reviewed paper

Post-Earthquake Quality of Life: Assessing the Bam Recovery Process

Homa Masoumi, Behzad Malekpour Asl, Siamak Badr

(Homa Masoumi, Faculty of Architecture and urban planning, Shahid Beheshti University, ho.masoumi@mail.sbu.ac.ir)
(Assistant Professor, Behzad Malekpour Asl, Faculty of Architecture and urban planning, Shahid Beheshti University, b_malekpour@sbu.ac.ir)
(Visiting Lecturer, Siamak Badr, Faculty of Architecture and urban planning, Shahid Beheshti University, s_badr@sbu.ac.ir)

1 ABSTRACT

This paper examines the recovery process of the Bam (earthquake hits on December 26, 2003) on the survivors' quality of life after 17 years. Our purpose is to explore the main root causes of the success or failure of the Bam recovery process. The results of this research could be effective in the success of the future disaster recovery process. For this reason, a self-report questionnaire designed to collect data on socio-demographic attributes, quality of life, and earthquake effects and its recovery rate from Bam's citizens' point of view. Cross-sectional data were collected during the summer of 2020 in Bam city by the snowball sampling method. The total sample comprised 150 of 164 (91.4% response rate) citizens who lived in Bam at least one year before the earthquake (and until now). Three analysis methods were applied, first descriptive statistics, second a statistical test (one-sample t-test), and third Ishikawa diagram. The results show that the Bam recovery process was not successful and Bam recovered only 54% in quality of life dimensions. The research hypothesis (H0: The recovery process of Bam city has improved citizens' quality of life) has been rejected based on the findings. Finally, in the last part of the analysis, eight main causes have been determined for the Bam recovery's failure in increasing the quality of life. Although failure causes are in both management and physical dimensions, it seems that the physical causes are also rooted in the management system of Bam city.

Keywords: Recovery; Quality of life; Resiliency; Vulnerability; Disaster management; Bam

2 INTRODUCTION

According to EM-DAT and NOAA reports, the number of reported natural disasters increased 7.5 times in 2010 compared to 1950. Moreover, due to the population growth, new urban developments, and increasing densities in urban areas, the number of human deaths has increased more than 2.5 times between the late 20th and early 21st centuries (The international Disaster Database, 2020; National Centres for Environmental Information, 2020).

Iran is considered as one of the most vulnerable countries in the world to natural hazards due to its geographical location and location in an earthquake-prone area. According to the national centre for environmental Information Centre (National Centres for Environmental Information, 2020), over the past 30 years, earthquakes have directly caused the death of 86,200 persons and nearly 168,000 injuries. Besides, Iran's earthquakes have indirectly injured more than 1.7 million people during 1988-2018. On December 26, 2003, the catastrophic Bam earthquake measuring 6.6 on the Richter scale, resulted in the deaths of more than 26,000 persons, and left more than 15000 casualties. This earthquake affected more than 268000 people's lives (Statistical Centre of Iran, 2003).

A four-phase disaster management strategy cycle has been applied worldwide to cope with increasing disaster events and their consequences. These phases include mitigation, preparedness, response, and recovery (David E Alexander, 2002). Most urban planners' actions and plans are focused on the two stages of mitigation and recovery, and this research particularly focuses on the recovery phase. The recovery phase will be effective and successful when it has four main goals: having long-term effects, reducing vulnerability, increasing resilience, and increasing the quality of life in disaster-affected cities (Diana Contreras, 2016; FEMA, 2006; J Eugene Haas et al., 1977). Therefore, due to this phase's long-term nature and its complexities, in many cases, the recovery phase in post-disaster planning has either been neglected or not even considered by the decision-makers (Diana Contreras, 2016). Although several studies have been done on mitigation and response phases in the urban planning field (Harriet Bulkeley et al., 2011; David R Godschalk, 2003), just a few of them focused on the recovery phase. Diana Contreras, (2016), James Schwab et al., (1998) and Gavin Smith (2012) in particular, examined the recovery in terms of quality of life. This aspect of recovery has an integral role in the recovery's success. As we can see, many urban plans look successful at first but practically failed because of citizens' dissatisfactions.

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER

Quality of life has a multidimensional structure (including physical, psychological, economic, social relationships, and environmental domains) and can be examined from objective and subjective aspects. Previous studies in post-disaster quality of life could be categorised into three groups: some studies focus on a particular group in society (age or gender) (A Ardalan et al., 2011; Ting Hu et al., 2018; Zhaobao Jia et al., 2010; Mau-Roung Lin et al., 2002); some studies analyse post-disaster quality of life in a specific field such as sociological, psychological, economical, etc. (Zhaobao Jia et al., 2010; Ying Liang, 2015; Jin Wen et al., 2012); and some studies analyse post-disaster quality of life in the short term (from months to 5 years) after a disaster event (A Ardalan et al., 2011; Zhaobao Jia et al., 2010; Jin Wen et al., 2012). To our knowledge, this is the first research in which the long-term recovery process has been evaluated from the citizens' point of view (subjective aspect) in general dimensions of quality of life.

Therefore, this research aims to explore the main root causes of the success or failure of the Bam recovery process 17 years after the earthquake. There were three research questions: (a) Has the Bam recovery process been successful in the opinion of the citizens? (b) How much has Bam recovered in quality of life dimensions? (c) What were the main root causes of the success or failure of the Bam recovery process? The study conducts a population-based survey of 150 Bam citizens who have been living in the city after the earthquake. Data collection and analysis took place in three stage yo answer the research question: (1) descriptive data was analysed; (2) research hypotheses were tested (Hypotheses 0 (H0): the recovery process of Bam city has improved the citizens' quality of life and Hypotheses 1 (H1): the recovery process of Bam city has not improved the citizens' quality of life); (3) root causes of the main problem have been identified.

3 DISASTER RECOVERY

The literature provides a variety of definitions of disaster recovery. Early literature defined recovery as a predictable part of the post-disaster process to return to normalcy (J Eugene Haas et al., 1977, p. 262; Enrico Louis Quarantelli, 1999). Today, disaster recovery is defined as a non-linear, dynamic, complex, and challenging process that involves all national and international parts and sources. In this definition, recovery aims to reduce society's risk and bring it to a better situation than it was before (J Eugene Haas et al., 1977).

Smith and Wenger broadly defined recovery as "the differential process of restoring, rebuilding, and reshaping the physical, social, economic, and natural environment through pre-event planning and post-event actions" (Gavin P Smith & Dennis Wenger, 2007, p. 237).

Disaster recovery is a complex and challenging process that involves all sectors of a community and outside interests. It is not even clear if and when recovery has been achieved in many cases because of the community's varying stakeholder goals. For example, some stakeholders want to return society to its pre-disaster status, and others like it to change and be less vulnerable to risks (William A Anderson, 2008).

FEMA (2006) stated that recovery activities might be designed to return systems to normal or a new and less vulnerable status. This has led some researchers to distinguish between short-term and long-term recovery. The short-term phase focuses on the restoration of pre-disaster functions, and the long-term phase focuses on community improvements (FEMA, 2006, p. 52; James Schwab et al., 1998).

Based on the literature review, recovery does not have a single and particular definition. This term is a broad and macro concept and cannot be easily measured (Recovery indicators give in table 1). In this research, recovery defines as a "post-disaster long-term plan and efforts that aim to develop the system, compensate the damages, improve the environmental conditions compared to the past, and sustain the society to future disasters." This process includes repairing, restoring, and reconstructing (not only repairing physical damages of hazardous events) to bring society to a normal and even better situation. According to this definition, recovery has three main goals for its process; First, improving the society's resilience; second, reducing society's disaster vulnerability; third, improving citizens' quality of life.

This term can be defined by three main concepts: resilience, vulnerability, and quality of life (fig 1). Based on this, most of the recovery actions, plans, and programmes are defined in one of these three concepts. It should be noted that although these concepts are not separate and have common parts, this research focuses on the quality of life concept. Concepts' overlaps mean there is a possibility that the causes of increasing or decreasing quality of life in the recovery process root in other concepts.

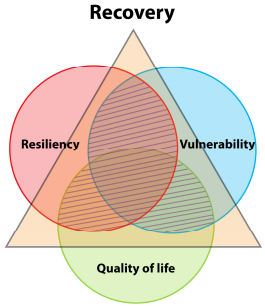


Figure 1: main concepts of recovery

3.1 Post-disaster quality of life

Although most definitions of quality of life have somewhat the same meaning, no exact and uniform definition has been provided for this concept. This term is difficult to define for four main reasons. First, the quality of life can be described and interpreted differently by different mental frameworks and conceptual filters. Second, this term highly depends on the values of the society. Third, the quality of life is a reflection of the human growth and development process. This reflection can change over a person's lifetime (by transforming mental processes, environmental factors, and system values). Fourth, different scientific disciplines only defined a part of the quality of life concept (based on their field of action) (J-C Dissart & Steven C Deller, 2000). The lack of a unique definition of quality of life has led researchers to use other terms instead. These terms include well-being, the standard of living, lifestyle, life satisfaction, and happiness.

Definitions of quality of life can mostly divide into two main categories. Several studies have been done about the quality of life, which focuses on one or both aspects of this term. These two aspects are described below.

(1) Endogenous attributes of quality of life: Endogenous attributes of quality of life (or the subjective approach) are designed to collect primary data at the individual level. The quality of life is defined by people's mental perceptions, their living conditions, and the individual's standard of living. This aspect of quality of life is measured by using subjective indicators.

(2) The exogenous attributes of quality of life: Exogenous attributes of quality of life (or the objective approach) are designed to work with and analysing secondary data. These data were collected from official governmental data collections, official reports of institutions, and census. In this respect, the quality of life is determined based on the external conditions of people's lives and measured by using objective indicators (Robert W Marans & Robert J Stimson, 2011, pp. 2-3; Mark Rapley, 2003).

This research is focusing on subjective facts of quality of life in post-disaster recovery plans and finding the root causes of success or failure of the Bam recovery process.

4 METHODS AND ANALYSIS

In this research, a descriptive-analytical path and a process based on three steps is developed. The analysis is done in three parts. In the first part, descriptive statistics (frequencies, percentages, mean and standard deviation) are used to describe the participants' background information and quality of life domains. In this part, two variables were defined that include "quality of life" and "earthquake effects and its recovery rate." These variables are divided into sub-classes and indexes weighted by employing the Delphi method (Münevver Özge Balta & Havva Ülgen Yenil, 2019; Afshin Gorbani Param et al., 2018; Mehrnaz Molavi, 2018; Mohsen Ahadnezhad Reveshty et al., 2014).

A Delphi questionnaire was designed based on binary comparisons, which are determined between the variables, sub-classes, and indexes. The digital scale was used as suggested by Saaty, ranging from 1 to 9 (Table 2) in the pair comparison matrices (Thomas L Saaty, 2008, p. 6). In total, 15 questionnaires were completed by disaster experts, researchers, and university professors to determine the data's weight. Each weight was calculated based on the arithmetic mean of the experts' opinions. At the end, the total quality of life score was calculated.

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER

Value	Preference level numeric
1	Equal Preference
3	Moderate Preference
5	Strong Preference
7	Very strong Preference
9	Absolute Preference
2, 4, 6, 8	Intermediate value between them

Table 2: The digital scale suggested by Saaty ranging from 1 to 9 (Thomas L Saaty, 2008).

In the second phase, the research hypotheses were defined and evaluated by comparing means and one sample t-test (Mehrnaz Molavi, 2018; Kusa Bill Noni Nope et al., 2020; De-Graft Owusu-Manu et al., 2020; Stephan Pauleit et al., 2005). The research hypotheses are H0 (the recovery process of Bam city has improved citizens' quality of life) and H1 (the recovery process of Bam city has not improved citizens' quality of life). The adopted decision level for the statistical significance level was 5 percent ($p<0.05$), which means if the significance level is higher than 0.05, the H0 hypothesis is acceptable. The data was analysed by the Statistical Package for the Social Sciences (IBM SPSS) version 24.

The third part, based on the findings pf the first two parts concerns the success or failure causes of the recovery process and is identified by the Ishikawa diagram. This method has been applied in different researches to find causes and effects (Xuedong Liang et al., 2016; L Luca et al., 2018; Nedjima Mouhoubi & Souad Sassi Boudemagh, 2019; Fazilat Tahari, 2014).

4.1 Data collection

Our team performed a cross-sectional survey in the summer of 2020 in Bam city in Iran for data collection. The total sample comprises 164 participants with a 91.4 response rate (150 participants answered the questions completely). Participants have one thing in common; living there for at least a year before the earthquake and until now.

As this study's data collection was hindered by the COVID-19 pandemic situation and its corresponding travel restrictions, we decided to employ Snowball sampling (Leo A Goodman, 1961) to improve our dataset. This approach applies to studies in which there is no easy access to participants (Leith Deacon et al., 2018; Celine Rendon et al., 2021; Andrew Rumbach et al., 2016). Moreover, we sent the questionnaires to three active NGOs and two social workers in Bam. For those participants with literacy problems, the questionnaires were read out and the answers were noted down.

4.2 Instruments

The self-report questionnaire was designed to collect data on socio-demographic attributes (gender, age, education, and residence time and history), quality of life (social capital, satisfaction with social, public services, housing, and living conditions), and earthquake effects and its recovery rate from Bam citizens' point of view. All items were covered using three sets of data as follows:

Basic socio and demographic variables: Basic socio and demographic variables were set as a dummy variable. These variables included age, gender, residency time, history of residence in Bam city, and educational attainment. Age was divided into four groups: 18-40 (coded as 1), 41-50 (coded as 2), 51-65 (coded as 3), and +65 (coded as 5). Gender coded as 1 (male) and 2 (female). The level of education coded as; 1 (high school), 2 (diploma), 3 (pre graduated), and 4 (post graduated).

Quality of life: based on previous studies and literature review, the quality of life in this research is captured by five subclasses. These subclasses include public services, housing, social capital, cooperation with the public, and satisfaction with life. Public services were evaluated with questions like "overall, how satisfied are you with the health services/educational services, etc.?". Housing conditions were assessed by questions such as "overall, how satisfied are you with your current housing situation?" or "overall, how satisfied are you with the security of your neighbourhood?". Social capital was indicated by trust in authorities and participation in public affairs, and social networks. In this research, social networks are measured by neighbourhood cohesion and sense of belonging (measured by a tendency to migrate). Cooperation with the public was evaluated by the level of citizens' cooperation with decision-making institutions. Finally, satisfaction with life was evaluated by questions like "Overall, how much happiness do you feel in your current life?" or "Overall, how satisfied are you with your current life?"

It should be noted that all the quality of life variables were measured by five Likert scales ranging from 1 to 5, representing the increased degree of each indicator. This range was considered as "Completely satisfied," "very satisfied," "moderately satisfied," "slightly satisfied," and "not at all satisfied."

Earthquake effects and its recovery rate: Questions in earthquake effects and its recovery rate subclass were designed as open-ended questions. Questions about Earthquake effects and its recovery rate was "how much the earthquake damages have been compensated in the Bam city recovery process?", "How much attention has been paid to the main elements (Bam citadel, palm fields, Qantas, etc.) of the city in the recovery process?", "how successful was the Bam recovery process in the past 17 years? If you are satisfied or not, please state your reasons". In the end, all the answers were gathered and coded into different fields.

5 FINDINGS

There were 150 participants (47.0% male and 53.0% female) aged 25 to 78 years (mean 42, standard deviation 10.9). Of the total, 92 (62.3%) were born in Bam, and 37.7% migrated from other provinces to Bam city. Participant's average reported residence time in Bam was 34.4 years. The majority of the participants were literate with an academic education (65.4%) and married (87.4%). The demographic characteristics of the research sample are given in Table 3. The mean age of the 150 participants was 41.5 years (ranging from 25 to 78 years), and the majority (i.e., 58%) of the subjects were female. The mean household number was 4.05, which is similar to the national level. Overall, the education level was relatively high and just 35.3% of the respondents had non-academic education.

5.1 Summary of measures

The frequencies, percentages, means, and standard deviations for the entire sample variables are reported in Table 2. Among the 150 participants in the study, the satisfaction with public services (health care, educational services, sports, parks, etc.) was 48.2%, which is low. The results in "satisfaction with public services" show that the most satisfaction is with educational (66%) and health care services (56%), and the last satisfaction is with parks and open spaces (37%) and cultural recreational land-use (32%).

Satisfaction with housing conditions was 67%; this high value is due to the post-earthquake reconstruction. It should be noted that some dissatisfaction with housing conditions is not because of the low quality of structure or building, but due to the lack of housing facilities such as a cooling system, central heating system, Wi-Fi, etc.

According to the respondents, social capital in Bam city is high and 71%. Social capital was assessed by three questions, "How satisfied are you with your current neighbourhood safety," "How close are you to your neighbours?", and "Do you want to continue living in Bam? (No tendency to migrate)."

Cooperation with public administrations and decision-making institutions was reported relatively low. The results show that 41%. 5 (3%) participants described their cooperation with public administrations "very much," 13 (9%) claimed it to be "somewhat," 28 (19%) believed it to be "Medium," 39 (26%) regarded it "not much," and 65 participants (43%) declare it 'not at all'. The last quality of life's subclass is satisfaction with life (including "life satisfaction" and "level of personal happiness"), which is quite well at 69%.

According to the respondents' opinion, the damages have been compensated by 47%. Concerning the city's main elements (including the palm fields, Qanats, and the citadel of Bam) only 48% were considered in the Bam recovery and reconstruction process, which is not satisfying. The success rate of the recovery process was reported 50%; just 1 (1%) claimed to be "completely satisfied," 7 (13%) believed to be "very satisfied," 23 (43%) declared to be "moderately satisfied," 14 (17%) regarded to be "slightly satisfied," and 20 participants (25%) assessed to be "not at all satisfied."

In an overview, the mean of "quality of life" and "earthquake effects and its recovery rate" subclasses is 30% and 24% in respondents' opinion. Scores in both subclasses could be assumed as "slightly satisfied/ not much." According to the analysis, the total recovery score is 54% which is quite low for a city where 71% of it was destroyed, and new developments have taken place over the past 17 years.

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER

5.2 Assessing the hypothesis

The research hypotheses have been evaluated by comparing means and one-sample t-test. The adopted decision level for statistical significance level was 5 percent ($p<0.05$). It means that if the significance level is higher than 0.05, the hypothesis is acceptable. In this research, the test level 0.6was adopted.

As the results show, the significance level is 0 and below 0.05. It shows that the research hypothesis (H0) is not acceptable and the recovery process of Bam city has not improved citizens' quality of life (Table 4).

	One-Sample Test					
	Test Value = 0.6					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
QOL	-2.978	149	.003	-.0278815	-.046380	-.009383

Table 4: one-sample t-test results.

5.3 Problem formulation

This research aims to find the root causes of the success or failure of the Bam recovery process, and according to previous analysis, Bam recovery was not successful in citizens' opinions. For exploring the failure causes, two main questions were asked from participants; first, "what damage has been done to your life by the earthquake?" and second, "state your reasons of satisfaction or dissatisfaction from Bam recovery process."

Based on answers, "the earthquake's consequences" were classified into three themes (personal, physical, and socio-economic) and eight codes. Results show that 124 (82.6%) people lost at least one of their family or relatives, 110 (73.3%) suffered from physical and psychological injuries, 106 (70.6%) lost their houses, 31 (20.6%) lost their jobs, and have economic problems, 9 (6%) lost their agricultural land (Figure 2). Although some damages (i.e., lost at least one of their family or relatives) are irrecoverable, the others could be recovered in midterm and long-term developments.

According to the answers, "recovery dissatisfaction" reasons are categorised into four themes and 12 codes (Figure 3). 60% of respondents believed the recovery failure is because of "improper physical reconstruction of the city," 34% declare it is "lack of urban services and facilities," 28% said it's "weakness in the institutional and management structure," and 22% regarded it to be "failure to reconstruct the identity elements of the city." Generally, most of the reasons mentioned for the Bam recovery process's inefficiency could be easily solved by efficient plans and programmes.

In this phase, finding problems and their causes is done by Ishikawa diagram (Fish Bone Technique), which is based on creative thinking. We grouped the factors identified into two main categories to achieve the fishbone diagram: management, institutional and physical. The main categories are shown in the diagram by the main-line/bone of the fish, and the corresponding root causes are indicated by sub-line/bones going off from the main-line/bone of the fish. In Figure 4, the authors root the causes of the problem with the Fishbone Diagram's help.

The following identified the root causes of the main problem that have been observed from the Bam city survey:

(1) Management and institutional problems: In this study, authors have seen some causes that led to management and institutional problems in the Bam recovery process. Most of the recovery failure roots found in figure 4 show that the Bam city management system has not been recovered properly after 17 years. Today, Bam is still dealing with the earthquake's challenges and problems, which could be solved in the city's mid-term development.

This research's outcomes find the following root causes of the Bam recovery process's management and institutional problems.

- Lack of integrative urban management: during a crisis, integrated management is more needed than ever before. In this situation, due to the conflicts of interest of the city organisations urban management faced a challenge; it is necessary therefore to create an integrated management structure (both vertical and horizontal relations of organisations) in cities (especially cities in crisis).
- Lack of decision support systems: The existence of decision support systems in crisis will increase the resilience of the impacted system. Lack of such a system may lead the urban management

structure to collapse (like the Bam situation after the earthquake, which is only partially restored after 17 years).

- High deceleration of the recovery process after the early stages of the disaster: The speed of reconstruction in the early stages of the disaster (due to national and international intervention) was very high. Usually, the reconstruction pace slows down after the early stages. It is expected that the urban management system has the ability to recover itself in mid-term development.
- Lack of an effective post-crisis development plan: The prescriptive scope of urban comprehensive plans in Iran is the same everywhere and must follow a specific type. For this reason, comprehensive plans do not have the resilience to adapt to the new conditions.
- Low citizen cooperation with decision-making institutions: The structure of urban planning and management in Iran is centralised and does not have the capacity to accept public participation in decision-making. Although actions have been taken to decentralise management and to involve citizens in many cities, this has not happened in Bam.

(2) Physical problems: Physical actions play an integral role in recovery success. The authors have found out the following root causes for the physical problems of the Bam recovery process.

- Lack of adequate (quantity and quality) public services: Urban plans in Iran use the concept of per capita to provide public services. The per capita concept does not discuss the quality of public services and only discusses quantitative issues. Density is also neglected in this concept. Due to this, the quantitative discussions of public services and the required area for them are also a challenge.
- Destruction (relative) of the main elements (Bam citadel, Qanats, palm fields) of the city in the recovery process: The main elements of Bam city are the city's identity and the economic source, and citizens' income. The Qanats and palm fields, which were the main source of city income, were severely damaged by the earthquake and have not been rehabilitated during the reconstruction/recovery process.
- Failure to complete the reconstruction process: In the reconstruction process and Bam recovery, there are many problems from the citizens' point of view, which have led the recovery to fail. The reasons given by citizens are factors such as debris existence in parts of the city, some citizens still living in the temporary situations after 17 years, lack of reconstruction of the city for the disabled, etc. Most of the problems stated could be solved in mid-term planning.

The root causes of Bam's recovery failure are divided into two scales, national (or supra-national) and local. Causes with national scale roots are outside the planning agenda and couldn't be solved by urban planning actions. Causes at this scale, which couldn't be solved at the local level, are because of reasons like:

- centralised planning structure;
- the prescriptive scope of urban comprehensive plans and their inflexibility;
- using traditional planning tools instead of new methods and technology;
- uncertainties outside the planning system like inflation rate, etc.

At the local level, Root causes are mostly related to the strategic level of the decision making, interconnection between actions, actors, and decisions on the urban project.

6 DISCUSSIONS

Why has the city of Bam recovered just 54% after 17 years? Although earthquakes cause massive destruction, they can also act as a window of opportunity for better development. Despite this fact, why is Bam still involved with basic physical problems? Especially as these problems can be easily solved in mid-term planning.

In the "Problem formulation" section, the main causes of the failure of the Bam recovery process to increase citizens' quality of life are identified with the Ishwaka diagram. These failure causes include:

- lack of integrative urban management
- lack of decision support systems

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER

- high deceleration of the recovery process after the early stages of the disaster
- lack of an effective post-crisis development plan
- low citizen cooperation with decision-making institutions
- lack of adequate (quantity and quality) public services
- destruction (relative) of the main elements (Bam citadel, Qanats, palm fields) of the city in the recovery process
- failure to complete the reconstruction process.

Although the causes of the Bam recovery failure are divided into two "management" and "physical" categories, it seems most of these causes are rooted in Bam's management system. Reasons such as centralised planning structure, inflexibility of comprehensive plans, the traditional urban management system, and planning at both national and local levels led to Bam's recovery failure after 17 years. Most of these reasons are rooted at the national level and couldn't be solved at the local level. At the local level, most causes are about local strategic planning and its inefficiency to cope with disasters.

It should be noted that in this study, recovery was evaluated in terms of subjective aspects of quality of life. Thus, all research findings stated about the Bam recovery process should not be generalised. Obviously, future research is needed for an extended view of examining the function of Iran's planning system in coping with disasters and the post-disaster recovery process.

7 ACKNOWLEDGEMENTS

This paper has been written in the pandemic situation of covid 19. Sorrowfully, we lost one of our mentors, teachers, and one of the greatest people we knew, Dr. Sharif Mottavef to this disease, who always had encouraged us to develop and to be a better version of ourselves. May his soul rest in peace, his memory be blessed, and his path be followed. He will always be in our minds and hearts.

8 REFERENCES

Adger, W Neil. (2000). Social and ecological resilience: are they related? Progress in human geography, 24(3), 347-364.

Ainuddin, Syed, & Routray, Jayant Kumar. (2012). Earthquake hazards and community resilience in Baluchistan. Natural Hazards, 63(2), 909-937.

Alexander, David E. (2002). Principles of emergency planning and management: Oxford University Press on Demand.

Anderson, William A. (2008). Recovering from Disaster: A Summary of the October 17, 2007, Workshop of the Disasters Roundtable.

Ardalan, A, Mazaheri, Monir, Vanrooyen, M, Mowafi, H, Nedjat, S, Naieni, K Holakouie, & Russel, M. (2011). Post-disaster quality of life among older survivors five years after the Bam earthquake: implications for recovery policy. Ageing and society, 31(2), 179.

Armaş, Iuliana. (2012). Multi-criteria vulnerability analysis to earthquake hazard of Bucharest, Romania. Natural Hazards, 63(2), 1129-1156.

Balta, Münevver Özge, & Yenil, Havva Ülgen. (2019). Multi criteria decision making methods for urban greenway: The case of Aksaray, Turkey. Land Use Policy, 89, 104224.

Berke, Philip R, & Campanella, Thomas J. (2006). Planning for postdisaster resiliency. The ANNALS of the american academy of political and social science, 604(1), 192-207.

Buckle, Philip, Marsh, Graham, & Smale, Sydney. (2001). Assessing resilience and vulnerability: Principles, strategies and actions. Strengthening Resilience in Post-disaster Situations, 245.

Bulkeley, Harriet, Schroeder, Heike, Janda, Katy, Zhao, Jimin, Armstrong, Andrea, Chu, Shu Yi, & Ghosh, Shibani. (2011). The role of institutions, governance, and urban planning for mitigation and adaptation. Cities and climate change: Responding to an urgent agenda, 62696, 125-159.

Chakraborty, Jayajit, Tobin, Graham A, & Montz, Burrell E. (2005). Population evacuation: assessing spatial variability in geophysical risk and social vulnerability to natural hazards. Natural Hazards Review, 6(1), 23-33.

Contreras, Diana. (2016). Fuzzy boundaries between post-disaster phases: The case of L'Aquila, Italy. International Journal of Disaster Risk Science, 7(3), 277-292.

Cutter, Susan L, Barnes, Lindsey, Berry, Melissa, Burton, Christopher, Evans, Elijah, Tate, Eric, & Webb, Jennifer. (2008). Community and regional resilience: Perspectives from hazards, disasters, and emergency management. Geography, 1(7), 2301-2306.

Cutter, Susan L, Burton, Christopher G, & Emrich, Christopher T. (2010). Disaster resilience indicators for benchmarking baseline conditions. Journal of homeland security and emergency management, 7(1).

Cutter, Susan L, Mitchell, Jerry T, & Scott, Michael S. (2000). Revealing the vulnerability of people and places: A case study of Georgetown County, South Carolina. Annals of the association of American Geographers, 90(4), 713-737.

Database, The international Disaster. (2020). Retrieved from https://public.emdat.be/data

Deacon, Leith, Van Assche, Kristof, Papineau, Jacob, & Gruezmacher, Monica. (2018). Speculation, planning, and resilience: Case studies from resource-based communities in Western Canada. Futures, 104, 37-46.

Dissart, J-C, & Deller, Steven C. (2000). Quality of life in the planning literature. Journal of Planning Literature, 15(1), 135-161.
Fahy, F, & Cinnéide, M Ó. (2008). Developing and testing an operational framework for assessing quality of life. Environmental Impact Assessment Review, 28(6), 366-379.
FEMA. (2006). Hazards, disasters and U.S. emergency management: An introduction, appendix: Select emergency management-related terms and definitions. FEMA, Washington, DC.
Godschalk, David R. (2003). Urban hazard mitigation: creating resilient cities. Natural Hazards Review, 4(3), 136-143.
Goodman, Leo A. (1961). Snowball sampling. The annals of mathematical statistics, 148-170.
Gorbani Param, Afshin, Shali, Mohammad, & Imani, Habibeh. (2018). Analysis of spatial inequalities in Tabriz Metropolis through Analysis Hierarchy Process (AHP). Journal of Geography and Spatial Justice, 1(2), 15-26.
Haas, J Eugene, Kates, Robert W, & Bowden, Martyn J. (1977). Reconstruction following disaster Reconstruction following disaster: US The Massachusetts Institute of Technology.
Hu, Ting, Xu, Siyuan, & Liu, Weizhi. (2018). A senior high school-based survey on the long-term impact of the Wenchuan earthquake on survivors' quality of life: PTSD as a mediator. Psychiatry research, 270, 310-316.
Information, National Centers for Environmental. (2020). Retrieved from https://www.ngdc.noaa.gov/
Iran, Statistical Center of. (2003). Listing results of places and households in the Bam earthquake zone.
Jeong, Seunghoo, & Yoon, DK. (2018). Examining vulnerability factors to natural disasters with a spatial autoregressive model: the case of South Korea. Sustainability, 10(5), 1651.
Jia, Zhaobao, Tian, Wenhua, He, Xiang, Liu, Weizhi, Jin, Chunlin, & Ding, Hansheng. (2010). Mental health and quality of life survey among child survivors of the 2008 Sichuan earthquake. Quality of Life Research, 19(9), 1381-1391.
Liang, Xuedong, Zhang, Weiwei, Chen, Lei, & Deng, Fumin. (2016). Sustainable urban development capacity measure–A case study in Jiangsu Province, China. Sustainability, 8(3), 270.
Liang, Ying. (2015). Satisfaction with economic and social rights and quality of life in a post-disaster zone in China: evidence from earthquake-prone Sichuan. Disaster Med Public Health Prep, 9(2), 1-8.
Lin, Mau-Roung, Huang, Wenzheng, Huang, Chingchaw, Hwang, Hei-Fen, Tsai, Lung-Wen, & Chiu, Yun-Ning. (2002). The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan–a before and after study. Quality of Life Research, 11(4), 379-388.
Luca, L, Todorut, AV, & Luca, TO. (2018). Quality management applied to analyze the reduction of the pollution which is generated from road transportation in agglomerated urban areas. Scientific Bulletin" Mircea cel Batran" Naval Academy, 21(1), 1-8.
Marans, Robert W, & Stimson, Robert J. (2011). Investigating quality of urban life: Theory, methods, and empirical research (Vol. 45): Springer Science & Business Media.
Molavi, Mehrnaz. (2018). Measuring Urban Resilience to Natural Hazards. TeMA-Journal of Land Use, Mobility and Environment, 11(2), 195-212.
Mouhoubi, Nedjima, & Boudemagh, Souad Sassi. (2019). A study on the causes of the failure to implement the Constantine metropolis urban project. Spatium, 52-61.
Nope, Kusa Bill Noni, Suthanaya, Putu Alit, Wedagama, Dewa Made Priyantha, & Astana, I Nyoman Yudha. (2020). The Jakarta TOD Model Application for Typology of Middle Cities (Applied Research Design in Kupang City). Geographia Technica, 15, 103-112.
Norris, Fran H, Stevens, Susan P, Pfefferbaum, Betty, Wyche, Karen F, & Pfefferbaum, Rose L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. American journal of community psychology, 41(1), 127-150.
Owusu-Manu, De-Graft, Debrah, Caleb, Oduro-Ofori, Eric, Edwards, David John, & Antwi-Afari, Prince. (2020). Attributable indicators for measuring the level of greenness of cities in developing countries: lessons from Ghana. Journal of Engineering, Design and Technology.
Pauleit, Stephan, Ennos, Roland, & Golding, Yvonne. (2005). Modeling the environmental impacts of urban land use and land cover change–a study in Merseyside, UK. Landscape and urban planning, 71(2-4), 295-310.
Quarantelli, Enrico Louis. (1999). The disaster recovery process: What we know and do not know from research.
Rapley, Mark. (2003). Quality of life research: A critical introduction: Sage.
Rendon, Celine, Osman, Khalid K, & Faust, Kasey M. (2021). Path Towards Community Resilience: Examining Stakeholders' Coordination at The Intersection of The Built, Natural, And Social Systems. Sustainable Cities and Society, 102774.
Reveshty, Mohsen Ahadnezhad, Kamelifar, Mohammad Javad, Ranjbarnia, Behzad, & Pashaiifar, Alireza. (2014). A comparative study on physical vulnerability of urban area against natural hazards: importance of health promoting approach in civil engineering. Health promotion perspectives, 4(1), 122.
Rezvani, Mohammad Reza, Mansourian, Hossain, & Sattari, Mohammad Hossain. (2013). Evaluating quality of life in urban areas (case study: Noorabad City, Iran). Social Indicators Research, 112(1), 203-220.
Rumbach, Andrew, Makarewicz, Carrie, & Németh, Jeremy. (2016). The importance of place in early disaster recovery: a case study of the 2013 Colorado floods. Journal of Environmental Planning and Management, 59(11), 2045-2063.
Saaty, Thomas L. (2008). Decision making with the analytic hierarchy process. International journal of services sciences, 1(1), 83-98.
Santos, Luis Delfim, & Martins, Isabel. (2007). Monitoring urban quality of life: The Porto experience. Social Indicators Research, 80(2), 411-425.
Schwab, James, Topping, Kenneth C, Eadie, Charles C, Deyle, Robert E, & Smith, Richard A. (1998). Planning for post-disaster recovery and reconstruction: American Planning Association Chicago, IL.
Smith, Gavin. (2012). Planning for post-disaster recovery: A review of the United States disaster assistance framework.
Smith, Gavin P, & Wenger, Dennis. (2007). Sustainable disaster recovery: Operationalizing an existing agenda Handbook of disaster research (pp. 234-257): Springer.
Tahari, Fazilat. (2014). Environmental Planning For Identifying, Analyzing And Solving Environmental Problems Of The City Of Rasht Based On Applying Creative Problem-Solving Techniques. International Journal of Economy, Management and Social Sciences, 3(12), 39-50.
Tobin, Graham A, & Whiteford, Linda M. (2002). Community resilience and volcano hazard: the eruption of Tungurahua and evacuation of the faldas in Ecuador. Disasters, 26(1), 28-48.

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER

Wen, Jin, Shi, Ying-kang, Li, You-ping, Yuan, Ping, & Wang, Fang. (2012). Quality of life, physical diseases, and psychological impairment among survivors 3 years after Wenchuan earthquake: a population based survey. PloS one, 7(8), e43081.
Yoon, Dong Keun. (2012). Assessment of social vulnerability to natural disasters: a comparative study. Natural Hazards, 63(2), 823-843.

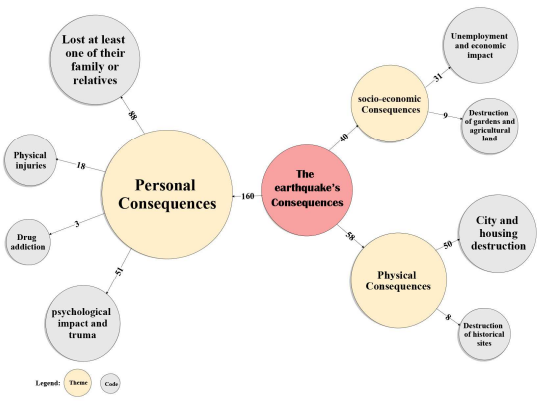
9 APPENDICES

Domains	Indicates	Concepts	Sources
Social	Educational level	Resiliency/ vulnerability/ Quality of life	(W Neil Adger, 2000), (Susan L Cutter et al., 2008), (Iuliana Armaş, 2012), (Luis Delfim Santos & Isabel Martins, 2007)
	Health coverage	Resiliency/quality of life	(Syed Ainuddin & Jayant Kumar Routray, 2012) ,(Luis Delfim Santos & Isabel Martins, 2007)
	Social capital (migration, social communication, community trust, etc.)	Resiliency/quality of life	(Syed Ainuddin & Jayant Kumar Routray, 2012) ,(Fran H Norris et al., 2008), (Susan L Cutter et al., 2008), (Mohammad Reza Rezvani et al., 2013)
	Demographic characteristics (age, sex, household number, vulnerable groups, population density, etc.)	Resiliency/ vulnerability/ Quality of life	(Fran H Norris et al., 2008), (Susan L Cutter et al., 2000), (Jayajit Chakraborty et al., 2005), (Luis Delfim Santos & Isabel Martins, 2007)
	Vitality and livability (sense of place, the identity of the city, etc.)	Resiliency/quality of life	(W Neil Adger, 2000), (F Fahy & M Ó Cinnéide, 2008), (Mohammad Reza Rezvani et al., 2013)
	Social equity	Resiliency/quality of life	(Fran H Norris et al., 2008), (Mohammad Reza Rezvani et al., 2013)
economical	Housing (Percentage of house ownership, housing area per household number, occupancy per room, etc.)	Resiliency/ vulnerability/ Quality of life	(Susan L Cutter et al., 2010), (Susan L Cutter et al., 2000), (Jayajit Chakraborty et al., 2005), (Dong Keun Yoon, 2012), (Iuliana Armaş, 2012), (Luis Delfim Santos & Isabel Martins, 2007)
	Economic structure (employment, economic growth, etc.)	Resiliency/ vulnerability/ Quality of life	Res (Syed Ainuddin & Jayant Kumar Routray, 2012), (Dong Keun Yoon, 2012), (F Fahy & M Ó Cinnéide, 2008), (Luis Delfim Santos & Isabel Martins, 2007)
	Income (household multiple source incomes, income per household number, Percentage of the population above the poverty line, etc.)	Resiliency/ vulnerability/ Quality of life	(Graham A Tobin & Linda M Whiteford, 2002), (Jayajit Chakraborty et al., 2005)
	Properties (vehicles, telephone, etc.)	vulnerability	(Jayajit Chakraborty et al., 2005)
Institutional	Mitigation (hazard mitigation Plan)	Resiliency	(Syed Ainuddin & Jayant Kumar Routray, 2012)
	Municipal services and budget (municipal expenditures for fire and emergency management system and medical services)	Resiliency	(Syed Ainuddin & Jayant Kumar Routray, 2012)
	Public participant (NGOs, participant in decision making, etc.)	Resiliency/ Quality of life	(Susan L Cutter et al., 2010), (Luis Delfim Santos & Isabel Martins, 2007)
	Information and Communication (databases, decision support systems, etc.)	Resiliency	(Fran H Norris et al., 2008)
Physical and Infrastructural	Buildings (density, age, structure, building codes, housing facilities, etc.)	Resiliency/ vulnerability/ Quality of life	(Philip R Berke & Thomas J Campanella, 2006), (Susan L Cutter et al., 2008), (Dong Keun Yoon, 2012), (Iuliana Armaş, 2012), (F Fahy & M Ó Cinnéide, 2008)
	Location (housing units located in the city's core, proximity to hazard-prone, distance to emergency services, distance to services, etc.)	Resiliency/ vulnerability/ Quality of life	(Philip Buckle et al., 2001), (Iuliana Armaş, 2012), (F Fahy & M Ó Cinnéide, 2008)
	Shelter capacity (vacant Houses)	Resiliency	(Syed Ainuddin & Jayant Kumar Routray, 2012)
	Public services (education, health care, parks, satisfaction with public services, etc.)	Resiliency/ Quality of life	(Susan L Cutter et al., 2010), (Luis Delfim Santos & Isabel Martins, 2007),
	Urban form (open spaces, development structure, etc.)	Resiliency/ vulnerability	(Syed Ainuddin & Jayant Kumar Routray, 2012) ,(Seunghoo Jeong & DK Yoon, 2018)
	Environmental Conditions (pollutions, water quality, etc.)	Quality of life	(Luis Delfim Santos & Isabel Martins, 2007)

Table 1: Recovery domains and indicators

Classes	Subclasses	Frequency	Percent	Mean	Std. Dev
Sex	Female	87	58.0	-	-
	Male	63	42.0		
Age	18-40	78	52.0	41.5	10.8
	41-50	42	28.0		
	51-65	20	13.3		
	+65	10	6.7		
Household Number	0-2	18	12.0	4.05	1.3
	3-4	84	56.0		
	+5	48	32.0		
Education	High school	17	11.3	-	-
	Diploma	36	24.0		
	Pre Graduated	80	53.3		
	Post Graduated	17	11.3		
Total		150	100.0		

Table 3: Demographic Characteristics of the participants in the questionnaire, Bam 17 years after Bam earthquake.



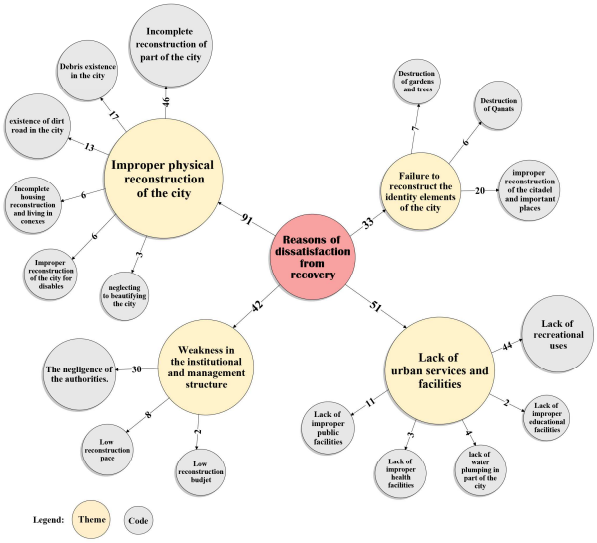


Figure 2 (left): classifications of the earthquake's Consequences. Gigure 3 (right): classifications of the recovery dissatisfaction.

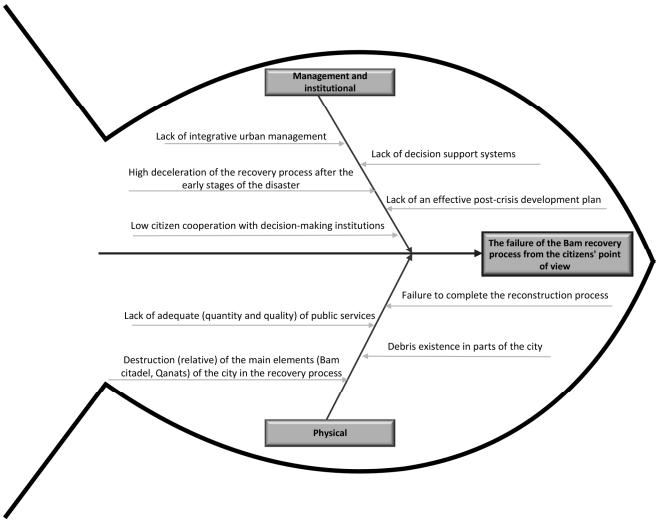


Figure 4: finding problems and their causes in the recovery process by Ishikawa diagram.

weigh t	variables	weigh t	Subclasses	weigh t	indexes	Percent%							Mean	Std. Dev	Score			
						5[1]	4[2]	3[3]	2[4]	1[5]	Yes	No						
0.5	Quality of life	0.23	Public services	0.20	Satisfaction with health care services	1	21	51	13	14			0.56	0.19	0.013			
				0.20	Satisfaction with Educational services	23	15	37	17	7			0.66	0.24	0.015			
				0.20	Satisfaction with Sports use	3	19	34	19	25			0.51	0.23	0.012	0.06		
				0.20	Satisfaction with Cultural recreational land-use	0	2	17	19	62			0.32	0.17	0.007			
				0.20	Satisfaction with parks and open spaces	0	3	19	34	43			0.37	0.17	0.008			
		0.29	housing	1.00	Satisfaction with Housing conditions	10	33	45	7	5			0.67	0.18	0.096	0.096	0.30	0.54
		0.11	Social capital	0.46	Satisfaction with Neighborhood safety	16	26	41	13	3			0.68	0.20	0.017	0.04		
				0.22	Level of neighborhood cohesion	11	25	43	9	13			0.62	0.23	0.007			
				0.32	No tendency to migrate						83	17	0.83	0.38	0.014			
		0.06	cooperation with public	1.00	Level of cooperation with decision-making institutions	3	9	19	26	43			0.41	0.23	0.011	0.011		
		0.32	Satisfaction with life	0.50	Life Satisfaction	21	29	41	8	1			0.72	0.19	0.050	0.10		
				0.50	Level of Happiness	15	24	41	16	3			0.66	0.21	0.053			
0.5	Earthquake effects and its recovery rate	1	Recovery	0.45	Earthquake damage compensation	6	9	33	20	33			0.47	0.24	0.107	0.24	0.24	
				0.09	Level of attention to the main elements	1	20	32	13	34			0.48	0.23	0.022			
				0.45	The success rate of the recovery process	1	13	43	17	25			0.50	0.21	0.113			

Table 3: Frequency (%) distributions of variables measured in the assessment among 150 Bam citizens.

ISBN 978-3-9504945-0-1. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, G. STÖGLEHNER