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Investigation of the effect of vernacular architectural components in housing after natural disasters on people's sense of place (Case study: *Rudbar* earthquake of 1990)

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Abstract

Every year, many people lose their homes to natural disasters and need their homes to be reconstructed. Iran ranks high among the countries of the world in terms of the number and severity of natural disasters and the subsequent need for home reconstruction for the affected people. The process of reconstruction and resettlement, however, focuses mainly on the physical aspects of the buildings and enough attention is not given to affective aspects of human life, the sense of place, for example. People's sense of place can be affected by the method and pattern of buildings. Variables such as low cost, speed, use of local and environmentally compatible material, people's participation in construction process, and use of vernacular architecture all play an important role in creating an identity space and people's sense of place. This research focused on the villages affected by the 1990 Rudbar earthquake and examined if there is a significant relationship between the use of vernacular architecture in housing reconstruction and the residents' perception of the sense of place. Both quantitative and qualitative methods were used in the study. In-depth field interviews were conducted with the residents of 12 villages of Rudbar County. The results show a significant relationship between vernacular architecture and its components (physical, communicational and functional) and people's improved sense of place and residents satisfaction. Variables such as form, breeze and perfume, material used, and social bond exerted an influence both directly and indirectly. Building robustness and people's memory had only a direct effect and function and nature bond only an indirectly effect on people's the sense of place. Also, form and materials have the greatest impact. Therefore, in addition to the form and materials, attention must be paid to updating the reconstruction plan, use of vernacular architecture in post-disaster housing in order to improve the sense of place and residents' satisfaction.

***Keywords*:** Vernacular architecture; Sense of place; Settlement after disasters; Natural disasters

1. Introduction

Iran, like many countries around the world, is exposed to different types of natural disasters particularly earthquakes. While each disaster is different in terms of type, time, and scope, the adverse consequences are basically the same (Lockhat, 1990, quoted by Barakat, 1993): people lose their homes and along the way they experience what is called placelessness, or a loss of sense of place (Relph, 1976). Therefore, rapid post-disaster reconstruction programs are developed and implemented in order to get people back into their homes. Past experiences in this area have led to different approaches to reconstruction (Fallahi, 2012). The haste in the matter of reconstruction with a technique-oriented approach (Fallahi, 2012), for example, has hindered attention to recreating the sense of home and space for the survivors and has usually neglected the revival of the social and cultural spirit of the local community after the crisis. Measures such as quality of life and living experiences, residents' satisfaction, a creation of the meaning of place, past identity, and a sense of belonging and attachment (Lak and Gholampour, 2015) are all neglected in the process. A negative result has been an increase in the sense of loss, damage, and deprivation among the survivors of the disasters (Zetter and Boano, 2010: 206).

Building a home, as Davis (1976) put it, is considered a process and not a product. It is a process in which the role of culture and social needs of the survivors is very important. As such, a reconstructed home could be a place of social bonding, dynamic actions of survivors with the surrounding environment after the disaster, shelter for freedom, safety, and security, the concentration of the concept of family in the local community, the memories of life, and the place of social and emotional structures (Zetter and Boano, 2010: 206). Key qualitative and quantitative factors that either negatively or positively affect the success of reconstructed homes as well as the wellbeing of the survivors must, therefore, be considered. Examples of factors in past research include: similar constructions and the sameness of places (Zetter and Boano, 2010: 206), high-quality housing that meets people's needs, delays or haste in reconstruction, cost, quality of the new buildings, residents' satisfaction (Ophiyandri et al., 2013: 2), preserving the identity, the origins, and the authenticity of the reconstructed places and creation of a clear sense of the past by using local architecture and knowledge, and a sense

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of belonging to the environment in reconstructed places (Modiri and Zanjani, 2014). Besides, the term "liveliness" was brought up by Alexander (1979) to describe the built environmental conditions that lead to the feeling of highly-quality being alive or in other words, users' satisfaction due to the presence in a place (Rezaei, 2020).

In the previous studies, above-mentioned factors, in general, and post-disaster settlement sense of place, in particular, has been extensively studied. However, no research to date has examined the role vernacular architecture plays in creating a sense of place among the residents who lost their homes to natural disaster, especially in cities and villages of Iran and in particular among the residents of the villages of Rudbar. This study could help make better decisions and policies when choosing a reconstruction program to address future disasters. The study expanded throughout the villages of Rudbar County that were severely damaged during the earthquake of 1990. The reconstruction has been delayed for many years. These villages were chosen as a study location for two primary reasons. Firs, rural areas of Rudbar have their own unique vernacular architecture which makes it possible to study the element of vernacular architecture. Second, a long time has passed since the reconstruction of damaged homes, it is possible to collect appropriate data in measuring people's sense of place in relation to build houses.

This research contributes to existing research and addresses the gaps in research as follows: 1) it uses both qualitative a quantitative methods to demonstrate how an incorporation of a unique vernacular architecture into re-construction process can create and enhance people's sense of place during post-disaster resettlement; 2) it incorporates people's sense of place in devising reconstruction plans post-earthquake in Rudbar villages that prior reconstruction plans had ignored; 3) it examines multiple dimensions of physical, relational, and operational elements in vernacular architecture that may have potential impact on people's sense of place.

Three basic hypotheses are explored in this research: 1) the use of vernacular architecture in the reconstruction process enhances people's sense of place; 2) different components of vernacular architecture differently affect people's sense of place; and 3) re-construction models that ignore essential, cultural, and affective needs and expectations of the affected people lead to people's dissatisfaction.

2. Literature Review

Disaster. Disaster is a situation or event that overwhelms local capacity, requiring an external response, or is recognized as such by national and/or international actors. Natural disasters are severe alterations in the normal functioning of a community or society due to natural hazard events (IPCC, 2014).

Vernacular Architecture and Post-Disaster Settlement Creating housing after a disaster is one of the most challenging and controversial responsibilities for countries involved in a crisis (Félix et al., 2013). Through reconstruction, destroyed buildings are replaced and recreated in their original place and shape either with temporary substitutes as a part of emergency response or during the organizing period (Aysan and Davis, 2006). Post-disaster housing is divided into three phases: emergency shelter, temporary housing, and permanent housing (IFRC & SKAT, 2012). Lizaraldo and Davidson (2005) suggest two approaches for temporary and permanent: one relies on people and vernacular materials under the title of empowering policy and the other relies on technology under the title of quick supply policy (Fallahi, 2007). Regardless of the approach, paying attention to important elements such as local culture, religion, ethnicity, beliefs, and values of the affected people, use of indigenous knowledge in all phases of reconstruction (Aysan and Oliver,1987; Aysan and Davis, 2006; Azmi et al. 2015; Jigyasu, 2002; Barnhart and Cavaglia, 2005) are of utmost importance in rebuilding and reconstruction and improving the overall success and affected people's quality of life.

In addition, the use of vernacular materials to reduce construction and transportation costs, and the use of local labor and help from relatives and neighbors make it economically feasible for the affected people (Zargar, 2008). Certainly, importing materials from distant or international markets can make the program more costly while use of domestic resources could strengthen the local economy, which has been weakened by the disaster (Aysan and Davis, 2006; Félix, 2013; Aysan and Davis, 2016; Prinz, 2014).

Ayvazian (1997) points to following the symbols and principles of vernacular architecture that is consistent with the audience's mental schemas, and serves as an influencing factor in the perception process and can have a favorable effect on legibility, identity preservation, and historical continuity of the town. Fallahi (2009) considers the concept of home as the most neglected point and considers it a result of a series of social, economic, technical, environmental, political, etc. relations. (Fallahi, 2009).

Sense of Place. Currently, there are two prominent views on the concept of sense of place. One is phenomenological on its basis and provides a philosophical view of the sense of place, and the other is based on the field of environmental psychology and rooted in an interactive relationship between the person and the environment. Christian Norberg-Schulz, Yi-Fu Tuan, Edward Relph, Christopher Alexander, and David Simon define the sense of place with a phenomenological approach based on the nature of the place, duration, and depth of experiences in the place (Lak and Gholampour, 2015). The sense of place in environmental psychology is less concrete and concise (Hidalgo & Hernandez, 2001). Shamai, Ilato, Altman, Stedman, and Richardson, with a psychological approach, express different interpretations of the sense of place (Lak and Gholampour, 2015). In environmental psychology, humans need specific sensory, emotional, and spiritual experiences regarding the living environment that can be realized through intimate interaction and identification with the place where they live. This intimate interaction and identification is called soul or sense of place and can act as a catalyst to transform an environment into a place that has meaning. Different qualitative and qualitative methods have been used to study sense of place. Jorgensen and Stedman (2001, 2006) present a theory by organizing the definitions of different dimensions of the sense of place that show it is

multidimensional in structure. For example, place identity (beliefs about the relationship between self and place), attachment to place (emotional bonding with the place), and place dependence (the degree to which a place supports behavior compared to other places) [See Fig 1] could be used as a reference for measuring sense of place (Nanzer, 2004; Wang, 2013; McCann, 2015; Zhang and Li, 2021; Damaria et al. 2022).

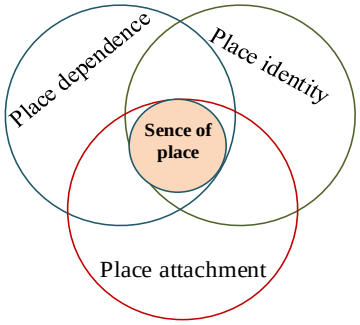

Fig. 1. Sense of place model
(Jorgensen & Steadman, 2006).

Post-disaster sense of place: Livability considers various principles and indicators, security, participation, identity and sense of belonging to a place, etc (komele et al., 2023) Natural disasters can destroy people's reference to a place and remove the roots of familiarity (Habibi, 1994). Heartbreak, psychological damage, and mental anguish then follow which lead to a sense of loss and destruction of people's assets. After such disasters, many survivors refuse to leave their place of living despite the dangers and warnings from authorities. They choose to stay where they are familiar mainly due to psychological security of staying at home or being at home. Remaining on the ruins of their homes gives the survivors a feeling of being at home. In the event of a disaster, home is not only a private space but also a public place for survivors. It serves as a shelter for person's social relations both internally and externally, even though its physical dimension has been destroyed (Fallahi, 1993). The survivors suffer multiple losses that is not just a loss of property and assets but a loss of neighborly and friendly relations, multiple natural and built environment such as homes and neighborhoods. As a consequence, they experience spiritual suffering, increased sense of confusion, disturbance, and a lack of bonding with the elements related to direction.

Recreating the sense of place is, therefore, considered an important solution in reducing the negative consequences of the crisis and the destruction of places, and strengthening cognitive and emotional relationships of the survivors with the place. It could be one of the psychological-social support activities that help post-disaster survivors face the adverse effects of the disaster since in the reconstruction phase they can find the possibility of controlling the changes that happened in their local society and environment. The survivors are thusly presented as the most important actors in recreating a sense of place to help the community's rehabilitation (Prewitt Diaz & Dayal, 2008). According to Fullilove (1996), having a suitable place for the survivors to choose a residence at the level of the home and neighborhood, they can meet both the physiological and mental-social needs and receive support in their individual and social life. Re-construction of social networks and social interactions are just as important as a suitable space; otherwise, the individual will be isolated in the environment, and the psychological problems of the individual will intensify.

3. Conceptual Model

The main purpose of being inspired by the phenomena and laws of Nature in architecture or the architectural application of Nature has been to improve the quality of architecture in various dimensions to respond to human residential needs. The quality of housing architecture includes three formal, functional, and semantic dimensions that are effective in meeting the residential needs of the psychological, material, and spiritual dimensions of human beings and, consequently, promoting residential satisfaction. The components of the architectural application of Nature, depending on the type of indicators and their Nature, exclusively or Multi-functionality, play roles in improving the quality of formal, functional, and semantic dimensions of housing architecture and directly affect the residential satisfaction variable (Azizibabani et al., 2022). With a comprehensive approach to the topics raised, one can explain the influence of the sense of place from vernacular architecture in post-disaster settlement in the form of a conceptual model. In this model, the vernacular architecture of the main components includes the physical component with two sub-components of form and materials, the communicational component with two sub-components of link with nature and social bonding, and the functional component with four sub-components of strength, function satisfaction, sensory satisfaction, and mental satisfaction affects the dimensions of the sense of place, including attachment, identity, and dependence, which will result in the sense of place (Fig. 2).

Vernacular Architecture of the Studied area

At local time, 30 min of morning, on the 21st of June 1990, a very strong earthquake shook Gilan and Zanjan provinces in the north of Iran. The epicenter of this earthquake was announced to be between Rudbar and Manjil in the south of Caspian Sea. This event, announced to be the greatest earthquake of Iran history, ended up to the killing of 14,000 individuals and 500,000 homeless persons (Bahreyni and Akhondi, 2000).The villages under the study in this research were destroyed severely as they were located in the east of Rudbar, on the South Mountain Chain of Caspian Sea between two small cities of Totkabon and Barehsar and nearness to earthquake epicenter.

In the reconstruction of Gilan Province's rural housing units after Manjil earthquake, the primary core unit of the building was set up in the temporary sheltering stage and was then expanded to the permanent sheltering stage using the survivors' participation (Bahreyni and Akhondi, 2000). In fact, the reconstruction program has been a core housing method. Hence, considering the use of local technology and building materials and the survivors' participation in all the stages, we witness a contradiction of the dwelling pattern

and climatic solutions in reconstructed houses in comparison with the traditional houses. This has led to the disruption of traditional housing pattern and the traditional architecture of the region.

In some villages $285 (20,000 Iranian Rials) in cash and some building materials (mostly wood, nail and galvanized sheets to cover the roof) were distributed among the people so that they begin to construct temporary shelters themselves using the Zigali method (Bahreyni and Akhondi, 2000; Shadi-Taleb, 1993). In some villages, there were applied wooden skeleton with gable roof by government and mud coating of walls was finished by dwellers. In fact, the method of setting up temporary shelter was based on constructing dwelling core by Zigali method (Bahreyni and Akhondi, 2000).

The stage of providing permanent shelter was done in terms of policy of exploiting the people's maximum participation in construction, local resources, technology and indigenous materials. In this stage, there were not strategies proposed to realize these policies in destroyed regions, based on the great scale of earthquake spread, yet there were some macro policies complied in reconstructing permanent shelters. Therefore, managers' Performance of assistance headquarters in different regions led to offer various solutions. What was implemented in the region of study was supply non-refundable loans of government and encourages the people to build strong houses apart from temporary shelter by using Zigali system of construction. In addition, some architectural plans and limited training were provided in constructing permanent shelter.

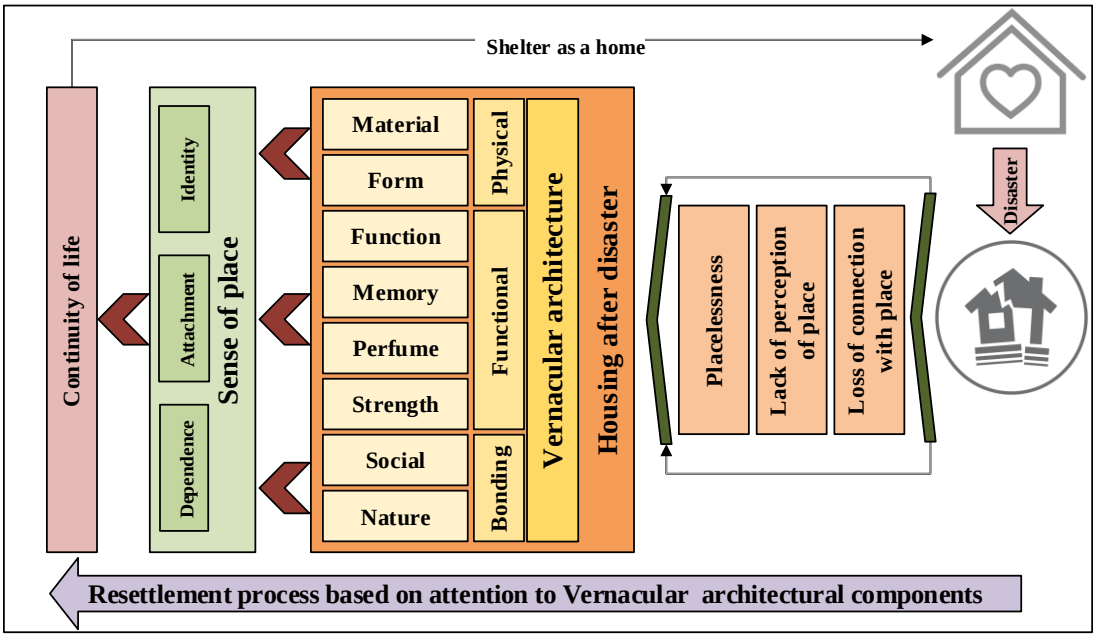

Fig. 2. Conceptual model of the effect of vernacular architecture on the sense of place.

The existence of rain-bearing winds of north and western north, Alborz mountain ranges in the south and the Caspian Sea in the north has amounted to a particular climate in the north of Iran with heavy rains, high humidity and hot summers. In addition, since the under study region in this research is located in the northern parts of Alborz mountain ranges, it has cold winters. Therefore, traditional architecture of this region has reached some solutions to these climatic conditions to provide peace and comfort for dwellers along with living, social and cultural factors. Because of continuity and severity of rain, the roofs of traditional houses were built with two or four slopes. The space between sloped roof and upper floor roof caused the air to flow and the humidity to decrease in warm seasons. In addition, since this space is usually filled with hay in cold seasons, it functions as insulation against cold. In this region, houses have been built in two storeys to avoid the penetration of land moisture into the house. The basement was built with stones and was allocated to livestock spaces such as stable, yarn, foodstuff storage places and bathroom. The mud-covered, wooden structure of the upper floor, which was free from the moisture of the floor or ceiling, was a suitable place for the habitation of the dwellers. With the linear expansion of the building in east-west direction, the inhabitants enjoyed enough sunlight and local airflow. The veranda was built in one or several faces of the building in order to prevent rain from hitting the building body. The livelihood and dwelling style of rural families has adapted to the climatic strategies after many years leading to a harmony in the architecture of rural houses (Bromberger, 1991; Khakpor, 2005). allocated to guests, did not have any special function and were used differently based on season and family's requirement. Veranda was located in one or more sun-facing sides of building which was the place of daily activities such as cooking, eating, doing house chores, living and even sleeping during some suitable months of the year while in the cold seasons of the year, these activities were transferred into the house. Water closet and bathroom were located in a corner of the building far from it due to humidity and reduction of useful life of wooden structure (Khakpor, 2005).

Fig. 3. Houses in Divarash (left) and Shirkooh (right) that were completely intact in the earthquake.

The shape of the buildings is extroverted; architecture and nature interact with each other, the roof of the building is designed as a slope with the appropriate slope and direction according to the prevailing wind in order to prevent the penetration of humidity and rainwater, the buildings are generally two stories (floor the bottom of the warehouse or stable and the upper floor of the living space) and in one-story buildings, the ground floor is placed above the natural level of the ground by creating a suitable foundation, and the construction method is by using Urgeni and Zigali walls. The lack of underground due to humidity, the placement of the hall, which is the main space with multiple functions around the rooms of the building, which connects the open and closed spaces and has a significant effect on creating suitable climatic conditions and comfort in the building, the use of vernacular materials, the use of wooden decorations such as niches, fences, and the absence of a wall around the ground are among of the architectural features of the studied villages that in the reconstruction process after the earthquake, attention was paid to some things such as construction with Zigali walls, sloping roof, but the building was built on one floor due to reasons such as people's fear of further destruction and the need for speedy construction, and as a result, the hall was converted into a small veranda (Fig. 3).

4. Research Method

This research is theoretical and practical in terms of type, descriptive-analytical in terms of data collection, and quantitative-quality in terms of the nature of the data, and it has used quantitative and qualitative tools and methods for data analysis (Fig. 4). The research examines the components of vernacular architecture and the sense of place in the villages of Rudbar County. Village selection is done based on the differences, whether close or distant to the main road, the urban or rural texture of the village studied, displacement or non-displacement of the village, large or slightly populated, and the size of the villages. The results of the research in the villages have been different (Table 1). First, due to the distribution and diversity of the villages, 36 rural homes rebuilt by the vernacular method were randomly selected, and residents were interviewed deeply and semi-structured. This phase took place within four days, and the interviews took between thirty minutes to an hour due to the interest of people. In some homes, more than one person participated in the interview. The interviews continued so far as to say that new people were not added to the words of the previous ones. An interview with some people was also suggested by the villagers. A total of eight villages were examined in the first phase. All homes were photographed, which was analyzed in the analysis of the architectural pattern used in the reconstruction as well as the registration of the changes made to buildings by the people.

From the content analysis method based on information obtained from interviews and based on library studies, literature review, as well as field studies, and observation, expanding the hypothesis as well as discovering hidden and obvious factors and variables, the conceptual model of the research was prepared as the next step. A questionnaire with 42 items was compiled by combining the Jurgensen and Stedman's sense of place standard questionnaire (12 items) and a researcher-made questionnaire (30 items) based on the Likert scale (Table 3) and with eight democratic and architectural questions, and 339 people from 12 villages were tested for 12 days. Overall, 56.6% of the interviewees are women, and 43.4% are men.

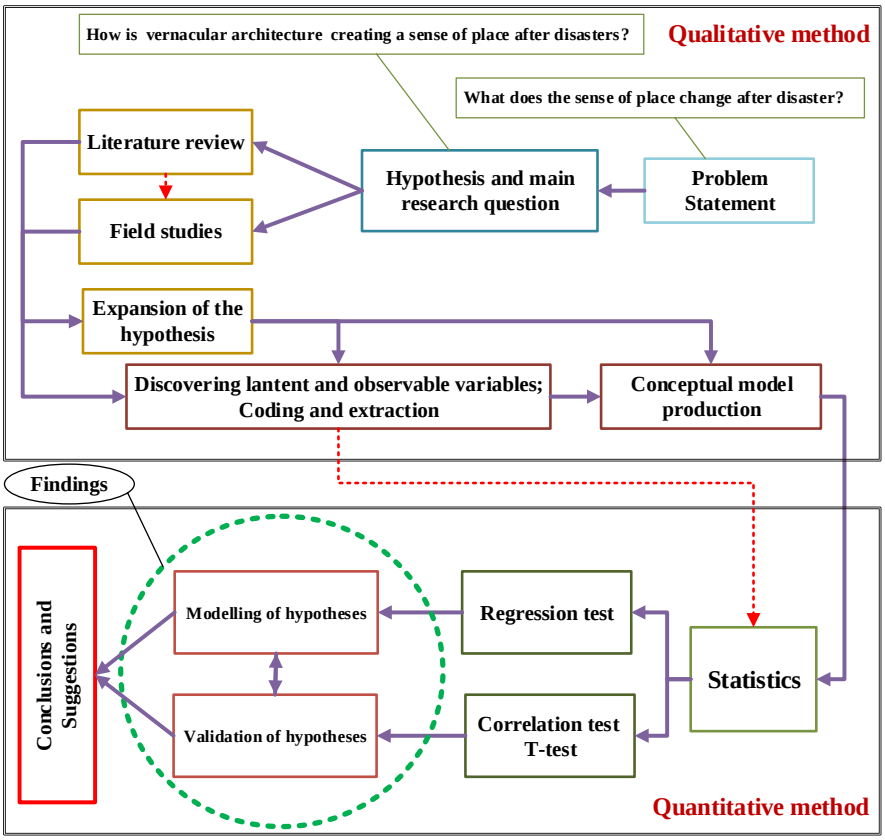

Fig. 4. The process of research.

Table 1.
Introduction of the studied villages. Source: The authors using the 2015 census.

	Village name	Household	Population	Female	Male	Status of village	Sample	
							Female	Male
1	Liavol-e Sofla	22	59	30	29	relocated	7	5
2	Hajideh	46	105	54	51	_	5	1
3	Sendes	63	151	81	70	_	22	13
4	Divrash	75	210	104	106	_	14	7
5	Dashtveyl	106	360	194	166	_	11	6
6	Nash	116	298	152	146	_	18	16
7	Chorreh	142	430	201	229	_	13	15
8	Poshteh Kollah	166	506	254	252	relocated	10	9
9	Nodeh	181	496	254	242	relocated	21	20
10	Shirkooh	187	492	252	240	_	23	17
11	Chahar Mahal	396	1,168	579	589	relocated	25	26
12	Barehsar	559	1,612	817	795	relocated	23	12
Total		**2,059**	**5,887**	**2,972**	**2,915**		**192**	**147**
							339	

Experts and elites approved the validity of the questionnaire, and its reliability was confirmed by the value of 0.907 for the Cronbach's alpha coefficient (Table 2). The eight items were deleted by the exploratory factor analysis as well as the opinion of the elite, and the analysis was done based on the remaining items. The KMO index and the Bartlett test were used to ensure the adequacy of a number of data desired for the exploratory factor analysis (sample size and the relationship between variables). The mean, variance, and standard deviation tests were used for extracting descriptive data, Pearson correlation and multivariate linear regression test using SPSS version 24 software for validating the conceptual model of the research.

Table 2.
Descriptive and reliability statistics of the questionnaire. Source: authors.

Variable	N of Items	Mean	Variance	Std. Deviation	Cronbach's Alpha	KMO	Bartlett	df	Sig.
Physical	7	4.027	0.317	0.563	0.757	0.802	543.577	21	0.000
Communicational	7	4.107	0.179	0.423	0.725	0.798	670.297	21	0.000
Functional	10	3.889	0.205	0.453	0.727	0.805	649.521	45	0.000
Vernacular architecture	24	3.976	0.171	0.414	0.876	0.890	2758.526	276	0.000
Sense of place	10	3.938	0.204	0.452	0.816	0.854	1261.163	45	0.000
Total test	34	3.984	0.154	0.392	0.907	0.902	4560.523	561	0.000

Table 3
Introducing the main concepts, factors, components and items of the questionnaire. Source: authors.

Main	Component	Factor	Item description
Vernacular architecture	Physical	Form	1- I prefer to live in a rural houses that is built in a local method than to live in a new house. 2- Veranda and sloping roof are the main architectural features of Rudbar villages. 3- Rebuilding by the form of traditional houses preserves the identity of the village. 4- Rebuilding by local carpenters and architects has made houses more similar to native houses.
		Material	5- Houses that are built with new materials such as concrete and iron destroy the village's identity. 6- I like the use of wood, thatch and local materials more than concrete and iron. 7- The use of wood in the veranda, balustrade, stairs, doors and windows makes the house beautiful.
	Communicational	Social bond	8- The absence of a wall around rural houses makes for better communication with neighbors. 9- The courtyards of houses are a good place to hold events such as weddings and parties. 10- My children and relatives who are in the city like to come to my rural house.
		Nature bond	11- When I am in veranda , I can easily see the village and the surrounding scenery. 12- In rural houses, trees and flowers can be planted in the yard. 13- Unlike new and urban houses, I can keep chickens, roosters and livestock in rural houses. 14- When I am on the veranda , I feel the smell and sound of nature very well.
	Functional	Strength	15- Rural houses built with stone and brick walls are not earthquake resistant. 16- Zigali houses are resistant to earthquakes. 17- I feel safe and secure in this rural house.
		Sensory satisfaction Breeze and Perfume	18- Traditional houses are warmer than new houses in winter and I use heating devices less. 19- The air at home is cool in the summer and I only use the air conditioner sometimes. 20- Air flow, ventilation and breeze in the veranda are done well. 21- I like the smell of a rural house.
		Function	22- Keeping livestock in the house and using under roof as storage is one of the advantages of a traditional house. 23- I prefer the wc to be in the yard. 24- I like to have a separate kitchen at home. 25- I do most of my activities in the veranda and spend most time of the day there. 26- I would like to make changes in traditional houses to make better use of them. 27- The stairs makes it difficult for the elderly to use the wc in the yard.
		Memory	28- I would like my house to be exactly like my previous house that was destroyed in the arthquake. 29- Living in a house that was built indigenous method brings back memories before the arthquake. 30- Using the elements and materials left over from the house reminds of the memories of the past.
Sense of place	Cognitive	Place Identity	31- Everything about my house is a reflection of me. 32- My house says very little about who I am. 33- I feel that I can be myself by living in this house. 34- My house represents my identity.
	Emotional	Place Attachment	35- I feel relaxed when I'm in my house. 36- I feel happiest when I'm in my house. 37- My house is my favourite place to be. 38- I really miss my house when I'm away from it for too long.
	Behavioral	Place Dependence	39- My house is the best place for doing the things that I enjoy most. 40- For doing the things that I enjoy most, no other place can compare to my house. 41- My house is not a good place to do the things I most like to do. 42- As far as I am concerned, there are better places to be than my house.

5. Data and Findings

The descriptive tests' results indicate that, according to residents of reconstructed homes, the highest score is the communicational component of vernacular architecture (M= 4.11m), and the lowest score is the functional component (M= 3.89m). Among the sense of place components, the highest score was reported for attachment to place and the lowest score for place dependence (Table 4).

Table 4
Descriptive status of research variables. Source: authors.

Component	value	Very Low	Below Average	Close to Average	Above Average	Very High	Mean	Std. Deviation	Range	Minimum	Maximum
Communicational	Frequency			18	256	65	4.11	0.4234	2.14	2.86	5
	Percent			5.31	75.52	19.17					
Physical	Frequency		2	59	211	67	4.03	0.5634	3.13	1.88	5
	Percent		0.59	17.40	62.24	19.76					
Functional	Frequency		1	45	255	38	3.89	0.4528	3.29	1.71	5
	Percent		0.29	13.30	75.22	11.21					
Vernacular architecture	Frequency		1	27	273	38	3.98	0.4140	2.59	2.41	5
	Percent		0.29	7.96	80.53	11.21					
Place identity	Frequency		9	30	259	41	4.02	0.5317	3	2	5
	Percent		2.65	8.85	76.40	12.09					
Place attachment	Frequency		6	17	194	122	4.25	0.5737	3	2	5
	Percent		1.77	5.01	57.23	35.99					
Place dependence	Frequency		22	166	133	18	3.44	0.6412	3.33	1.67	5
	Percent		6.49	48.97	39.23	5.31					
Sense of place	Frequency		8	34	269	28	3.91	0.4519	2.92	2.08	5
	Percent		2.36	10.03	79.35	8.26					

The correlation test was used to evaluate the significance, intensity, and relationship between different factors and variables of the research. Initially, the correlation test was conducted between variables and components of vernacular architecture, which shows that all components and variables have a direct, positive, significant, and high-intensity relationship with vernacular architecture. The highest correlation among the main components of vernacular architecture is the functional component, with a coefficient of 0.925, and the largest correlation between its constructive components is the breeze and perfume variable, with a coefficient of 0.781. Also, the lowest correlation coefficient of vernacular architecture with the communicational component with a coefficient of 0.794 and the function variable with a coefficient of 0.617 was obtained (Table 5)

Table 5
Pearson's correlation test between the sense of place and its dimensions with the components and variables of vernacular architecture. Source: authors.

		Physical	Form	Material	Communicational	Nature bond	Social bond	Functional	Strength	Breeze and Perfume	Function	Memory	Vernacular architecture
Place Identity	Pearson Correlation	.449**	.467**	.358**	.358**	.274**	.347**	.487**	.342**	.420**	.272**	.390**	.514**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Place Attachment	Pearson Correlation	.520**	.469**	.461**	.500**	.423**	.439**	.529**	.384**	.520**	.287**	.367**	.596**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Place Dependence	Pearson Correlation	.385**	.325**	.357**	.362**	.275**	.353**	.395**	.293**	.322**	.223**	.316**	.442**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sense of place	Pearson Correlation	.526**	.495**	.454**	.473**	.355**	.465**	.547**	.394**	.489**	.298**	.425**	.603**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vernacular Architecture	Pearson Correlation	.855**	.757**	.768**	.794**	.738**	.623**	.925**	.628**	.781**	.617**	.669**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation test was also conducted to understand the direction, intensity, and significance of the relationship between vernacular architecture as well as its components and variables with its sense of place and dimensions, including identity, attachment, and dependence. The results show the positive, direct, and significant relationship between vernacular architecture and all its variables and components with sense of place and three dimensions of sense of place. The intensity of the vernacular architecture relationship with a sense of place is very strong, significant, positive, direct, and with a correlation coefficient of 0.603. Also, the highest correlation coefficient of vernacular architecture among the three components of identity, attachment to place, and dependence was with attachment to place with a coefficient of 0.596 and the least relationship with the place dependence component with a coefficient of 0.442. The point is that place dependence is the function dimension of the sense of place, and as mentioned above, the least vernacular architecture relationship with its variables is with the function variable (R= 0.617). In this test, this issue has shown its effect on the sense of place in a different way. Among the main components of vernacular architecture, including physical, communicational, and functional components, the highest relationship was between the functional component and sense of place (R= 0.547) and the least with the communicational component (R= 0.473). Among the variables, the highest correlation was between the sense of place and the form variable (R= 0.495), and the lowest correlation was between the sense of place and the function variable (R= 0.298). The highest relationship was between place identity and functional component (R= 0.487) and its least with communicational component (R= 0.358). The highest correlation coefficient between variables with place identity was the form variable (R= 0.467), and the lowest coefficient was the function variable (R= 0.272). The highest relationship between the main components of vernacular architecture, including the physical, communicational, and functional components with a sense of place, was with the functional component (R= 0.529) and the lowest with the communicational component (R= 0.500). The highest coefficient of correlation between attachment to place and vernacular architecture variables was the breeze and perfume variable (R= 0.520), and the lowest was with the function variable (R= 0.287). The highest relationship between the main components of vernacular architecture with place dependence was the functional component (R= 0.395), and the least was the communicational component (R= 0.362). Among the variables, the highest correlation coefficient of place dependence was with the material variable (R= 0.357), and the lowest coefficient was the function variable with place dependence (R= 0.223) (Table 5).

Predicting the direct and indirect susceptibility of the dependent variables is performed through the regression test. In this research, this test was performed using a multivariate linear regression test and explained in the form of model.

For a more detailed examination of the extent and how different aspects of vernacular architecture influence the sense of place, the multivariate linear regression test is performed between the sense of place as the dependent variable and sub-components of vernacular architecture (eight variables) as independent variables. Table 6shows the beta coefficients, significance level, tolerance coefficients, and VIF of these variables and their effect on creating a sense of place for individuals. Also, in Table 7, the direct, indirect, and total effect of each of these variables is presented, which is obtained from the calculation of path coefficients of Fig 5. The results in Table 12 show that the function dimension of the vernacular architecture alone is not effective in creating sense of place and in the predicted model, it has been deleted by the software, as well as the effect of link with nature variable is significant on the sense of place, and these two variables can affect the sense of place through other variables. Of the other six variables, the effect of vernacular architecture by providing conditions for communicational between individuals (social bonding dimension) has the greatest direct effect with a coefficient of 0.252 in creating a sense of place, which is almost twice the effect of other dimensions. According to the theoretical foundations of the research, the dimensions of strength and memory only affect the sense of place. In this test, like the first phase test, taking into account the direct and indirect effect of the variables, the form variable with the effect coefficient of 0.376 and the material variable with the effect coefficient of 0.312 has the highest effect on the sense of place, and the function variable has the least effect on creating a sense of place (Table 13). By comparing the results with the propositions resulting from the qualitative interviews with the residents of the villages, these results are quantitative, valid, and reliable.

Table 6
Multivariate linear regression between vernacular architectural variables and sense of place.

Independent Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Constant	1.278	0.209		6.124	0.000		
Strength	0.113	0.038	0.150	2.952	0.003	0.701	1.428
Memory	0.093	0.036	0.135	2.598	0.010	0.665	1.505
Breeze and Perfume	0.134	0.050	0.163	2.709	0.007	0.502	1.994
Form	0.135	0.055	0.149	2.461	0.014	0.495	2.022
Material	0.066	0.033	0.111	1.976	0.049	0.568	1.761
Nature bond	-0.100	0.057	-0.100	-1.754	0.080	0.558	1.791
Social bond	0.209	0.042	0.252	4.954	0.000	0.700	1.429
R		R Square	Adjusted R Square	Std. Error of the Estimate		F	Sig.
0.634		0.402	0.389	0.353		31.783	0.000

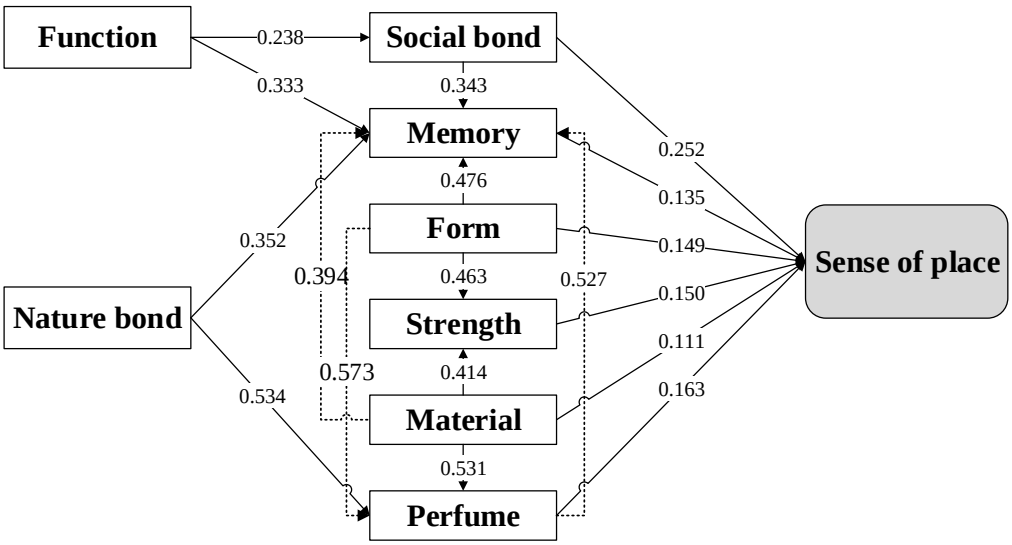

Fig. 5. Path analysis graph.

In examining a regression model, it is also important to examine the linearity of variables and components. The collinearity shows that an independent variable is a linear function of other independent variables. Suppose the collinearity is high in a regression equation. In that case, it means that there is a high correlation between the independent variable. It is possible that despite the high coefficient of determination, the predictive power of the model is invalid. If the variables are collinear, the reliability and appropriateness of the variables of the proposed regression model are questioned. In regression analysis, the VIF is used to examine the intensity of multi-collinearity. This statistic shows how much of the changes related to the estimated coefficients have increased due to collinearity. If the VIF is greater than 5, the collinearity is high. The amount of tolerance coefficient is also the reversal of the amount of VIF statistics; tolerance is the percentage of variance in a predictive variable that other variables cannot explain. Small tolerances indicate that the corresponding variable with other predictors can also be determined that they do not have an important role in the regression model and the final prediction of the dependent variable of the research. If it is more than 0.2, it is a sign that the regression model has a good fit.

Table 7
The effect of independent variables (vernacular architectural variables) on sense of place.

Independent variable	Dependent variable	Direct effect	Indirect effect	Total effect
Form	Sense of place	0.149	0.227	0.376
Material		0.111	0.201	0.312
Social bond		0.252	0.046	0.298
Nature bond		0	0.135	0.135
Strength		0.150	0	0.150
Function		0	0.105	0.105
Breeze and Perfume		0.163	0.071	0.234
Memory		0.135	0	0.135

The results show that the tolerance coefficients and the VIF have acceptable values. In the analysis, all components and variables have a tolerance of more than 0.2, indicating their importance and independence from each other in the proposed model. The results of the calculation of VIF in the regression models of the present study also indicate an acceptable value of the VIF, the assumption of a non-collinearity relationship is proven, and the regression model can be cited.

6. Discussion

People's satisfaction with their living place is one of the most important aspects of increasing their life quality (Lundgren et al., 2020). The results of the study show that there is a significant relationship between the sense of place and its triple dimensions, including place identity, attachment to place, and place dependence on vernacular architecture. The highest correlation was between vernacular architecture and attachment to place, and the least relationship was between vernacular architecture and place dependence. There is also a significant relationship between the components of vernacular architecture and their components, including physical (form and material), communicational (link with nature, social bonding), and functional (strength, breeze and perfume, function, memory) with its sense of place and its dimensions. Among the main components of vernacular architecture, the physical, communicational, and functional components, the most communication was between the functional component and

sense of place and the least with the communicational component. Among the variables, the highest correlation was between the sense of place and the form variable, and the lowest correlation was between the sense of place and the function variable. The results of this study from the perspective of how the architectural variables influence the sense of place show that the function dimension of the vernacular architecture alone is not effective in creating the sense of place. Also, the effect of the link with the nature variable is not significant in the sense of place, and these two variables can be effective in the sense of place through other variables. Among the other six variables, the influence of vernacular architecture has the most direct effect on the sense of place by providing conditions for communicational between individuals (social bonding), and then the strength and memory alone are effective in the sense of place. Form and material variables have the highest, and function variables have the least effect on the sense of place. The results showed that the least relationship and susceptibility of the sense of place and its triple dimensions with the function variable, the changes made by the residents for better use of homes that were observed in most rural homes also confirmed these results and people's dissatisfaction, and it indicates that the functional dimension of the buildings did not meet the needs of the residents, which was based on the observations and interviews with the residents due to the change in lifestyle in different areas. Satisfaction with living place is obtained when an individual feels adapted to his/her living place (Rajabian & Dehghan 2022).

The results of the correlation test showed that there was a strong, significant relationship between the sense of place and its dimensions with the vernacular architecture. This result is consistent with most of the previous research. For example, Fallahi (2017) showed that in the reconstruction of the Qir and Karzin earthquake, some residents who were mostly tribes in the area, after entering earthquake-resistant homes, despite the unusual form of homes, due to the similarities with the life of the tent dwellers, the homes have been accepted and still after nearly five decades, life is going on in this area. This issue was also proven in the investigation of Bam City earthquake reconstructions in Lak (2015). In another study (2014), he stated that rebuilding the Bam neighborhoods has caused dissatisfaction with the home regardless of the past because the neighborhood's acceptance is a dual implication; on the one hand, the focus of residents and facilitating life and on the other hand, has the function was the lack of a separate space for the kitchen in the vernacular rural homes. People have turned one of the living spaces into a kitchen, and even in some homes, they have created it in the style of urban apartments (Fig. 6).

Another notable result was that the form variable had the most effect on the sense of place. To explain this, it can be noted that even in new buildings made with modern materials, including concrete and iron, what has been noticed by the people is the preservation of the form of indigenous homes, which shows the importance of this The use of vernacular materials also greatly affects the sense of place, a finding that various research has previously confirmed. Of course, some studies, such as Garakani (2015), have reported that changes in some of the characteristics of vernacular architecture, such as materials, can make people more satisfied with reconstructed homes.

led to the dissatisfaction and refusal of homes built in terms of structural and form for residents. Also, Aslani (2017), by examining the reconstruction of the architecture of the village of Baresar village in the Rudbar earthquake, stated that the lack of attention to vernacular architecture, the texture of the village, and the livelihoods had caused people's dissatisfaction and consequently lack of belonging to the new texture. Therefore, it can be acknowledged that the vernacular and traditional architecture of each region, while examining and considering the factors affecting the formation of rural settlements, can lead to a quality and appropriate space tailored to the needs of the villagers' lives (Abdullahi, 2015 and Anabestani, 2021).

This issue has also been approved by researchers in foreign empirical literature. For example, Clemente (2017), in describing the reconstruction program after the earthquake in Italy, introduces two titles for reconstruction: one is supply instead of demand, and the other is "where it was and as it was", in the first approach due to the lack of attention to the needs of the people, reconstructed homes and areas are deserted. On the contrary, in the second approach, which focused on the physical and architectural conditions of the past, the return of people to the reconstructed areas and the reverse migration was available. Prior to that, Kitzbichler (2011), by examining the earthquake in Aceh, Indonesia, found that the lack of attention to vernacular architecture in reconstruction had caused people's dissatisfaction.

Other findings of the study were that the function variable, in addition to having the least correlation in relation to the sense of place, would have the least effect on the predictive model. This finding is fully compatible with the analysis of field observations of reconstructed homes. Field studies show that people have made major changes to improve function in reconstructed homes over time. One of the most important of these has been the displacement of toilet. One of the cultural indicators and characteristics of the rural vernacular architecture of Rudbar has been the construction of a toilet in the surrounding area, which has been moved due to a change in lifestyle. On the other hand, since the materials used in indigenous homes are wood and mud, the placing the toilet in the home environment has a devastating effect on it. The inhabitants have chosen an interdisciplinary solution and placed the toilet in a corner of the hall or veranda. Another change caused by people's dissatisfaction with

component for the people. This finding is consistent with Falahat (2005). In a study to measure the factors affecting the sense of place, he found that the physical component has the most effect on the perception of the sense of place and that the components of activity and meanings fall into the subsequent rankings. Studies have shown that in most reconstruction experiences, people are better linked to homes built with old building forms and materials, and therefore, reconstruction officials are trying to present patterns that match vernacular forms (Kitzbichler, 2011).

Fig. 6. Moving the toilet from the courtyard to the veranda (top pictures) and creating a separate kitchen (bottom pictures).

7. Conclusion

Paying attention to purely physical approaches to post-disaster reconstruction and settlement and ignoring important factors such as people's sense of place, incorporation of vernacular architecture and local knowledge can have adverse outcome in affected people's wellbeing and satisfaction with their reconstructed homes. As our study demonstrated, the use of vernacular architecture in post-disaster settlements can be an important strategy to enhance sense of place and satisfaction of the inhabitants. Also, we demonstrated that the use of vernacular architecture patterns, in addition to benefits such as cost effectiveness, speed of implementation, environmental compatibility, and public participation in local construction methods, can play an important role in the construction of an identity space and increase perception of the sense of place in the affected population. Furthermore, use of vernacular architecture in reconstruction is environmentally friendly and an expression of how to use vernacular architecture to build post-disaster housing in Iran. Certainly, given vast variability in Iran's topography, climate, and local cultures, use of vernacular architecture in regions different from Rudbar require their own local examination and studies. However, our research method, models, and findings could serve as a guide to design similar studies customized according to local characteristics. In addition, use of modern construction systems for vernacular materials and proving limited training for the rural unskilled force, the new technology can be localized to meet people's need for housing and in accordance with any concurrent functional requirements and lifestyle changes.

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