Analysis of Effective Key Factors in Adaptability of a Building in the Future with Emphasis on Flexibility in Historical Buildings (Case Study: *Bu-Ali* of Hamadan)

Mehrdad Shahbazi [a*], Mohammad Reza Bemanian [b], Hamid Reza Saremi [c]

[a] PhD Researcher in Architecture, Borujerd Branch, Islamic Azad University, Borujerd, Iran.
[b] Professor of Architecture, Faculty of Art and Architecture, Tarbiat Modares, Tehran, Iran.
[c] Assistant Professor of Urban Planning, Faculty of Art and Architecture, University of Terabit Modares, Tehran, Iran.

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Abstract

Today, since the contemporary world is changing to meet the needs of various people, the aim should be to provide a condition for areas and buildings in order to respond to the needs of various shapes, its future audience requirements, adaptability, flexibility, versatility, etc. Since the scarcity of environmental resources and ecological crises in the world today cannot justify the demolition and reconstruction of areas is more important. So areas should be designed in such a way to compliance with the contemporary needs. Moreover, it can be adaptive to its future audience. The method used in this research is descriptive-analysis collected using questionnaires and library tools and the software SPSS and factor analysis to analyze to express the characteristics and the reliance of each one. The results show that between the effective factors on the admissibility of space users, flexibility has the greatest impact on Adaptability and also its sub-variable (ranging versatility) has the greatest impact on flexibility of the place, and after that, fluidity factors, scalability, flexibility, and eventually, convertibility has had impact in monument of *Bu-Ali* which is located in Hamedan city Subsequently and convertibility is the least factor influencing the flexibility in monument of *Bu-Ali* in Hamedan.

Keywords: Versatility, Flexibility, Adaptability of a Building, Monument of *Bu-Ali*

1. Introduction

The term "adaptability" refers to the ability of a building to accept fundamental changes. Being impossible to alter hanging social and economic conditions and the physical environment and the needs and expectations of people building over time justifies the need for these capabilities in buildings. Now to avoid the problem of lack of awareness of the needs of users and gain on extension needs, farmers have used different methods. One of these regulations is the Design Guide, which aims to translate user needs into design standards and recommendations. And the other method of research in the history of settlement aims to use existing data to meet the needs of future beneficiaries (Einifar, 2003). According to the definition done by the adaptability of functionality, a building where the greater amount has the advantage of having a higher operate more efficiently and more duration of service. These advantages arise due to applying changes with low cost (Schneider & Till, 2007). This indicates that many of the buildings in terms of physical look should be designed according to the building components, and so to be flexible with compatible environmental design and long life worthy proposition (Kincaid, 2000). In other words, areas should be designed in such a way that in addition to adapting to Contemporary needs, their future would be acceptable for human contact. The purpose of this article is to present a definition of the term "adaptability of a building" for future flexibility in areas as a concept, and also to achieve adaptability of a building in the future, among which, the indicators of the adaptability of a building and environmental considerations have been covered. The method of this research was descriptive-analysis using collected questionnaires and library software SPSS, to analyze the characteristics and dependence expressed in each case together. It seems that physical flexibility is the most important factor in the adaptability of buildings.

2. Research Body

2.1 Adaptability of Buildings

Adaptability is equivalent to the Latin word which is formed with a Latin (ad) interior and (aptare) which means suitable that includes any work on the building and its maintenance in order to change, capacity, performance or efficiency (Douglas, 2006). The general characteristic of adaptability is the ability to change (Gerwin, 1993: 398). Being able to respond to environmental feedback which comes from nature to change (Upton, 1994:10),
and may be activated as a feature rather than behavioral responses considered in system design. As a result, it can

* Corresponding Author Email: mehrdad1364@hotmail.com

be limited to time, effort, cost and performance (Naim et al., 2006:300). In adaptability of a building, two aspects of strategic should be planned. 1. Configuration 2. How to reconfigure the initial design and subsequent changes that will be used in framework for describing the following admissibility (Beadle, 2008). Adaptability of a building is a key feature and can be considered as the capacity of a building to absorb minor and major changes (Grammenos & Russel, 1997). The five main criteria for the adaptability are as the following:

1. Convertibility: This allows to make changes in user types. (Economical, Legal, Technical) (Douglas, 2006). Along the main functions of service delivery and performance area adds to its diversity of activities and increases the presence of different people in the building. This is, therefore, effective in case of a proper control on the sociability area and buildings (Mohammadi & Ayat ol Allahi, 2014: 83). Functionality of areas in the socialization occurs in two modes. One with "direct functionality" that allows the physical behavior of interpersonal interactions in space and buildings. And the other "indirect functionality" as a factor of perception and sense, by creating images of social relationships between users and facilitates the definition of the building (Mohammadi & Ayat ol Allahi, 2014: 83). Increasing the functionality of areas for common activities for active and semi-active and passive is effective on quality of area sociability (Daneshpour & Charkhian, 2007: 23).
2. Non-destructivity: Destructivity means physical components exit of the original form and moving towards the elimination of physical-performance (Zebardast, 2005:17). To avoid destructivity of buildings we must have theoretical principles and practical approach to the issue of restoration of buildings and their concept saves buildings with those which are endangered (Amid: 2013:171). Also, study and review should be done comprehensively so that after theoretical studies related to the history, climate, urbanization and architectural features of buildings in various fields of studies be taken to document evidence and remaining works. At the same time, in order to achieve the specific situation in general and specific conditions, local research should be done and after summarizing data and concluding from the data, restoration techniques should be considered (Falamaki, 2007).
3. Sustainability: Sustainability occurs when parts of a building can be dismantled or recycled into other usable form (Douglas, 2006). In American sustainable instructions, this refers to acting or representing, form, features and details in the building campus in order to simulate its appearance and its historical places is a specific time. In Bora's Chapter, sustainability means to restore a place to its previous status and the difference with the restoration is to implement new materials into a building's texture (Yukilheto, 2008). Creative architects can develop new materials and products for special applications of architecture and will be able to create a new industry based on these new products (Addington & Schodek, 2005). In order to produce recycled materials, what matters most about smart materials and recyclable classification system is how these materials interact with the environment in terms of functions, durability and stability, the possibility of recycling, beauty and utility, etc (Atkins, 2004) (Tourani, 2008).
4. Expandability: This means to increase the volume or the capacity of a building (Douglas, 2006). The process of growth and development in historical buildings of a city represents a chaotic and in some cases, forming quality conditions of crisis in historical perspective, as one of the most important consequences of policies of urban development (Kheiroldin et al., 2014). Development of historical buildings means a lot beyond the "historical centers" of attending these buildings and historical perspective of the evolution of the concepts (Riahi Moghadam, 2012: 7). Small scale historical use of space plays an important role in the development of urban areas and improves the quality and readability perspective of the urban environment and has a direct impact on the perception of citizens (Kheiroldin et al., 2014).
5. Flexibility: Flexibility literally means the ability to adapt to new conditions and changes in variability, the ability to deal with changing conditions, and the ability to change easily (Afhami & Alizadeh, 2013:61). In architecture and environmental design, flexibility means areas and spatial organization to achieve its man-made and changes in the conditions, new requirements and usages (Einifar, 2003: 69). Flexibility refers to the possibility of setting up an area in terms of individuals' needs, such as meeting the special needs of sensory or mobility (Moore & Jeffery, 1994). Flexibility in architecture design offers a variety that includes possibility of configurable and compatible housing units over time and finally causes the building to showcase its new species (Zebardast, 2005:17) [34]. The aim of flexibility in architecture is to create areas with minor structural changes to make changes in requirements, performance and usages (Habraken, 2008: 293).

   The concept of flexibility is widely used in architecture and literature which can be categorized in five areas in areas as the following (Torin, 2002:17):

   5.1. Fluidity: Fluidity is created through various aspects such as interaction with nature, the

unity of the part and the whole, proportions, stability, sense of place, identity of a space, spatial contrast and composition and spatial organization, coherence, continuity, transparency, openness and balance (Toghyani, 2015). Among the various arts, architecture is perhaps the most smooth and fluid nature of his appearance in the large and often hidden steadfast (Caudill, 1954). But since it is clearly vivid, it absorbs more symbolic meaning and admits affairs to special functions. Fluidity of a building causes the manifestation of life, social stratification and hierarchy to be formed (Mansouri, 2010:6-7).

5.2. Versatility: It features areas which allow multiple applications to be used (Torin, 2002:17). Versatility is an ability to coordinate an area with terms of a new required one. In new buildings, versatility is an ability which matches new requirements with changing degree in interior areas (Einifar, 2003: 69). One of the preconditions of versatility is the performance of holding and separating elements of buildings. Thus, the history of versatility is closely linked to developments and flourishment of buildings in a new era of prosperity (Groter, 2008).

5.3. Convertibility: This is to determine the ease of adapting an area to create a new user (BRUBAKER, 1998) .Convertibility has long been of an importance in traditional places and historical buildings and area communications. With proper use and proper conversion approach, we can recover soul of modern buildings, and re-inject original meaning of buildings into them (Toghyani, 2015). The most conversion of spatial properties are:

- Easily accessible and legible to spaces
- Integration of functions in an area and reduce waste in communication areas
- Utilization of available areas so that applications become possible (Einifar, 2003: 69).

5.4. Scalability: A building's contraction or expansion must be evaluated into community goals in the design of the building in which it can be temporarily converted to other purposes or different centers [6]. Scale is measured by the size of the users. The proportions used in space can give a sense of scale to the user. Through scalability of the building, one can create harmony between the different components of the building and through the balance of the surrounding landscape (Toghyani, 2015) .In evaluating the flexibility of a texture, all three scales like, large, middle and micro be assessed in the context of spatial hierarchy.

5.5. Corrigibility: This is a special feature of activities and professions in areas which lead to rapid areas that can be reformed with moving parts like, walls, partitions, furniture, and equipment (Leggett, 1977). Corrigibility means quantitative increasing and decreasing or separation and integration of areas and to return to the original design to be built after the expansion or reduction of its area. The concept of corrigibility is connected with study of area requirements of a building. Such flexibility may be long-term or short-term (Einifar, 2003: 69).

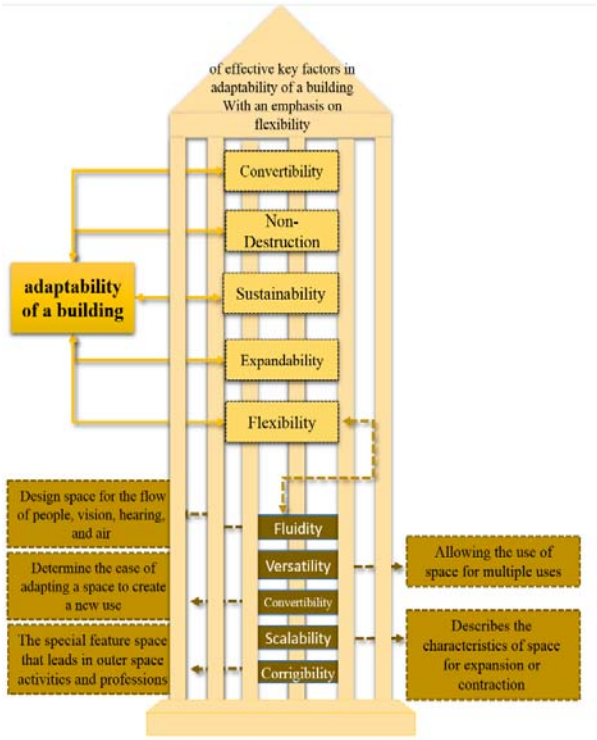

Fig. 1. Theoretical Framework
(Source: the Authors)

2.2 Background Research

Kathy Biddle *et al.* in a compatible future article: Sustainable aspects of adaptability of a building have highlighted different aspects of sustainability in a consistent building with a focus on the characteristics of the economic, environment and society. In fact, the purpose of this article is to optimize the configuration of components and systems of building designs and to innovate an invention that the parameters of changing society protect the ability of its own adaptability. The method in this research is a structural link through which action research, interviews, focusing groups, workshops, scenario modeling, literature review and analysis of

relational matrix structure. Finally, it is concluded that sustainability is a vital part of a building's adaptability and both parameters of adaptability and stability of a building are considered as the most important features of the construction of industry standards in a society which are constantly changing (Beadle et al, 2008). Giib *et al.* in this article running a receptive and stable building: Pre-configuration and re-configuration are compatible in order to create an environment to explore solutions to build and host. This paper is the preliminary results of an experimental project that challenges its work affairs. The results show that if any initial construction of applications is used, it will result in fully understanding of the techniques, an increase in business in the area of the building, process-centric and understanding of the implications of building projects will be compatible and adaptable. In case any of these measurements are about to be considered, a movement will start to be created toward establishing true compatibility and adaptability in the non-residential structures, especially in large buildings (Gibb et al., 2007:1-12) . In the simulation study based on the method of determining the energy strategies of strengthening systems, Capelloto and Ochoa used a system of compatible façade in order to check how to reduce national energy, reduce environmental impact, strengthening the short term, increase adaptability of buildings by reducing the involvement of residents by promoting posing with elements that enhance energy efficiency and user convenience. The aim in this research is to develop a mass production system adapted to an increase in the receptivity of energy through improvements in residential buildings across Europe. The research methodology of this paper is to identify preferred strategies and combinations for the early stages of design such a system. Finally, the method and synoptic plan to identify the energy rating of the building facade to improve and combine abbreviated orientation of a simulation model is designed to identify and rank the desired settings (Capeluto & Ochoa, 2014: 375–384).

Gosling et al in the article of adaptable buildings: a system of approach is used to process characteristics of a building and those which can host and adapt it. This study aimed to rationalize the route compatibility and adaptability in the construction and delivery of a specific model to study the relationship between the dissimilar. Finally, it has been concluded that in case of any interchangeable parts, the uncertainty in the construction, and layout of the building, rationalizing the concepts of compatibility and adaptability, using optimization, auditing methods, integration using system operating which can empower the resulting increase in its adaptability (Gosling,2013: 44-51) .

3. Case Study: The Memorial Monument Of BU-ALI

The monument of *Bu-Ali* was built during the Qajar. It was ordered to be established by a girl named "Negar", a granddaughter of F. Ali Shah. A fusion of two ancient styles of Iranian and the Islamic architectural one was utilized. Also a set of elements of traditional Iranian architecture was used. Currently, South Hall of the monument is used as a museum to hold coins, pottery, bronze and other objects found on millennia BC and dedicated to Islamic period, and in the North Hall, there is a library consisting of 8,000 precious Iranian and foreign manuscripts and printed books and stands to keep the works of Bu-Ali and other poets and writers from Hamadan. A very good supplement to this building is a semi-circular garden with green space. Also, a statue of Bu-Ali with a book in his hand is installed on the east side of the square.

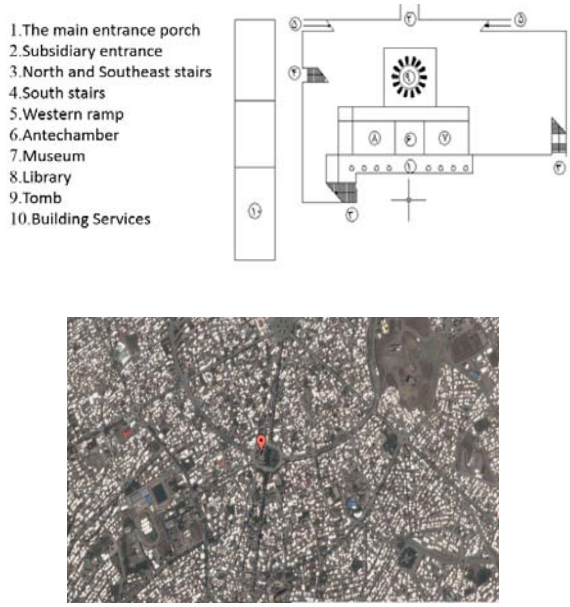

Fig. 2. Case Study (Source: the Authors)

4. Research Methodology

The main objective of this study was to achieve a definition of the term "adaptability of a building" for future area flexibility as a concept to achieve. And also the test of the mentioned hypothesis is a type of descriptive-analytic research; then the underlying case study method was used to evaluate the study area, and begins to review and assess the criteria derived from the theoretical framework which will be discussed in the study area. The data collection tools are: questionnaire, interview and observation. After gathering the data, first a non-normal or normal distribution is evaluated using the Kolmogorov Smironov test, and spss software is intended for independent variables. Flexibility within the adaptability of the contribution of each of the criteria is specified through factor analysis and multivariate regression of Spearman's rho and Kendall's tau_b. Reliability with Cronbach's alpha coefficient was calculated by (Cronbach's Alpha = 0.71) sample size based on Cochran formula was obtained by calculating the amount of clients 584,014 people in Hamadan in 1395 (95% and an error level n = 384) $\alpha = 0.05$ Is.

5. Research Findings

5.1 Test of normal distribution of samples

In this section, one must recognize distribution of collected data to determine the choice of the appropriate tests and hypotheses to be tested. For this purpose, the Kolmogorov-Smirnov test is used. The hypotheses of this test are:

H0: Studied distribution of the sample is normal
H1: Studied distribution of the sample is not normal
The results are provided in the table below

Table 1
Survey the normality of variables

Distribution Status	The significance level	Variables
Not Normal	0.002	adaptability of a building
Not Normal	0.000	Convertibility
Not Normal	0.000	Non-destructivity
Not Normal	0.000	sustainability
Not Normal	0.000	Expandability
Not Normal	0.000	Flexibility
Not Normal	0.000	Fluidity
Not Normal	0.000	Versatility
Not Normal	0.000	Convertibility
Not Normal	0.000	Scalability
Not Normal	0.000	Corrigibility

(Source: the Authors)

Based on the above table, since the significant level of variables is lower than 0.05, so with a 95% of probability, the hypothesis (H1) is confirmed and H0 should be rejected. As a result, it is not accepted as normal distribution of the sample studied. Therefore, nonparametric tests should be used.

According to Table 2, since the amount of KMO is equal to 0.728, the data is appropriate to perform in analysis.

The test results of Cruet Bartlett's are also significant that the null hypothesis is rejected in the sense that there is a correlation between variables.

Table 2
Statistics measuring the adequacy of sampling

Statistics measuring the adequacy of sampling .Kaiser-Meyer-Olkin.		0.728
Bartlett's test of sphericity	Approx. Chi-Square	74.477
	df	45
	Sig.	0.006

(Source: The Author)

5.2 Factor Analysis

Factor analysis is only used when you want to discover a few of the large number of variables. In other words, large numbers of variables lie in several factors. Factor analysis is a general name for some multivariate statistical methods whose main purpose is to summarize the data.

The above table shows a special value and the corresponding variance. Special value of each factor is a proportion of the total variance of variables that can be explained by that factor. Special value is calculated particularly through the sum of squares of loadings of all variables of that factor. Low value of a factor means the variation has had a negligible role in determining the valiance. As it can be seen, four factors can explain the variance. If we rotate the factors obtained by Varimax method, we'll see that five factors of adaptability will follow their variance. If these factors are rotated by Varimax method, the operating factors will be first (convertibility), second (destructivity), third (sustainability), fourth (expandability) and fifth (flexibility), respectively with values of (11.340), (12.543), (12.565), (11.338), and (14.652), total value of 61.163% of the variance in them. The first factors are (fluidity), second (versatility), third (convertibility), fourth (scalability), and fifth (corrigibility), respectively with values of (12.182), (13.675), (11.212), (10.926), and (9.848) with the total of 59.142% of the variance in them.

Table 3
% of the variance and special values of different

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	0.625	11.340	14.340	0.625	11.340	14.340	0.653	12.767	12.767
2	0.673	12.543	26.883	0.673	12.543	26.883	0.685	12.171	24.937
3	0.617	12.565	38.534	0.617	12.565	38.534	0.650	12.767	37.901
4	0.609	11.338	49.872	0.609	11.338	49.872	0.643	11.971	49.872
5	0.770	14.652	61.163	0.770	14.652	61.163	0.696	12.964	61.163
1	1.218	12.182	13.675	1.218	12.182	13.675	1.223	12.232	12.242
2	1.367	13.675	25.875	1.367	13.675	25.875	1.224	12.242	24.484
3	1.121	11.212	37.069	1.121	11.212	37.069	1.222	12.221	36.705
4	1.093	10.926	47.955	1.093	10.926	47.955	1.129	11.290	47.995
5	1.393	9.848	59.142	1.387	13.875	59.139	1.223	12.202	59.139

(Source: the Authors)

5.3 Pearson Correlation

The above table shows the correlation between variables. There is a significant test of flexibility level between variables of fluidity, flexibility, convertibility, scalability which is less than 0.01. Therefore, the assumption of the relation between these variables has been accepted and this is considered as a meaningful test. Also, the correlations between them are accepted.

According to the results of the first hypothesis, there is a significant relation with variables of flexibility with variables of fluidity, versatility, convertibility, scalability, and corrigibility.

There is a significant level of test between adaptability of a building with variables of flexibility, convertibility, recyclability, destructivity, and expandability is less than 0.01. Therefore, hypothesis of the relation between these variables is accepted. Also, the correlation between the variables of them is strong and direct.

According to the results of the second hypothesis, there is a significant and meaningful relation with these variables. There is a significant level of test between adaptability of a building with variables of fluidity, versatility, convertibility, scalability, and corrigibility is less than 0.01. Therefore, with this hypothesis, the relationship between them is considered as a meaningful test.

Table 4

Pearson's coefficient Secretary of variables based on variables admissibility flexibility

dimension	Variable	The correlation coefficient	The significance level
Adaptability of a building	Flexibility	0.766	0.000
	Convertibility	0.547	0.000
	destruction	0.517	0.000
	sustainability	0.529	0.000
	Expandability	0.467	0.000
Flexibility	Fluidity	0.498	0.000
	Versatility	0.521	0.000
	Convertibility	0.447	0.000
	Scalability	0.476	0.000
	Corrigibility	0.456	0.000

(Source: the Authors)

5.4 Step by Step Regression

5.4.1 Regression between independent variables and dependent variables of fluidity, flexibility, versatility, convertibility, scalability and corrigibility.

Among the variables introduced into the model, variables of flexibility, versatility, convertibility, scalability, as well as corrigibility are considered as independent variables to predict variability and flexibility using the same method (step by step), which were entered into the regression model. In stepwise variable, which is very effective, enters the model. In the first step, versatility, in the second step, flexibility, scalability, in the third step fluidity, in the fourth step convertibility, and in the fifth step corrigibility are entered the regression model. The table 5 shows the summary statistics related to the number of models fitted within the model, including multiple correlation coefficient, coefficient of determination, determination coefficient and standard error of regression estimation.

Table 5

Summary statistics related to the number of models fitted within the model

Model	Multiple correlation coefficient	The coefficient of determination	Adjusted coefficient of determination	Standard error of regression estimation
1	0.419[a]	0.176	0.173	1.88544
2	0.572[b]	0.327	0.324	1.70535
3	0.662[c]	0.438	0.434	1.56061
4	0.717[d]	0.514	0.508	1.45414
5	0.763[e]	0.582	0.577	1.34910

(Source: the Authors)

a. Dependent Variable: Scalability
b. Predictors: (Constant), Scalability, Versatility
c. Predictors: (Constant), Scalability, Versatility, Fluidity
d. Predictors: (Constant), Scalability, Versatility, Fluidity, Convertibility
f. Predictors: (Constant), Scalability, Versatility, Fluidity, Convertibility, Corrigibility

The table 5 the shows correlation coefficient between independent and dependent variables. In the first model, only variable of versatility has entered the model and the value of the multiple-correlation coefficient is reported to be 0.419; thus, there is a strong correlation between the variables flexibility and adaptability. The value of the

reduced coefficient of determination is reported to be 0.176 which means that the independent variable of scalability stands alone by 0.176, or 17% of the total variance of the dependent variable (Criteria). Adding the variable of versatility to model number two adds 15% to the coefficient of determination and increases the coefficient of determination to 0.327. In the third model, by adding the variable of fluidity, about 11% is added to the determination factor. And the correlation coefficient has reached 0.438, and in the 3rd model, 7% is added to coefficient of determination. Finally, in the last model, by adding correlation coefficient, about 6% is added to the coefficient of determination and the final coefficient reaches 0.582 or 58.2% and the rest is under the changes due to variables out of the model. Also, 58% of the data is defined by the regression model, which is a relatively high percentage. The final model is as the following:

Flexibility = (-0.734) + scalability (0.176) + Versatility (0.327) + Fluidity (0.438) + convertibility (0.508) + corrigibility (0.582)

5.4.2 Regression between dependent variable of adaptability of a building, and independent variables of the convertibility, destructivity, recyclability, expandability and flexibility

Among these variables, variables of fluidity, versatility, scalability, and corrigibility are introduced into independent variables to predict changes of the variables of adaptability of a building using the same method (step by step) to enter into the regression model.

In stepwise (step to step) method, the variable with the highest effect enters the model. In the first step flexibility, in the second step destructivity, in the third step sustainability, in the fourth step expandability, and in the fifth step convertibility enter into the regression model. The table below shows the summary statistics for the model and includes a number of fitted models, multiple correlation coefficient, and determination coefficient, adjusted coefficient of determination and standard error of regression estimation.

Table 6
Correlation coefficient between independent and dependent variables

Model	Multiple correlation coefficient	The coefficient of determination	Adjusted coefficient of determination	Standard error of regression estimation
1	0.542[a]	0.293	0.292	2.50735
2	0.719[b]	0.517	0.515	2.07531
3	0.835[c]	0.696	0.694	1.64788
4	0.923[d]	0.852	0.851	1.15119
5	1.000[e]	1.000	1.000	.00000

(Source: the Authors)

a. Dependent Variable: Flexibility,
b. Predictors: (Constant), Flexibility, Non-destructivity,
c. Predictors: (Constant), Flexibility, Non-destructivity, sustainability,
d. Predictors: (Constant), Flexibility, Non-destructivity, sustainability, Expandability
f. Predictors: (Constant), Flexibility, Non-destructivity, sustainability, Expandability, Convertibility

The table 6 shows the correlation coefficient between independent and dependent variables. In the first model, only variable of flexibility enter the model and the multiple correlation coefficient is reported to be 0.542. Thus, there's a relatively strong correlation between the variables of flexibility and corrigibility. Adjusted determination coefficient has been reported to be 0.293. This means that the independent variable of flexibility equals 0.293, equivalent to 29% of the total variance of the dependent variable (corrigibility). Adding a variable of destructivity to the second model increases the coefficient of determination by 17% and the coefficient of determination reaches 0.517. In the third model, by adding the variable of sustainability about 11% is added to the adjusted determination coefficient and it reaches 0.696. In the fourth model, 15% is added to determination coefficient; and finally in the last model, with the added variable conversion feature by 6%, final determination coefficient has to reaches 0.100. In the end, all 100% of the data is determined by the regression model. The final model is as in the following:

Adaptability of a building = (-0.344) + flexibility (0.542) + convertibility (1.000) + sustainability (0.696) + destructivity (0.517) + expandability (0.714)

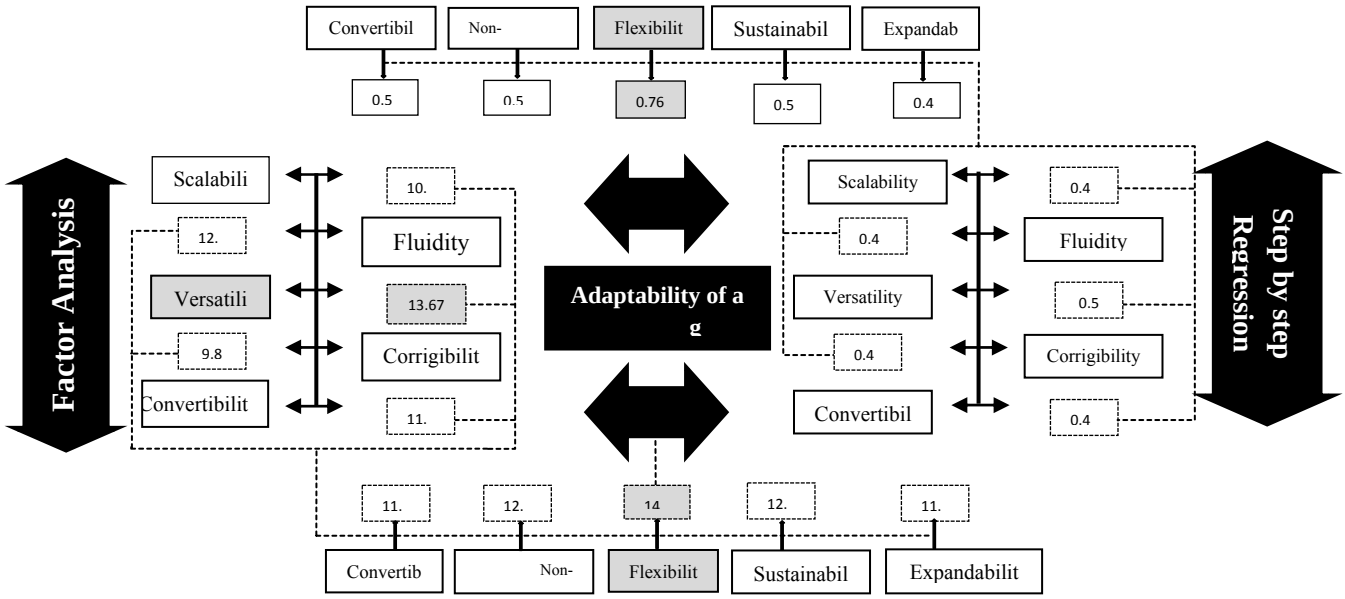

Fig. 3. Adaptability of a building (Source: the Authors)

5.5 Analysis of the variables of flexibility in the monument of Bu-Ali

A: Versatility

As you can see from the results of SPSS software, it can be said that one of the most important characteristics of flexibility is versatility. In Iranian traditional buildings, along with the changes, different sectors of space evenly matched with required functions while elements of these functions play an important role in the regulation area. Spaces such as the library, museum, hall, and courtyard adapt areas with the needs of people as well as tourists. Among these, platforms, stairs and green spaces around in the summer need effective implementation of the space. Since the backyard of the tomb shades in summer and the front yard is for winter time, the tomb of Bu-Ali also provides shades to cool down the Southern part of the campus where library, museum and hall are located. And where the tomb is located in the central area, avoids exposure to direct sunlight. And thus, in the micro scale, these places according to the general design pattern defined by the spatial features, daily and seasonal needs are evenly matched.

B: Convertibility

One of the characteristics of flexibility is convertibility. Convertibility which means the ability to provide different usages of spaces depends on two variables: time and area. Based on this definition, different spaces of a building can have several functions simultaneously and can be used for different functions at different time periods.

Convertibility in main areas of Bu-Ali tomb like the main layer (main and secondary entrances, north and south stairs, western ramps) has been more than servicing areas. Functional diversity of areas like the museum, hall, and

library fits the needs of visitors and tourists, and uses these spaces to have delivered in different time period. Also the intermediate spaces between internal and external transformation of the public areas are also semiprivate space and neutral access to these areas through communication areas which provides convertibility. Service Building forms the most consistent layer of the monument's campus which is located farther away from the monument.

Fig .4. Facing south eastern area of *Bu-Ali*
(Source: the Authors)

C: Corrigibility

Corrigibility and convertibility and the separation of parts of space have had a good performance to other areas. General characteristics of the area around the shrine and

the inner courtyard make it possible to use different ways to provide quiet areas. The space separating the outer and inner areas has been possible by creating separate inputs. In terms of performance, functional construction of the tomb provides the needs of people and tourists using small and large scales. These smaller scale spatial changes can be seen in outer area and inner area extensive space parts. That is why the servicing area has been built smaller than other parts of the area according to the needs of residents. Also, this part of the area, since it needs a close and smooth connection with other parts, is made in the form of a floor.

D: Fluidity

In the designing project of the monument of Bu-Ali it has been tried to reduce a condition that specifies architecture for areas, and form it in a state and optimized way by its reduction. It a way that its architecture only refers to the most efficient and effective way possible and that the designer just provides a sublime form and do the calculations. And as its work was connected with the non-static range of mathematics, its mental complexity ultimately leads to a framework specific architecture. As a result, users can find an understanding of the form and function of the building, including the design, history of the building and forming scenario in which all forms and levels of enrichment is stored.

E: Scalability

As the monument of Bu-Ali is a historic site, it can be effective in qualifying and strengthening the sense of place and its readability role. This monument, by observing the spatial hierarchy and human scale and also by its design, position and performance, has been able to protect its character. In the courtyard of Bu-Ali there's a relation between the size of elements and proportions which gives a sense of scale to the user. Scalability of Bu-Ali campus has created a harmony between the different components, and therefore, there is a balance between the surrounding areas. In the large scale, this meets the average level of natural light and ventilation in terms of depth. About the access, there's a key point between the areas with the surrounding environment, and ultimately, in terms of height there is no limit on the ease of access to the area. In mid-point scale, to analyze the flexibility increases the communication spaces, and as a result, it increases receptivity creating a sense of place and in tourism and the protection of economic and social activities. Among the micro-scale, there is a library, a museum, a hall and ... human scale.

6. Conclusion

In this study, after determining the factors of adaptability of a building, areas in the city were was assumed that the improvement of the adaptability thereby increases the flexibility of urban areas. The study of variables using factor analysis and correlation test and Spearman's rho Kendall's tau_ b proved that citizen satisfaction with optimal performance of Bu-Ali tourist area space leads to flexibility. The adaptability of a building includes five dimensions of convertibility, destructivity, convertibility, sustainability, expandability, and then goes flexibility including five dimensions of fluidity, versatility, convertibility, scalability, is beyond corrigibility. As long as the area doesn't provide citizens to meet their expectations, it will not be welcomed. To do so, we must strengthen these areas in terms of acceptability and flexibility while meeting the needs and expectations of citizens and, it turned out to be an efficient space. The results show that the factors affecting the adaptability of area by users have the greatest impact on operating flexibility in Hamadan's Bu-Ali adaptability erected in the courtyard. Also, the variable (variable adaptation) had the greatest impact on flexibility. In the campus, hallways and stairs, different space element adapter with different functions and regulations of all the elements are necessary changes in internal communication. At the same time, elements of the enclosure play an important role in the regulation of these functions. Areas like the library, museum, hall, courtyard provides the needs of people as well as tourists. After that, factors of mobility, scalability, convertibility and ultimately the study area had a minimal impact on flexibility.

In addition to information and discussion presented in this study, stability can meet the changing needs of users with diverse lifestyle fit. Therefore, further studies related to the flexibility and corrigibility can be derived from the information and arguments provided by this study.

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