish joint committees composed of representatives from local government, the private sector, civil society, and local residents to manage conflicting interests and set priorities through dialogue and coordination. Additionally, creating transparent platforms for information exchange and collective decision-making can enhance trust among stakeholders. To address the challenge of limited resources, innovative financing models such as public-private partnerships (PPP) or attracting foreign investors can be utilized. Furthermore, educating and empowering the local community to actively participate in projects and foster a sense of collective ownership plays a key role in ensuring the sustainability and success of these initiatives. These approaches not only mitigate existing challenges but also pave the way for the effective and equitable implementation of regeneration projects.

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Author contributions

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References

Aitani, K., & Sathaye, V. (2018, April). New York high line as urban catalyst: Impact to neighbourhood. In *24th ISUF International Conference*: *City and Territory in the Globalization Age* (pp. 1665–1672). Valencia, Spain. https://doi.org/10.4995/ISUF2017.2017.5882

Aitani, K. (2017). The idea stores as urban catalyst to uplift the life of residents in the London Borough of Tower Hamlets. In *Seoul World Architects Congress* (pp. 1–9). Seoul, South Korea.

Arman Shahr Consulting Engineers. (2015). *Comprehensive plan of Semnan city*. Supreme Council of Urban Planning and Architecture of Iran.

Attoe, W., & Logan, D. (1989). *American urban architecture: Catalysts in the design of cities* (2nd ed.). University of California Press.

Awad, J., & Jung, C. (2022). Extracting the planning elements for sustainable urban regeneration in Dubai with AHP (Analytic Hierarchy Process). *Sustainable Cities and Society*, *76*, Article 103496. https://doi.org/10.1016/j.scs.2021.103496

Berthold, S. (2015). Urban catalysts protagonists of urban transformation in Bangkok's neighbourhoods. *Traditional Dwellings and Settlements Review*, *26*(1), 100–111.

Bohannon, C. L. (2004). *The urban catalyst concept* [Doctoral dissertation, Virginia Tech]. https://vtechworks.lib.vt.edu/items/019e4d9d-0dac-467c-b545-c15323402091

Branco, R., Canelas, P., & Alves, S. (2024). The governance of urban regeneration in Lisbon: Drivers of continuity and change. *Cities*, *154*, Article 105324. https://doi.org/10.1016/j.cities.2024.105324

Chen, M., Chen, L., Zhou, Y., Hu, M., Jiang, Y., Huang, D., Gong, D., & Xian, Y. (2023). Rising vulnerability of compound risk inequality to ageing and extreme heatwave exposure in global cities. *Npj Urban Sustainability*, *3*(1), Article 38. https://doi.org/10.1038/s42949-023-00118-9

Chen, X., Zhu, H., & Yuan, Z. (2020). Contested memory amidst rapid urban transition: The cultural politics of urban regeneration in Guangzhou, China. *Cities*, *102*, Article 102755. https://doi.org/10.1016/j.cities.2020.102755

Colorni, A., Ferretti, V., Luè, A., Oppio, A., Paruscio, V., & Tomasini, L. (2017, July 3–6). Rethinking feasibility analysis for urban development: A multidimensional decision support tool. In *Lecture notes in computer science: Vol. 10406. Computational science and its applications – ICCSA 2017* (pp. 624–638). Springer International Publishing. https://doi.org/10.1007/978-3-319-62398-6_44

Della Lucia, M., Trunfio, M., & Go, F. M. (2017). Heritage and urban regeneration: Towards creative tourism. In N. Bellini & C. Pasquinelli (Eds.), *Tourism in the city*. Springer. https://doi.org/10.1007/978-3-319-26877-4_12

Della Spina, L. (2019). Multidimensional assessment for "culture-led" and "community-driven" urban regeneration as driver for trigger economic vitality in urban historic centers. *Sustainability*, *11*(24), Article 7237. https://doi.org/10.3390/su11247237

Dipace, R. (2014). La rigenerazione urbana tra programmazione e pianificazione. In *Rivista giuridica dell'edilizia* (Vol. 5, pp. 237–260). Giuffrè Editore.

Dixon, T. J. (2005). The role of retailing in urban regeneration. *Local Economy*, *20*(2), 168–182. https://doi.org/10.1080/13575270500053266

Doucet, B. (2007, September 12–14). Flagship regeneration: Panacea or urban problem. In *EURA Conference*: *The Vital City* (pp. 1–27). Glasgow, Scotland.

Dubey, D. P. (2024). Changing variation in the study of social exclusion in Indian society. *Educational Administration: Theory and Practice*, *30*(5), 4694–4700. https://doi.org/10.53555/kuey.v30i5.3690

Ekemode, B. G. (2020). Impact of urban regeneration on commercial property values in Osogbo, Osun State, Nigeria. *Smart and Sustainable Built Environment*, *9*(4), 557–571. https://doi.org/10.1108/SASBE-04-2019-0059

Falanga, R., & Nunes, M. C. (2021). Tackling urban disparities through participatory culture-led urban regeneration. Insights from Lisbon. *Land Use Policy*, *108*, Article 105478. https://doi.org/10.1016/j.landusepol.2021.105478

Ferilli, G., Sacco, P. L., Tavano Blessi, G., & Forbici, S. (2017). Power to the people: When culture works as a social catalyst in urban regeneration processes (and when it does not). *European Planning Studies*, *25*(2), 241–258. https://doi.org/10.1080/09654313.2016.1259397

Francin, K. I. (2015). *Urban catalyst*. McGill University.

Gökşin, A., & Müderrisoğlu, B. (2005). Urban regeneration: A comprehensive strategy for creating spaces for innovative economies. In *41st ISoCaRP Congress* (pp. 1–14). İstanbul.

Hanberry, B. B. (2022). Global population densities, climate change, and the maximum monthly temperature threshold as a potential tipping point for high urban densities. *Ecological Indicators*, *135*, Article 108512. https://doi.org/10.1016/j.ecolind.2021.108512

Hasanzade Tavakoli, S., Zand Moghadam, M., & Korkebadadi, Z. (2020). Estimation of worn-out texture resilience to natural hazards by fuzzy demilitarization and fuzzy ANP (case study: Urban texture of Semnan city). *Sustainable City*, *2*(4), 83–99.

Hashemkhani Zolfani, S., Hedayatnezhad Kashi, S. M., & Antuchevičienė, J. (2024). Livability and futures studies of worn-out urban textures: Scenario analysis for evaluating the livability system and achieving sustainability. *International Journal of Strategic Property Management*, *28*(2), 101–115. https://doi.org/10.3846/ijspm.2024.21341

He, C., Liu, Z., Wu, J., Pan, X., Fang, Z., Li, J., & Bryan, B. A. (2021). Future global urban water scarcity and potential solutions. *Nature Communications*, *12*(1), 1–11. https://doi.org/10.1038/s41467-021-25026-3

Heesche, J., Braae, E. M., & Jørgensen, G. (2022). Landscape-based transformation of young industrial landscapes. *Land*, *11*(6), Article 908. https://doi.org/10.3390/land11060908

Hlaváček, A., Farka, Z., Hübner, M., Horňáková, V., Němeček, D., Niessner, R., Skládal, P., Knopp, D., & Gorris, H. H. (2016). Competitive upconversion-linked immunosorbent assay for the sensitive detection of diclofenac. *Analytical Chemistry*, *88*(11), 6011–6017. https://doi.org/10.1021/acs.analchem.6b01083

Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037//1082-989X.3.4.424

Kana, K. (2012). An experiment in urban regeneration using culture and art in Senba, Osaka's historic urban center, with a focus on the regeneration of urban space. *City, Culture and Society*, *3*(2), 151–163. https://doi.org/10.1016/j.ccs.2012.06.006

Korkehabadi, Z., Seyed Alian, E., & Abdi, K. (2019). Evaluation of environmental indicators affecting citizens' satisfaction with the quality of urban living environment (case study: Semnan). *Geographical Planning of Space*, *9*(32), 233–248.

Kim, J. Y. (2015). Urban regeneration utilizing art: A case study of the Samlye Art Village, Korea. *International Journal of Multimedia and Ubiquitous Engineering*, *10*(11), 337–342. https://doi.org/10.14257/ijmue.2015.10.11.32

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.) The Guliford Press.

Klingmann, A. (2023). Rescripting Riyadh: How the capital of Saudi Arabia employs urban megaprojects as catalysts to enhance the quality of life within the city's neighborhoods. *Journal of Place Management and Development*, *16*(1), 45–72. https://doi.org/10.1108/JPMD-06-2021-0062

Kula, S. (2011). *Occupational stress and work-related wellbeing of Turkish national police* (*TNP*) *members* [Doctoral thesis, University of Central Florida]. Orlando, Florida.

Lees, L., & Melhuish, C. (2015). Arts-led regeneration in the UK: The rhetoric and the evidence on urban social inclusion. *European Urban and Regional Studies*, *22*(3), 242–260. https://doi.org/10.1177/0969776412467474

Li, W. (2023). Sustainable development of anti-Japanese war heritage in the central urban area of Chongqing based on urban catalyst theory. *International Journal of Social Science and Education Research*, *6*(4), 146–151.

McIntosh, C. (2007). Rethinking fit assessment in structural equation modeling: A commentary and elaboration on Barrett (2007). *Personality and Individual Differences*, *42*(5), 859–867. https://doi.org/10.1016/j.paid.2006.09.020

Mehan, A. (2016). Urban regeneration: A comprehensive strategy for achieving social sustainability in historical squares. In *Sgem international multidisciplinary scientific conference on social sciences and arts* (Vol. 2, pp. 863–867). Sofia, Bulgaria.

Mirzakhani, A., Turró, M., & Jalilisadrabad, S. (2021). Key stakeholders and operation processes in the regeneration of historical urban fabrics in Iran. *Cities*, 118, Article 103362. https://doi.org/10.1016/j.cities.2021.103362

Mohammadi, H., & Fakharzadeh, Z. (2022). Investigating the role of the flagship projects in regeneration of urban deteriorated areas based on an analytical comparison of Goudal-e Mosala and Sheykhdad neighborhoods. *The Journal of Urban Research*, *1*, 31–48.

Morano, P., & Tajani, F. (2018). Saving soil and financial feasibility. A model to support public-private partnerships in the regeneration of abandoned areas. *Land Use Policy*, *73*, 40–48. https://doi.org/10.1016/j.landusepol.2018.01.036

Nesticò, A., Elia, C., & Naddeo, V. (2020). Sustainability of urban regeneration projects: Novel selection model based on analytic network process and zero-one goal programming. *Land Use Policy*, *99*, Article 104831. https://doi.org/10.1016/j.landusepol.2020.104831

Ovwigho, B. O. (2013). Empirical demonstration of techniques for computing the discrimination power of a dichotomous item response test. *IOSR Journal of Research & Method in Education*, *3*(2), 12–17. https://doi.org/10.9790/7388-0321217

Palermo, L. (2014). The role of art in urban gentrification and regeneration: Aesthetic, social and economic developments. *Il Capitale Culturale: Studies on the Value of Cultural Heritage*, *10*, 521–545.

Paul, A., & Sen, J. (2020). A critical review of liveability approaches and their dimensions. *Geoforum*, *117*, 90–92. https://doi.org/10.1016/j.geoforum.2020.09.008

Pourzakarya, M., & Bahramjerdi, S. F. N. (2019). Towards developing a cultural and creative quarter: Culture-led regeneration of the historical district of Rasht Great Bazaar, Iran. *Land Use Policy*, *89*, Article 104218. https://doi.org/10.1016/j.landusepol.2019.104218

Salehi, S. S., & Jafari, F. (2024). Evaluation of the worn texture of the region 4 in Tabriz, Iran, with an emphasis on increasing populatability. *Advanced Engineering Science*, *4*, 25–34.

Samara, A. (2020). *Industrial heritage as a catalyst for urban regeneration in Thessaloniki* [Doctoral dissertation, University of Lincoln]. https://doi.org/10.24385/lincoln.24326221.v1

Sarkheyli, E., & Zakerhaghighi, K. (2021). Identification, dimension and evaluation of catalytic projects in Tehran, Iran. *Environmental Science and Sustainable Development*, *6*(1), 38–51. https://doi.org/10.21625/essd.v6i1.790

Sarvari, H., Mehrabi, A., Chan, D. W., & Cristofaro, M. (2021). Evaluating urban housing development patterns in developing countries: Case study of worn-out urban fabrics in Iran. *Sustainable Cities and Society*, *70*, Article 102941. https://doi.org/10.1016/j.scs.2021.102941

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, *8*(2), 23–74.

Sharma, M., & Abhay, R. K. (2022). Urban growth and quality of life: Inter-district and intra-district analysis of housing in NCT-Delhi, 2001–2011–2020. *GeoJournal*, *87*(Suppl. 4), 797–819. https://doi.org/10.1007/s10708-021-10570-8

Shemirani, S. M. M., Alalhesabi, M., & Zolfigol, S. (2021, February). A comparative study of catalyst projects in urban centres: Imam Square in Hamedan. *IOP Conference Series: Materials Science and Engineering*, *1067*(1), Article 012072. https://doi.org/10.1088/1757-899X/1067/1/012072

Shen, L. (2013). *The research and application of urban catalyst theory in revitalization historic urban quarters redesign Nanbuting District in Nanjing, China* [Master's thesis]. Blekinge Institute of Technology, School of Planning and Media Design.

Shen, T., Yao, X., & Wen, F. (2021). The Urban Regeneration Engine Model: An analytical framework and case study of the renewal of old communities. *Land Use Policy*, *108*, Article 105571. https://doi.org/10.1016/j.landusepol.2021.105571

Statistical Center of Iran. (2019). *Statistical yearbook of Semnan province*. Statistical Center of Iran.

Stein, C. M., Morris, N. J., Hall, N. B., & Nock, N. L. (2017). Structural equation modeling. In R. Elston (Ed.), *Statistical human genetics. Methods in molecular biology* (Vol. 1666). Humana Press. https://doi.org/10.1007/978-1-4939-7274-6_28

Sukovata, V. (2022). Demolition of monuments as a phenomenon of culture in global and local contexts: Iconoclasm, 'new barbarity', or a utopia of memory? *Studies on National Movements*, *10*(1), 44–73. https://doi.org/10.21825/snm.85741

Sun, M., & Chen, C. (2023). Renovation of industrial heritage sites and sustainable urban regeneration in post-industrial Shanghai. *Journal of Urban Affairs*, *45*(4), 729–752. https://doi.org/10.1080/07352166.2021.1881404

Temelová, J. (2007). Flagship developments and the physical upgrading of the post-socialist inner city: The golden angel

project in Prague. *Geografiska Annaler: Series B*, *Human Geography*, *89*(2), 169–181. https://doi.org/10.1111/j.1468-0467.2007.00246.x

Tihanyi, L. (2016). Organizational learning and international management: The contributions of Marjorie A. Lyles. In *Global entrepreneurship: Past*, *present* & *future* (Vol. 29, pp. 19–25). Emerald Group Publishing Limited. https://doi.org/10.1108/S1571-502720160000029003

Ting, C.-T., Hsieh, C.-M., Chang, H.-P., & Chen, H.-S. (2019). Environmental consciousness and green customer behavior: The moderating roles of incentive mechanisms. *Sustainability*, *11*(3), Article 819. https://doi.org/10.3390/su11030819

Vafaei, A. (2020). Explaining the contexts of achieving sustainability in old and worn textures with integrated urban regeneration approach; case study: The old texture of Kashan. *Iranian Islamic City Studies*, *11*(41), 55–68.

Wang, N. (2022). Research on the design of old building reconstruction from the perspective of urban catalyst theory. *World Scientific Research Journal*, *8*(9), 214–220. https://doi.org/10.1155/2022/2022757

Yadav, V., & Ghosh, S. K. (2019). Assessment and prediction of urban growth for a mega-city using CA-Markov model. *Geocarto International*, *36*(17), 1960–1992. https://doi.org/10.1080/10106049.2019.1690054

Zheng, J. (2017). Contextualizing public art production in China: The urban sculpture planning system in Shanghai. *Geoforum*, *82*, 89–01. https://doi.org/10.1016/j.geoforum.2017.03.024