

Integrating Disaster Management and Metropolitan Planning in Tehran

Alireza Fallahi, Zohreh A. Daneshpour, Vahideh Ebrahimnia

(Alireza Fallahi, PhD, Associate Professor, Alireza Fallahi, Urban and Regional Planning Department, Faculty of Architecture and Urban Planning, Sh.Beheshti University (SBU), Tehran, Iran, E-mail : alifallahi30@gmail.com)
(Zohreh A. Daneshpour, PhD, Professor, Zohreh A. Daneshpour, Urban and Regional Planning Department, Faculty of Architecture and Urban Planning, Sh.Beheshti University (SBU), Tehran, Iran, E-mail: z_danesh@sbu.ac.ir)
(Vahideh Ebrahimnia, PhD candidate, Vahideh Ebrahimnia, Urban and Regional Planning Department, Faculty of Architecture and Urban Planning, Sh.Beheshti University (SBU), Tehran, Iran, E-mail: v_ebrahimnia@sbu.ac.ir)

1 ABSTRACT

Natural disasters affect the performance of urban and regional systems in various forms. Problems caused by unpredictability of the environmental changes can cause inefficiency in short and long-term planning strategies. The importance of avoiding this indicates the necessity of applying appropriate approaches to problem solving in metropolitan planning as well as in disaster management. The process of disaster management and planning in metropolitan areas differ from other urban levels. These difference may be due to such reasons as (a) the importance of responding to disasters in all spatial aspects including social, economic, and physical aspects, (b) the need to act promptly by various stakeholders and players involved in disaster situations and (c) unclearness of the problem which both planning and management systems (i.e., metropolitan planning and disaster management) have to deal with. It is based on these reasons that the establishment of an integrated disaster management and planning system is crucial specifically in metropolitan areas. Such an integrated planning activity comprises both substantive and procedural aspects including integrated metropolitan planning and disaster management strategies as well as producing an integrated “spatial metropolitan and disaster management plan” plus specifying the role, functioning and responsibilities of the varied actors active in such an environment.

Tehran (the capital of Iran), a metropolis with more than eight million residents within its statutory boundaries and more than 13 million people residing in Tehran province as the urban region of Tehran, is prone to disasters, that the most important of them would be a severe earthquake. While the last devastating earthquake of Tehran occurred in about mid 1880’s, according to studies on the return period of earthquakes, it is estimated that an earthquake with the magnitude of 7 to 8 Richter scale would occur sometime in Tehran in an undefined future. In this respect launching an efficient, while an integrated, planning and disaster management system is a major and crucial concern of policy making in Tehran. Accordingly, this paper has adopted a dual aim of (a) analysing the existing situation of Tehran in terms of disaster management as against metropolitan planning including an identification of the strengths and weaknesses of such a situation, and (b) envisaging the ways and means of integrating the two parallel but highly inter-related areas of metropolitan planning and disaster management

2 INTRODUCTION: ISSUE UNDER STUDY, AIME AND PURPOSE

Large cities and metropolitan areas are the place in which people live, perform their activities and is a place where their assets are concentrated. The high-level of aggregation of human activities makes metropolitan areas increasingly vulnerable to all kinds of disasters, man-made and natural. A natural disaster - usually defined as hazard – is the impact of an extreme and rare natural event that usually overcomes the capacity of communities and organisations and threaten the efficiency and effectiveness of urban physical, social, economic, and natural systems and their planning efforts (refer to & Fleischhauer & Wanczura, 2006: 741).

Application of strategic thinking in spatial planning provides it with a contingency nature. Meaning that spatial planning requires a multi-risk approach to consider all relevant disasters which threatens the vulnerability of a certain area. In such an integrated approach disaster management puts forward a task for spatial planning which enables it - from the beginning of a planning process - to anticipate and consider the consequences of disasters as part of the significant factors in achieving planning goals and objectives (refer to EPSON Monitoring Committee, 2006: 6-7, Greiving and Fleischhauer, 2006: 110).

This paper aims to integrate metropolitan planning with disaster management - with special attention to earthquake as a natural disaster - in Tehran, and envisages agenda such as the followings:

- Analysing the existing situation of Tehran in terms of disaster management within its broad framework of metropolitan planning. This analysis includes an identification of the strengths and weaknesses that such a situation presents.
- Envisaging the ways and means of integrating the two parallel but highly inter-related areas of metropolitan planning and disaster management

In order to achieve these aims a method comprising a four staged process has been devised as follows and as is shown in Figure (1):

- First stage involves studying the conceptual framework produced by reviewing and summing-up the findings of the parallel experiences worldwide.
- Second stage involves analysing the current state of both metropolitan planning and disaster management in Tehran in terms of their linkages so as to find the strengths and weaknesses of such systems. This stage would answer the two following questions of:
 - How does spatial planning system in Tehran take into account the risks of earthquake as a natural disaster?
 - Which role does spatial planning system in Tehran play in practice in the disaster management process?
- Third stage, based on the conceptual framework produced by reviewing and summing-up the findings of the parallel worldwide experiences as well as the analysis done in the second stage, involves proposing a framework for an integrated spatial planning and disaster management system in Tehran.
- Fourth stage involves the application of the proposed framework in the second stage in Tehran.

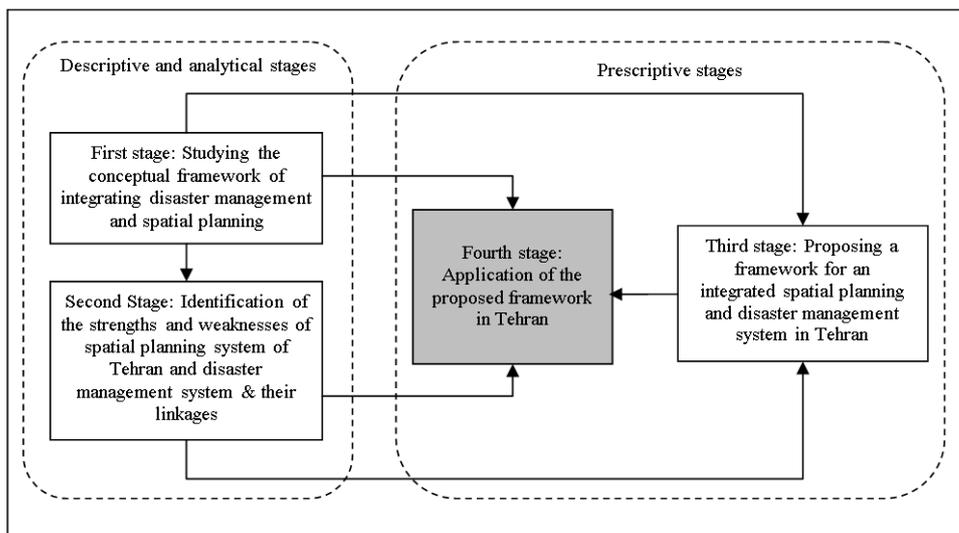


Fig. 1: Flowchart depicting the method adopted in achieving the aims of this paper

3 STUDYING THE CONCEPTUAL FRAMEWORK PRODUCED BY REVIEWING AND SUMMING-UP THE FINDINGS OF THE PARALLEL EXPERIENCES WORLDWIDE

This conceptual framework consists of disaster management related definitions as well as spatial planning responses to disaster management.

3.1 Disaster

A disaster is the impact of an extreme and rare natural event that usually overcomes the capacity of communities and organisations to cope with which causes severe negative impacts on people, goods, services and/or the environment. A disaster happens when a hazard impacts on the vulnerable population and causes damage, casualties and interruptions. Thus it is a product of the combination of hazard, vulnerability and insufficient capacity or measures to reduce the potential chances of risk (refer to Greiving, Fleischhauer and Wanczura, 2006: 740, Sutanta, et. al., 2009: 342).

3.2 Vulnerability

Vulnerability is the degree of expected damage of natural, socio-economic and physical systems of a community as of the impact and the consequences of natural hazards which is rooted in the interaction between a system and its environment: this is related both to the internal system of a society and the way in which this system interacts with its external environment (refer to EPSON Monitoring Committee, 2006: 6-7, Chunliang, et. al. 2011: 204). Altogether, two types of vulnerability can be identified: first, the stress-driven vulnerability which refers to the potential of a natural hazard, and second the vulnerability which is related to the potential to react to and/or to endure the hazard. On this basis, reducing vulnerability consists of two main kinds of activities (refer to Chunliang, et. al. 2011: 204):

- First, removing the causes of the disaster (reducing the hazard),
- Second, removing the effects of the hazard if it occurs.

3.3 Risk

Risk is a combination of the probability (or frequency) of occurrence of a natural hazard and the extent of the consequences of its impacts which is a function of the exposure of assets and the perception of potential impacts as perceived by a community or system (refer to Greiving, Fleischhauer and Wanczura, 2006: 740, Sutanta, e. al., 2009: 342).

3.4 Disaster management

Disaster management can be defined as the organisation and management of resources and responsibilities for dealing with all humanitarian aspects of disasters in terms of activities, programmes and measures which can be commence before, during and after a disaster in order to avoid a disaster, reduce its impact and recover from its losses. Disaster management is a cyclical process which consists of following activities (refer to UNDP, 1994: 13, EPSON Monitoring Committee, 2006: 6-7, Greiving and Fleischhauer, 2006: 114-118):

- Risk assessment: Risk assessment is a combination of these activities (Greiving and Fleischhauer, 2006: 115):
- Risk analysis: The scientific and deterministic task of risk analysis is a mathematical calculation including estimation and description of a hazard – which have been determined based on scientific and technical findings- its frequency of occurrence (hazard component) and magnitude of its consequences (damage potential).
- Risk evaluation: In risk evaluation the outcome of risk analysis and risk perception - which is the overall view of risk as perceived by a person or a group and includes both feeling and judgment – determines the significance of the estimated risks for those affected.
- Mitigation: Mitigation includes a wide range of actions and interventions aiming at long-term goals and objectives that might be designated to reduce the adverse effects of a natural hazards and/or potentially harmful processes before it occurs. Mitigation activities fall broadly into three categories of (a) prevention oriented mitigation, (b) structural mitigation, and (c) non-structural mitigation.
- Preparedness: Preparedness means readiness for short-term activities, such as evacuation and temporary property protection, undertaken as soon as a disaster warning has been received.
- Response: Response indicates short-term initial emergency aid and assistance during or following the disaster as part of the reaction towards it.
- Recovery: Recovery, consist of activities such as the rebuilding of damaged structure, which brings the community back to a normal state

3.5 Spatial planning response to disaster management

Spatial planning response towards earthquake as a natural disaster that contributes to a disaster management system will be discussed in terms of the stages of disaster management process (Table 1).

3.5.1 Risk assessment

Sectoral planning is the main existing approach for risk assessment, though the outcome of this task indicates a multiplicity of aspects of a system that might be threatened by disasters. A basic prerequisite for any kind of risk assessment to meet the requirements of spatial planning and be used in spatial planning is the existence of a legally binding basis for risk related information. Meaning that spatial planning needs specific spatially and cartographically presentable information which must fit into the spatial scale to be used on different levels: a basis for decisions about future land-uses/space uses (refer to Fleischhauer, et. al., 2007: 385 and JAICA, 2000: 61).

Disaster management activities	Linkages between spatial planning and disaster management systems	Aims
Risk assessment	<ul style="list-style-type: none"> • Providing vulnerability-related information for land suitability analysis and future development in spatial planning 	<ul style="list-style-type: none"> • Provide awareness about high-risk, medium risk and low risk areas
Mitigation/ Risk reduction	<ul style="list-style-type: none"> • Prohibition / restrictions of land-uses and activities based on of identification of risk priority zones 	<ul style="list-style-type: none"> • Reduce building damage and casualties
	<ul style="list-style-type: none"> • Regulating locations of significant public services of the city 	<ul style="list-style-type: none"> • Reduce vulnerability of public services
	<ul style="list-style-type: none"> • Decentralisation of elements at risk 	<ul style="list-style-type: none"> • Reduce the risk of failure
	<ul style="list-style-type: none"> • Decentralisation of population densities 	<ul style="list-style-type: none"> • Reduce casualties
	<ul style="list-style-type: none"> • Strengthen service networks 	<ul style="list-style-type: none"> • Reduce the risk of failure
	<ul style="list-style-type: none"> • Application of legislative powers and administrative functions 	<ul style="list-style-type: none"> • Setting up building regulations
Preparedness, response, and recovery	<ul style="list-style-type: none"> • Distribution of urban facilities and infrastructure necessary to respond to the disaster 	<ul style="list-style-type: none"> • Increase coping capacity
	<ul style="list-style-type: none"> • Rebuilding planning 	

Key:	Main responsibilities of disaster management division toward spatial planning	Main responsibilities of spatial planning toward disaster management division
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Table 1: Disaster management activities and linkages of spatial planning and disaster management systems. Source: writers (2012) based on various sources used in this article

3.5.2 Mitigation

For earthquake, preventing the actual geological or meteorological process from occurring is impossible and spatial planning have no potential for reducing earthquakes (refer to UNDP, 1994: 20) so the mitigation strategies focus on measures to reduce both disaster impacts and damage potential. Spatial planning has the specific responsibility in (a) making decisions on long term utilisation of land and (b) providing community with the adapted spaces to enable it to employ the following mitigation activities (refer to EPSON Monitoring Committee, 2006: 6-7, Greiving, Fleischhauer and Wanczura, 2006: 742, UNDP, 1994, Greiving and Fleischhauer, 2006: 121-122):

- Prohibiting future development in certain areas: Areas identified as high-risk, should be designated as risk priority zones. The effects can be greatly reduced if in highly prone areas development would be prohibited and restricted, especially in terms of public sector facilities which are easier to control than those controlled and decided by the private sector. According to the classification of risk priorities, two types of prohibition / restriction would be applied:
- Exclusion of all uses, except the priority use. Priority use is the permitted use of land/space due to the possible occurrence of earthquake.
- Exclusion of especially threatened facilities (e.g. schools, hospitals) and hazardous facilities (e.g. chemical plants).
- Regulating land use or zoning instruments: An important measure in reducing the vulnerability of a society is carefully selecting the location of public sector facilities and major infrastructure.

- Decentralisation of elements at risk: Services concentrated are always more at risk than those well distributed all over the city. The same principle applies equally to hospitals.
- Decentralisation of population densities: A denser concentration of people will always be less desirable than a more dispersed pattern. In this context, permitted development densities in urban plans should reveal the spatial distribution of hazard severity. At regional levels, the concentration of population and industry in a city, generally has more disaster potential than extension of development over a broader region.
- Design of service networks to reduce risk of failure: In terms of roads, pipelines, and cables, radial networks are less vulnerable than long lengths of lines in circular systems which are at risk if they are cut at any point.
- Developing safety standards, construction codes and building regulations: Legislative powers and administrative functions are procedural tools aiming at special compulsion to protect buildings or other facilities against potential hazard impacts. Based on the information about potentially hazardous zones, it would be useful to integrate special compulsions within a legally binding urban plan aimed at the protection of buildings that might be developed within threatened areas. These obligations may include safety standards, construction codes and building regulations. Codes are likely to have little effect unless they are enforced by authorities. Such efforts need some requirement as:
 - An existing and enforceable system of control.
 - Awareness of building developers of the standards, codes and regulations and understanding them to considering them necessary.
 - Acceptance by the affected community of the objectives and the authority imposing the controls.
 - The economic capability of the affected community to comply with the regulations.

3.5.3 Reaction: preparedness, response, and recovery

Emergency response units are the key actors in reaction. Two elements can be recognized as the spatial planning tasks in the reaction stages (refer to Greiving and Fleischhauer, 2006: 122):

- Distribution of urban facilities and infrastructures necessary to respond to the disaster: Some of these facilities include search, rescue and relief stations, emergency medical and health centres, temporary accommodation and emergency roads. The existence and proper distribution of these features can lead to service quickly after the disaster and consequently reduce injuries and fatalities caused by the earthquake.
- Rebuilding of houses and infrastructure: Urban planning can be understood as a key actor in case of recovery activities after a disaster has occurred. The necessary rebuilding of houses and infrastructure has to be coordinated by planning that is ideally oriented on key risk management principles like avoiding hazardous areas.

4 ANALYSING THE CURRENT STATE OF BOTH METROPOLITAN PLANNING AND DISASTER MANAGEMENT IN TEHRAN

Analysing the current state of both metropolitan planning and disaster management in Tehran using the above identified conceptual framework, indicates the gaps (as weaknesses) and linkages (as strengths) in an integrated disaster management and spatial planning system in Tehran.

4.1 The role of the disaster management system in Tehran

The Study on Seismic Micro zoning of the Greater Tehran Area” is the most important and comprehensive study of risk assessment in Tehran and Tehran Metropolitan Area. This study has provided a comprehensive seismic disaster evaluation (or vulnerability analysis) based on many types of physical, environmental and socioeconomic data items, including (refer to: JAICA, 2000: 9):

- Earthquake catalogue,
- Active faults,

- Geology,
- Ground property,
- Topography,
- Census of buildings (building distribution and building density by type of structure, storey, and construction year),
- Census of population (population distribution and density),
- Urban facilities (distribution of fire fighting stations, police stations, traffic police stations, hospitals, public facilities, educational facilities, parks and public open spaces),
- Urban utilities (water network, gas network, electricity network, and telecommunication network),
- Road and metro network structures,
- Hazardous facilities (distribution of hazardous facilities).

Based on analysing the above data items, some analytical information is provided as peak ground acceleration, seismic intensity, slope stability, building damage, human causality, utility damage, and structural damages. Using this analytic information, overall earthquake risk of Tehran was evaluated by physical and social indicators as (refer to: JAICA, 2000):

- Hazard and damage: seismic, intensity, building damage and casualties,
- Social conditions: population density, open space, and narrow road.

The final result of risk evaluation presents high-risk districts, medium-risk districts, and relatively low-risk districts of Tehran. This risk assessment does not present a comprehensive and thorough picture required for considering the earthquake's risks in the spatial planning system of Tehran. The main problems of this assessment could be explained as follows:

- At the urban scale of spatial planning, data analysis employed in administratively delineated city sub-districts, or some smaller units is frequent. In Tehran, however, this study presents only concrete and detailed maps for Tehran's 22 urban district boundaries which do not fit in with the suitable scale for urban/ metropolitan planning.
- Considering changing social and physical data (population and density, building distribution and density, urban utility networks and so on), there is no mechanism to update the data and provide reliable and up to date vulnerability-related information for urban planners.
- The study area consists of 22 urban districts of Tehran, but the area beyond the city limits has not been considered in this study agenda: there is no information about the vulnerability aspects of the surrounding areas of Tehran (i.e., Tehran's urban region).

Although there are some other studies on Tehran or parts of Tehran that present some information or analysis about the vulnerability aspect, but since these studies have been done in diverse years (starting from 1996) and by distinct agencies, they have different study areas, basics and principles, methods and outcomes and thus, they cannot be able to be integrated to be used in an attempt towards spatial planning.

4.2 The role of the spatial planning system in Tehran

Tehran spatial planning response in employing mitigation measures of mitigation measures could be explained in terms of procedural and substantial aspects. Procedural aspects refer to planning documents and substantial aspects assess the Tehran urban physical and activity sub systems.

4.2.1 Procedural aspects

Urban planning documents system in Tehran is mainly consisted of two parts: (a) Strategic-Structural Plan of Tehran, and (b) detailed plans of Tehran's 22 urban districts. This two were prepared in Research and Planning Center of Tehran, an organization established to manage the collaboration of Tehran municipality and Ministry of Roads and Urban Development in terms of preparing spatial plans of the city.

Strategic-Structural Plan (2006) of Tehran has been recognized the importance of earthquake risk of this city and developed objectives considering managing this risk like identifying vulnerable areas and developing

planning and construction legislations appropriate to each area. Subsidiary documents of this plan also has been mentioned the necessity of developing construction legislative due to the importance of buildings, their stories and vulnerability of their location, developing legislative regarding risk reduction of utility and transportation networks, developing legislative to restrict building's density and arrangement based on vulnerability-related information and so on. But these have not yet become legal statement, and their implementation mechanisms are not defined yet.

Detailed plan of each Tehran's district is prepared based on an agenda which includes two main parts:

- First, studying and analysis of characteristics and specifications of urban development related issues, which lead to assess the determinant factors and trends of changes, and find the problems in the following categories:
 - Land use characteristics,
 - Spatial structure characteristics,
 - Transportation networks characteristics,
 - Environmental characteristics,
 - Demographic characteristics,
 - Socio-economic characteristics,
 - Housing characteristics,
 - Financial characteristics.
- Second, formulation of optimal spatial structure elements, including:
 - Vision and mission statements,
 - Goals statement and spatial strategies,
 - Land use structure,
 - Transportation network structure,
 - Rules and regulations of space use,
 - Subject and action area projects and their general framework.

The above tow-part agenda shows that disaster management consideration (such as identification and analysis of threats caused by hazards) is not embedded in, so there is no specific obligatory framework to application of earthquake mitigation measures in the optimal spatial structure proposed by these plans.

4.2.2 Substantial aspects

The most important shortcomings of spatial planning response in terms of urban physical and activity sub systems in Tehran in employing mitigation measures include (refer to JAICA, 2000 and International Institute of Earthquake Engineering and Seismology, 2005):

- Considerations of risk reduction were not observed in current location of public sector facilities and major infrastructure elements.
- Most parts of Tehran water network are more than 30 years old and even in normal conditions are often crushed. Studies indicate that in times of earthquake, fractures of water network in Tehran would disable the entire system.
- Tehran electricity, gas, and communication networks suffer from lack of sufficient strength against earthquakes and complete cessation of these networked is possible.
- Tehran's road and transportation network and traffic congestion in normal conditions shows that this network is also highly vulnerable to earthquake. Collapse of adjacent buildings and /or destroyed bridges will freeze the network and cause disorder in the rescue and relief operations and thus increase damages caused by the earthquake.

- Population density in Tehran does not compliance with vulnerability-related information and even some most vulnerable districts (including districts 10, 11, and 12) are the most densely populated ones.
- Not only, there are not enough safe evacuation spaces with reliable accessibility in times of disaster to settle the survivors, but also the distribution of them is inefficient.

Disaster management activities	Strengths and weaknesses in linkages of spatial planning and disaster management systems in Tehran	
	Strengths	Weaknesses
Risk assessment	<ul style="list-style-type: none"> • Existence of a relatively comprehensive study on risk assessment of earthquake in Tehran. • Provision of the seismic data of Tehran (such as earthquake catalogue, active fault, topography and so on). 	<ul style="list-style-type: none"> • Absence of the up to date physical and social data to evaluate risk of earthquake in Tehran. • Lack of detailed vulnerability related information in scales required in spatial planning (such as sub-districts and building blocks). • Lack of any applicable study on risk assessment of earthquake in Tehran metropolitan area beyond the city with its 22 districts. • Lack of a defined basis for doing studies on risk assessment so that they could be integrated and used in spatial planning.
Mitigation/ Risk reduction	<ul style="list-style-type: none"> • Increasing attention to the spatial planning role in mitigation strategies in Tehran spatial plans. 	<ul style="list-style-type: none"> • Lack of mitigation consideration in Tehran Detailed Plans' agenda • Lack of detailed and well-defined legislative to regulate the use of lands and spaces, building density, population density and so on. • High vulnerability of Tehran urban utility, urban facility, road and metro network to the earthquake. • Congestion of population and buildings in some of the most vulnerable districts of Tehran.
Preparedness, response, and recovery	<ul style="list-style-type: none"> • Increasing attention of spatial plans to the spatial planning role in response and recovery strategies. 	<ul style="list-style-type: none"> • Inefficient distribution of emergency stations. • Lack of safe accessibility to the most vulnerable areas in times of earthquake.

Table 2: Describing strengths and weaknesses of linkage between spatial planning and disaster management systems in Tehran.
Source: writers (2012) after JAICA (2000) and International Institute of Earthquake Engineering and Seismology (2005)

5 PROPOSING A FRAMEWORK FOR AN INTEGRATED SPATIAL PLANNING AND DISASTER MANAGEMENT SYSTEM IN TEHRAN

To Integrate disaster management process with the spatial planning process, their interrelationships and interdependencies could be studied in three following main lines of activities (refer to Greiving and Fleischhauer, 2006: 111-115):

- First, problem analysis: Problem analysis process starts with the identification of certain conditions in the real world that regarded as unsatisfactory or demanding urgent action. Prerequisite for this phase is planning goals developing which describe the desired future circumstances. Afterward, observation of the environment, surveying and description of the information can be done to identify the dependencies, interactions and interrelations between the current condition and influencing variables. One of these variables is vulnerability-related information which could be provided by Tehran disaster management system through the appropriate and necessary data and assessment methods (such as hazard maps, risk maps and so on) to develop a correct scientific foundation of the decision-making process. Nevertheless, this activity itself depends on preparation of physical data (such as building types, distribution and density) from spatial planning supporting system.
- Second, evaluation of alternatives: In this stage, planning alternatives would be developed and later, they would be assessed to estimate their anticipated impacts through using necessary measures. Considering the impacts of these alternatives on the damage potential and coping capacity of Tehran could be a significant contribution to the disaster management system, especially in mitigation activities.
- Third, decision-making and implementation: Paying attention to the above considerations in evaluating the alternatives in the line with willing, proficiency, and power of Tehran spatial planning to regard disaster management as an element of planning process leads to establishment of procedures and development of measures contributing to disaster management activities.

These three activities can be categorized in two main parts of (a) providing a scientific base, and (b) making decisions and implementation as shown in Figure (3).

6 APPLICATION OF THE PROPOSED FRAMEWORK IN TEHRAN

An integrated spatial planning and disaster management framework in Tehran consists of two elements, including providing scientific base and taking decisions and implementing.

6.1 Providing scientific base

A scientific basis provide both required spatial information for risk assessment and vulnerability-related information and classification of earthquake-prone areas which enable the spatial planning system to define land and space uses based on alerting about hazardous areas. Provision of this basis requires the following activities:

- Establishment of an information support system, including complete physical data (building type, building distribution, building age, building density, urban facility distribution, urban utility networks, road networks and so on), demographic data, and seismic data for building blocks of Tehran,
- Designing a mechanism to update spatial data in the information support system,
- Designing a mechanism to update population census in the information support system.

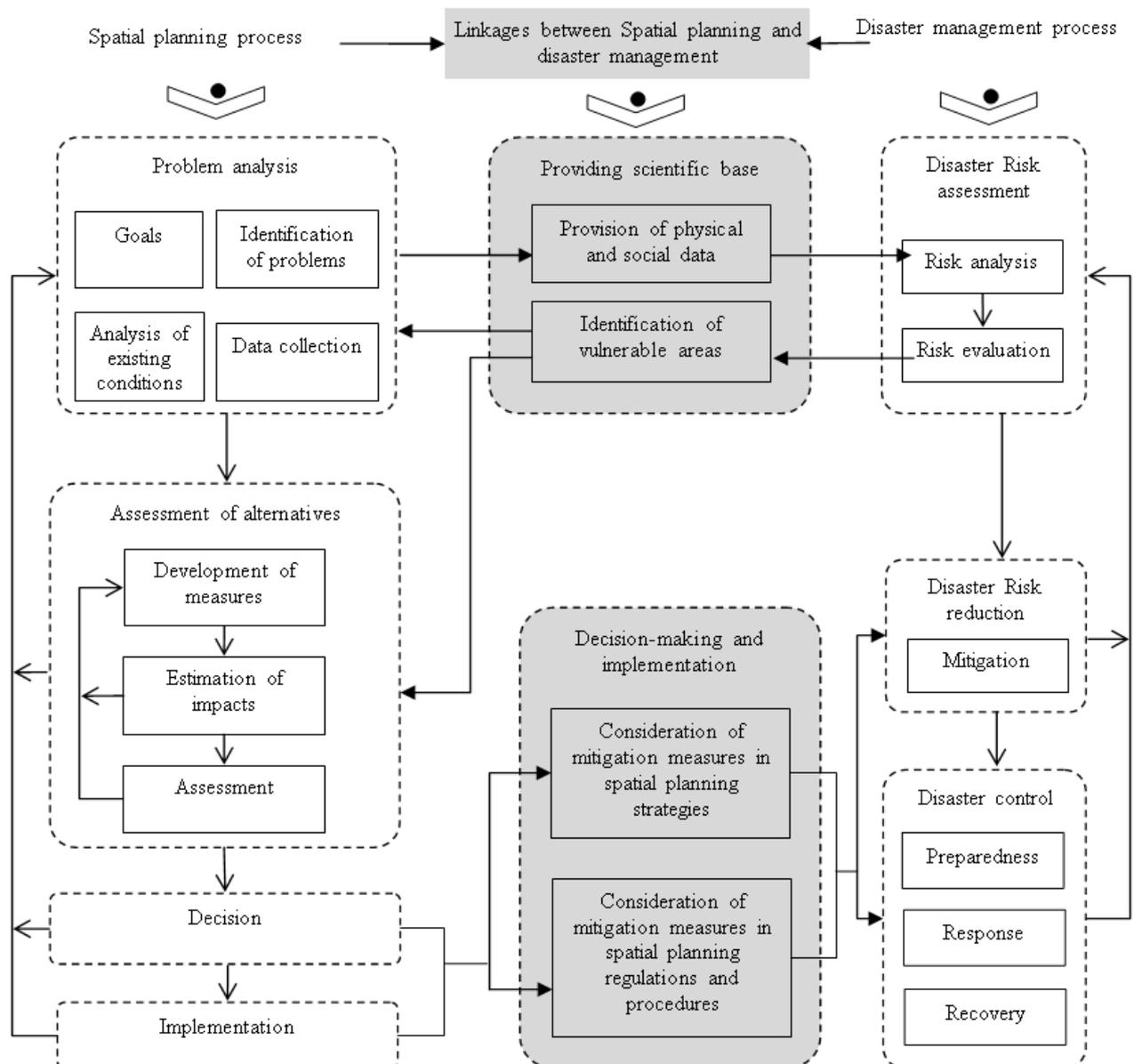


Fig. 3: Integrated framework of spatial planning and disaster management in Tehran. Source: Writers (2012) after Greiving and Fleischhauer, 2006: 116

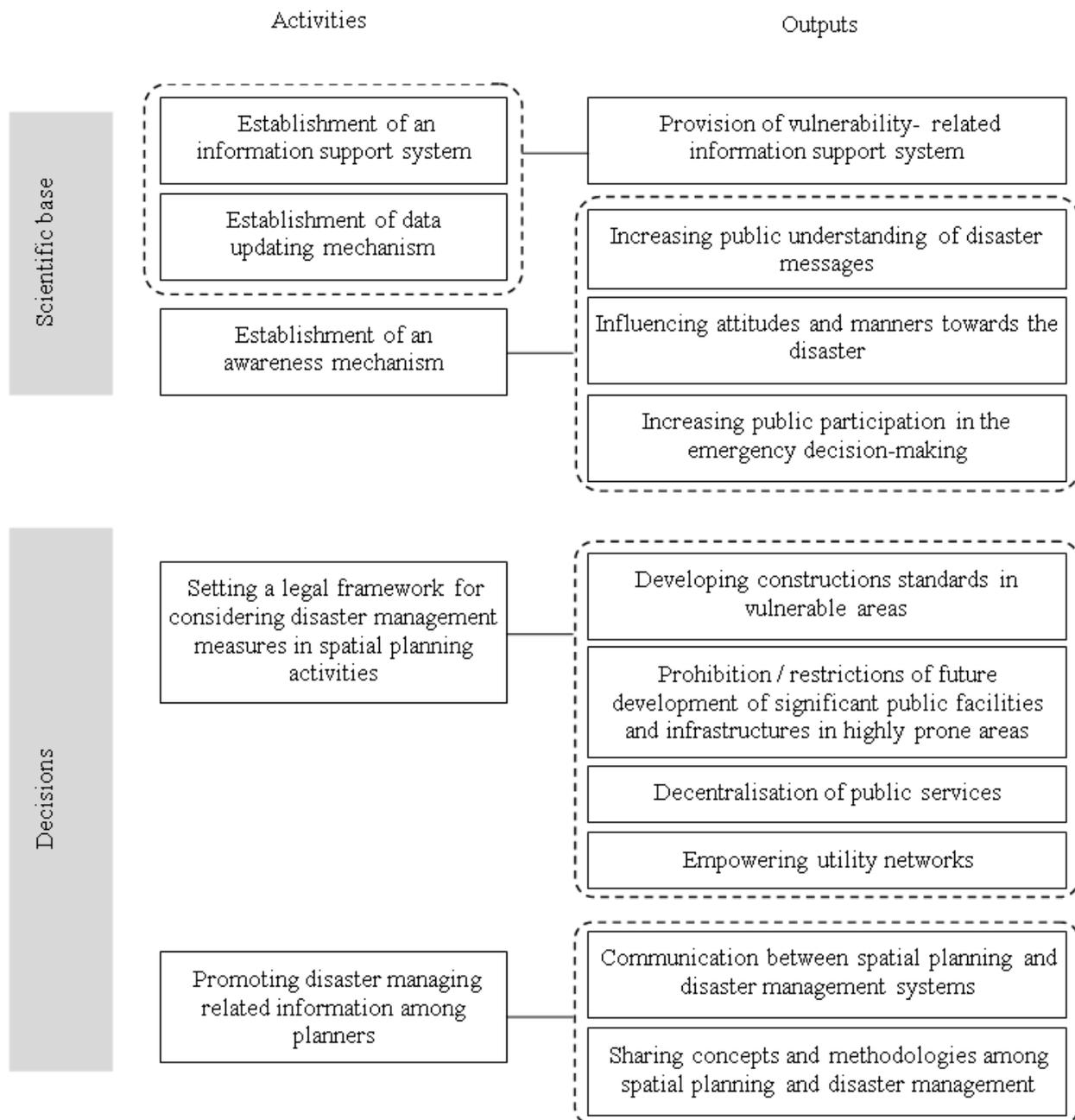


Fig. 4: Application of the proposed framework of spatial planning and disaster management in Tehran. Source: Writers (2012)

Scientific base can also have a different role in raising awareness of Tehran spatial planning officials and experts about disaster management by equip them with information which broadens their view of hazards and risks, since only those hazards and risks that are known can be managed. Moreover, the training of experts engaged in planning is also important in that they may act as multipliers and contribute to the raising of awareness to public. In this situation, the provision of any kind of information (including sources, existing actors and contacts, the cost and effectiveness of different measures, and, etc.) to introduce a disaster management process at the metropolitan level by means of a guideline or a handbook can be seen as a good solution. The guideline or handbook would fulfil these three main objectives:

- Guaranteeing the ability of all receivers of a risk message to understand its meaning,
- Influence receivers of such message to change attitudes towards the disaster and their manners,
- Offering the basis of a two-way communication process which increases public participation in the emergency decision-making.

6.2 Decisions-making and implementation

A legal framework to considerate disaster management measures in planning activities can be seen as the most important need procedurally and legally since it direct spatial planners to take into account earthquake risk while making decisions about urban change and development. Such a framework could include disaster management measures as follows in the spatial plans' agendas:

- Developing spatial construction standards /criteria in vulnerable areas,
- Prohibition and/or restrictions of future development of significant urban facilities and major infrastructure elements in highly prone areas,
- Relocation of hazardous facilities,
- Decentralisation of public services,
- Empowering utility networks through the replacement of damaged parts and switching circular systems with radial ones.

In addition, considering disaster management strategies in spatial planning requires training planners who have skills of understanding seismic map or at least are capable to communicate with the disaster management sector. Cause the lack of shared concepts and methodologies to assess vulnerability may lead to pay little attention to vulnerability in Tehran spatial planning practice. Furthermore, these planners can inform the disaster management system about the real information spatial planning system needs to deal with earthquake in decision-making.

7 CONCLUSION

This article with regard to the important role of spatial planning in disaster management cycle and the connection between the ways of dealing with earthquake and the role of spatial planning, concerns the demands that are made on Tehran spatial planning to integrate with the disaster management system. For the earthquake, preventing the actual geological or meteorological process from occurring is impossible. Thus, disaster management effort toward earthquakes mainly focuses on protection measures related to internal characteristics of the urban system, including city size, density, spatial form, socio-economic development, infrastructures, and the level of emergency response.

Analysis of current state of disaster management and spatial planning systems in Tehran indicates that the main shortages of disaster management system, in terms of its relationship with spatial planning process are lack of maps with suitable scale for urban/ metropolitan planning, lack of mechanism to update vulnerability-related information for urban planners, and lack of vulnerability-related information for the area surrounding Tehran. Additionally, there is no legal framework for taking into account the disaster management considerations in urban planning practises, which leads to high risk of spatial structure and residents of Tehran in times of an earthquake.

In this regard, the proposed framework of integrating spatial planning and disaster management consists of two main elements: (a) setting a supporting scientific base, and (b) making decisions and implementing them according to the mentioned scientific base.

In the scientific base, integrating spatial planning and disaster management process would be occurred in a tow-way relationship: first, spatial planning system provides physical and social data, which is needed for disaster risk analysis of disaster management system, and later, risk evaluation activity of disaster management process identifies vulnerable areas which would be important in analysis of existing conditions, setting planning goals, and assessment of alternatives in spatial planning process.

Disaster risk reduction and control activities would also be integrated in spatial planning process by considering of mitigation measures in spatial planning strategies, regulations and procedures, which are determined in decision-taking and implementation stages of spatial planning process.

In such a framework, the responsibility for disaster management is shared by sectoral planning and spatial planning whereas spatial planning mainly acts in the area of earthquake mitigation due to the long-term character of planning decisions.

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