

Determining the facilitator factors and barriers to relief supply chain planning in disasters

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ABSTRACT: *Objective:* Planning covers all steps of the cycle of disaster management and addresses different dimensions among which decreases destructive consequences of disasters can be mentioned. There are different strategies which can be taken in planning process to reduce destructive consequences of disasters and risk factors when disasters and emergencies happen. One of these strategies is the utilization of supply chain management. This research aims to determine facilitators and barriers of supply chain planning in disasters. *Method:* The present study is a mixed method research conducted by the cross-sectional method. In quantitative part, the sample consisted of 35 members of Disaster Committee from Red Crescent Organizations, Emergency Medical Services, Governorship and Governorship-General Headquarter. Data was collected using questionnaire in terms of reliability and validity which was confirmed; in qualitative part, the sample consisted of 12 experienced professionals working in disasters. Data was collected by semi-structure interviews. As to capture service recipients' views, we reviewed Bam Earthquake service recipients systematically. After completing and collecting the questionnaire, descriptive statistics was used in to analyze quantitative results true spss18; qualitative data was analyzed by using content analysis, main themes were extracted and coded. Then, the results obtained were formed into a pattern. *Findings:* The results indicated that in the human resource dimension, relief supply chain management planning performed strongly in Kerman Province (75.6%) including facilitating factors of manager and staff education at all levels, education and having organization plan for volunteers, performing of maneuvers in the province, plan for calling emergency team members and alternate people. Coordination-control dimension performed weakly (34.43%), which the lack of coordination among organizations involved and the lack of communication to other agencies are among improvable points in the dimension. The design dimension (59.05%) and the need assessment (64.15%) are in a good state. In the support dimension, although some past problems have been corrected, there are barriers that must be eliminated; it is in a medium state (50.73%). *Conclusions:* The results indicated that planning in relief supply chain solved many problems in Bam Earthquake. Nonetheless, there are still barriers to achieve this purpose, which authorities and planners should pay attention to notice considerably. Some problems have been existed since Manjil Earthquake. Although reforms may solved with time-consuming, more efforts are required in this respect.

Keywords: Barriers to and facilitating factors of planning, Relief supply chain, Disasters

INTRODUCTION

In the past 25 years, natural disasters have caused 3 million mortality worldwide and brought about losses valued 23 billion dollar. Iran in terms of geographical location as well as a lack of enough attention to the physical structure, each year is witness to large losses of life and property caused by natural disasters, particularly earthquake. So managers must prepare for uncertainty. Also due to factors such as population growth, climate change and systems integration, natural disasters are on the rise. It is predicted that the current help is insufficient (Amiri et al., 2010).

If the commercial supply chain is defined as a network that consists of the flow of goods, information and financial sources from the source to the final customers, the supply chain then can be defined as quite similar, such that it is a network to manage flow of goods, information and financial resources from relief sources to people in crisis (Afghahi, 2002; Rao, 2007). Supply chain management is a new approach has dominated operations management in recent years. While respecting the role of time in rescue operations in earthquake time and stating that in rescue and relief operations, the first 4 hours after the quake are referred to as the golden time, relief supply chain in addition to providing managers and organizations, coordinates the activities so that customers can obtain products with high quality and at minimal cost.

Katrina Hurricane and the Asian tsunami showed that even modern societies face difficulty in providing effective and timely relief supplies, however, this is while 81 percent of the relief efforts are logistic. Also for effectiveness and responding to relief programs, this challenge is felt more strongly in the health sector due to the mortality results with the lack of supply chain management (Jahanbani et al., 2014).

Planning is a tool that takes us from the current situation to a good condition. One of the most important parts of supply chain management, is supply chain planning (Hoseinpuor, 2017). Using modern management principles, along with attempts for correct understanding of the events that occur during a disaster, we can achieve a convenient plan (Jahangiri, 2009). The most important principle of crisis management is planning in order to have readiness, because all the cases of public, organization, division of labor, resource allocation and task assignment and fulfilled authorities and communication channels are determined in it (Hojjat, 2010). Fortunately, disasters are rare events; however, careful planning and training is necessary, with the aim of preparing organizations for events and restoring them to normal conditions (Alexander et al., 2009).

Since most of the existing articles emphasize on poor planning, equipment and coordination as well as the importance of human resources and on the other hand internal studies on the relief supply chain that include this aspect are handful (planning, coordination, manpower), thus studying in this case, is the most common concern for the research community. In the present study, the view is towards relief supply chain which is related with health services, which evaluates facilitator factors and planning barriers in the variables of design, assessment, control and monitoring, supplying human resources, support and coordination.

METHODS

This is a combined study (mixed methods) which has two dimensions of quality and quantity (case).

This is a cross-sectional study conducted in 3 stages:

The first stage- library study

The library and documentary study includes reviewing of books, scientific journals, documents, publications, official and written reports of responsible organizations in the area of supply chain in disaster and relief supply chain models, the output of which was using this method and its dimensions to determine the facilitator factors and barriers to management planning of relief supply chain of health and treatment at the time of disaster occurrence, in Kerman province. The second stage, quantitative: the quantitative part of the study was used to answer the question "what is the status of management planning of relief supply chain of health and treatment at the time of disaster occurrence?" And also to gain an overview of the organization and identification of weaknesses, and the power of supply chain planning. The study group consisted of 35 members of the crisis committee and disasters in the provincial organizations, government, Red Crescent society and incident management center and medical emergency, which entered into the study by census. Data are collected through questionnaire, and observing the documents.

Data collection tools in the quantitative part, was the adopted questionnaire from the study of Jahanbani (2012), in which the content validity was confirmed by three experts in the field and its reliability was tested using test-retest. The questionnaire had five options, and was scored by Likert scale. Numbers 5 to 1 were given for the strongly agree, agree, no idea, somewhat agree, disagree and strongly disagree. The questionnaire had two parts. The first part included demographic information about the interviewee and the related organization and the second part which was the main part of the questionnaire had 40 questions, 10 questions related to the design, 8 questions

related to needs assessment, 8 questions related to coordination and control, 7 questions related to human resource management, 7 questions related to the support. Data were gathered through questionnaires completed by related persons, observing the documentations, documentations and interviewing with the members of study population consisted of senior managers of crisis management units of planning in Kerman province, the center of EMS and Disaster Management and Rescue Department and the Red Crescent. Data in the qualitative part were collected through semi-structured interviews and the interviews continued until saturation. In quantitative data analysis, using descriptive statistics in SPSS19 software, the desired results were extracted. For data analysis, using descriptive statistics, frequency response of each questions were determined by study participants, then in the interpretation of the data, the percentage of frequency of responses to strongly agree and disagree options was summed up with each other, the same was the case for the percentage of frequency of response to strongly disagree and disagree options. Combination and the total frequency of the questions were presented as strongly disagree and disagree options and ultimately the questions were analyzed separately according to their components. The questions were designed so that the agree option, show the strengths and the disagree option show the weaknesses and challenges, so in each component, the highest and lowest percent were selected and were considered as the strength and weaknesses.

Third stage, qualitative

After the above steps, the qualitative stage (case) was began to determine the "barriers and facilitator factors of healthcare relief supply chain planning at the occurrence of disaster ". Its components includes relief supply chain dimensions (design, needs assessment, human resource, coordination, support) and that the reason for choosing this, is the importance of these dimensions according to the study of Pallavi et al (Dash et al., 2013).

The subjects included all managers and officials of crisis and disaster management at the provincial organization, higher managers and officials in the Red Crescent organizations of the city and town, managers of emergency service, the directors of the relief and rescue organization, and officials of the Institute of Education Studies in the municipality of crisis management.

In qualitative section, the data were collected using semi-structured interviews. Questions were asked regarding the review of the literature and the quantitative section. All interviews were recorded and immediately implemented by the researcher on the same day. The time of interviewing ranged between 20 to 40 minutes. The studied samples were chosen with both snow bullets targeted methods. Meaning that first the known managers were interviewed in the field of disasters and in the next stage these people were asked to introduce the next samples, and the research flow continued, so that the sample size were selected 12 subjects and the interview was stopped when the data reached saturation. Finally, data were analyzed using content analysis. The reliability and validity of the qualitative research data were investigated with respect to the four features of credibly, transferability, reliability, and validity.

RESULTS

Among the five organizations studied, the Red Crescent with 25.7 percent, allocated most participants members to itself and the most degree of the research members were bachelor with 65.73 percent. 80% of study participants were men and 20% were women. 14.28% of studied sample was formed by the higher managers, 31.44% of middle managers and 54.28% were operational experts.

1) The facilitator components and barriers to planning regarding the design in management of relief supply chain

Regarding the parts of design components, respectively, 80 and 82.14% of study participants agreed that existence of a written program to address unexpected events and identification of strengths and weaknesses of the program are among the strengths of this component. To better understand this issue, the results regarding the qualitative data showed that the formation of the Crisis Management organization and Disaster Response Program in line with strategic plan are considered facilitator factors in this regard.

Regarding the design barriers, only 14.30% of study participants agreed that the information and communication infrastructures are predicted in crisis and 36.59 percent believed that this item is one of the weaknesses of designing components. To better understand this issue, the results of qualitative data suggests that the lack of targeted program regarding information on the crisis is one of the obstacles of design component. The qualitative results also showed that the lack of a written programs to accommodate victims is another obstacles of this component.

2) The facilitator components of and planning barriers regarding support in relief provision chain management

The quantitative data showed that the 85.3 and 79.1% of study participants agreed that the program for collecting public donations and field hospitals is one of the strengths of the support component. To better understand the results, the qualitative data in addition to confirming these strengths, demonstrated that among facilitator factors to support the affected people is the existence of field hospitals in the earthquake-stricken place for fast treatment. Also the development of a written program to collect donations from people is another facilitator.

Regarding the obstacles of support component, quantitative data analysis showed that only 33.3% of study participants agreed with the financial ability at times of crisis, but 57.7 percent of study participants believed that they lack financial ability at times of crisis which is one of the weaknesses of this component in line with the supply chain. In the qualitative part of the study, the lack of financing is one of the main obstacles cited.

3) The facilitator components and planning barriers regarding needs assessment in managing relief supply chain

Regarding the implementation of needs assessment, study participants agreed that factors such as separation of treatment and non-treatment needs at times of crisis, initial assessment of needs in order to meet the relief needs and investigating the possibility of air relief 86.6%, 6 and 76.7 and 76.7% respectively is considered to be one of the strengths of this component. To better understand this issue, the results of qualitative data showed that, separating, separation of medical and non-medical needs in disasters by special teams, damage assessment teams, and the needs and the existence of air emergency management are root causes of these components that are considered as needs assessment facilitator factors of supply chain management.

Regarding the barriers to needs assessment component, the results showed only 33.3 percent of people studied believed that a written program for specific social groups such as the elderly people, and 59.9% of respondents disagreed with it which is a weak point in needs assessment component. To better understand the issue, the qualitative research results showed that no specific program is considered for such people.

4) The facilitator components and planning barriers regarding Human Resources Supply in managing relief supply chain

In this case, all participants agreed that the development of a program to organize volunteers and basic education programs for dealing with disasters are 2 strong points in this component. To better understand these results, the qualitative data showed that factors such as training managers and employees at all levels, written educational program and organizing volunteers, conduction of provincial maneuvers, and program for calling out emergency team members and successor individuals will improve relief supply chain performance in Kerman regarding the supply of human resources, which is considered one of the strengths of this aspect.

Regarding the barriers of human resources components, qualitative research results showed that the lack of volunteers, is one of the obstacles of human resources supply. Before the crisis, volunteers are very few, as a result, individuals haven't received the necessary training in times of crisis and won't have sufficient preparedness; So with a written program we should attract interested forces and by training them, increase their preparedness against disasters.

5) The facilitator components and planning barriers regarding control-coordination in managing relief supply chain

Regarding the components of this element 86.6 percent of study participants agreed that communication with the international agencies is one of the strengths of this element. Making effective communication is among facilitator factors which has been very successful in the earthquake of Bam, foreign organizations on the scene, confirms this issue.

Regarding the barriers to coordination, the results showed that only 13.3 percent of the studied individuals agreed with the development of plan to inform the other organs, and 78.5% of individuals disagreed with it. Also 16.6 percent of study participants agreed with plans to evaluate transportation of goods to the damaged regions and 70 percent disagreed with it which can be noted as the weaknesses of these elements. In order to better understand the results, the qualitative data showed that lack of informing other organs and lack of coordination among them is considered among the important obstacles of coordination of relief supply chain. Summary of results of qualitative data is visible in the table below.

Main themes		Sub- themes	quotation
Design	Facilitator	The formation of the Crisis Management organization and Disaster Response Program in line with strategic plan	-After the Bam earthquake, National Disaster Management Organization And Regulations was officially born(i:3,4,8,10,11) -We are the only university that have disaster response program and are being implemented step by step(i:3,5)
	Barriers	-The lack of targeted program regarding information on the crisis -Places shortage of temporary housing for Disaster	-Communication is still incomplete and is part of future plans(i:2,12) -Our facility is not responsible for a large population(i:1,7)
Needs assessment	Facilitator	-Separation of medical and non-medical needs in disasters -Damage assessment teams activity -Air emergency	-In times of disaster, every organization will send its experts to assess the needs(i:2,6,7,12) -The formation of this team is a successful experience that we had not in Bam earthquake(i:5,3,11) -Air ambulance was not in the earthquake and Air Force helicopters were not performance due to delay(i:3,4)
	Barriers	-Lack of specific program for specific social groups	-The specific and separate program are still not considered for them but is the future plans(i:5,8)
Control-Coordination	Facilitator	-Coordinating with some organizations to get the space to house -Communication with the international agencies	-there is coordination for some organizations, such as schools and mosques for the space accommodation(i:1) -In Bam earthquake,we had an effective international communications That was shown in this area were successful(i:12)
	Barriers	-Lack of coordination among organs -Lack of informing other organs	-Regular informing is done through the media, but there is not Targeted informing(i:3,4) -we know what to do after the Bam earthquake but still there is not a coordinated program between organizations(i:1,4)
Human Resources	Facilitator	-Training managers and employees at all levels -Written educational program and organizing volunteers -Conduction of provincial maneuvers -Program for calling out emergency team members and successor individuals	-Training is conducted on a wide scale in most organizations(i:9,12) -Training programs for volunteers prepared And refer to the Red Crescent centers and trained(i:6) -maneuvers are the remind aspect of earthquake and is one of the programs of personnel readiness against earthquakes(i:1) -Crisis team members are known in advance and are available in times of disaster(i:3,9)
	Barriers	-The lack of volunteers -Non-recognition of strengths and weaknesses provincial maneuvers	-At the moment we have no plan to absorb these forces(i:11) -Usually does not identify the strengths and weaknesses maneuvers and There is no coordination to fix it(i:10,12)
Support	Facilitator	-The field hospitals -Development of a written program to collect donations from people	-Field hospital for natural disasters that Health centers damaged is useful(i:5) -Fundraiser by Red Crescent Has led organizations not to take donations(i:8,10)

		-Donations targeted separation at source	- After this experience Bam earthquake, a program was developed that First aid separately and then be sent(i:1)
	Barriers	-Lack of funds on disaster -Lack of an operational program using a field hospital	-Of course in against step much we invest it is not enough, we must invest on prevention(i:1,4,8,11) -We do not yet operational plan for the field hospital(i:6,8)

DISCUSSION

The results of the study showed that the existence of a written program to deal with unexpected events, and identification of its strengths and weaknesses are among facilitator factors in the supply chain planning which is due to the formation of the National Disaster Management Organization and the response program to events in disasters is in line with the strategic plan, as Orouji deemed its formation necessary in a study on the teachings of Bam earthquake (Orouji, 2004) Zare et al. in a study on Tohoku earthquake crisis management in Japan stated that the crisis management program has not been effective, mainly due to weakness in the design (Zaré & Afrouz, 2012) this shows that Iran has acted well in crisis management programs and as the results of this study show, Kerman has had a performance improvement using different programs in this regard.

Regarding information systems which are another component of the design aspect, it can be said that lack of written information program and communication channels are obstacles to this aspect. As it is known the use of information systems in earthquake crisis management is vital (Sadeghi-Bazargani et al., 2015). The study conducted after the Haiti crisis shows that due to the lack of information, attempts for relief operation had become very complex, which reduced the level of performance (Zook et al., 2010) This lack of information system is consistent with the present study, but Hesia et al. in a research stated that the effective use of information systems in Taiwan crisis, led to the reduction of a lot of damages and many patients received treatment (Hsiao et al., 2009).

Accommodation is another improvable item in the design aspect. The results indicate that there are plans to resettle affected people at the time of crisis, but due to overcrowding, these programs and spaces, are not enough and we require complementary programs and planning models for accommodation. A case study conducted by Johnson on the Marmara and Bulow crises in Turkey in 1999 showed that the planning and preparation for temporary accommodation, reduces costly errors in decision-making. The occurrence of these two crises has now created the temporary accommodations with high quality and substantial safety without damaging the environment (Johnson, 2002) the picture of the results can be seen in this study. On the other hand, El-Anwar et al. in their study on the crisis of Northridge stated that lack of any plans for temporary accommodation in this crisis, reduced the optimal efficiency regarding the accommodation and the need for a planned model deemed essential (El-Anwar et al., 2008) which is consistent with the present study.

Bardayan et al. in a study about the Adapazari crisis in Turkey believed that rapid settlement of a field hospital after the crisis, led to save time and many affected people were rescued (Bar-Dayan et al., 2005) but still no operational program of Human Resources and field hospital equipment is considered in Kerman. Among other facilitator factors in the support aspect, the existence of a written program is to collect donations from people. The results of this research shows that the responsibility for collecting donations was handed over to the Red Crescent through a written program that has in turn caused situation in which no organization measure to take donations such as what happened in Bam earthquake. Non-cash donations may not be exactly what is needed, thus they should be investigated and should be performed by trained personnel (Aflatoonian, 2006) that is consistent with our results. Another element of the support aspect is financial resources.

The results of the study showed the lack of financial resources, and as said by the experts, in case of employing the resources in the phase of confrontation, lack of resources will create more damage. so it's better to use resources in the prevention phase, so the lack of financial resources and especially lack of planning on the use of financial resources is one of the major obstacles. During a research, Aflatoonian stated his experience of Zarand and Bam earthquakes that the financial resources spent on a service is excessively spent or is spent in parallel which is indicative of the lack of planning and coordination (Aflatoonian, 2006) that is consistent with this study.

Results of needs assessment component indicate that assessing the needs in Kerman is implemented by experts of the Red Crescent and University of Medical Sciences during disasters, also medical and nonmedical needs are separated from each other, which is itself considered as an advantage. Also the presence of damage assessment team is considered as one of the facilitator factors in supply chain management planning. According to 2010 Haiti crisis, Asmilu considers needs assessment as one of the main components of the planning process (Da Costa). Charles addresses that due to variability of the needs of injured people because of type and severity

of disasters as well as society culture, needs assessment must be implemented by experts (Charles, 2010), as the results of the present study confirm that the assessment must be done by the experts.

Another component of needs assessment, is needs assessments for specific social groups. The results show that lack of planned programs for specific social groups is one of the improvable points of this component. According to Hanshin crisis, Tanida states that most injured people in the crisis are aged, whom should be paid more attention to and specific programs must be considered for their protection (Tanida, 1996). The results of the present study indicate that apart from preparing welfare for these people, no planned and pre-specified program exists. After the occurrence of crisis in Japan, Suzuki et al. states that the employed policies pertaining to the aged has been very effective, and medical and health intervention are offered at best, and that is confirmed through a survey (Suzuki et al., 2011), but the results of this study, confirms a lack of policy in this regard, but a lack of systematic planning in this regard is consistent with the results of this study.

Another component of needs assessment is air relief. The results indicate that the formation of air emergency is one of the strengths that exists in the city of Kerman. Air relief by helicopter may have a maximum impact in reducing injuries, and temporary as well as permanent disability (Moradian et al., 2012). According to the results of the retrospective study in Norway, it was shown that the air relief is a strength that caused 321 people to be transmitted through air relief amongst 345 casualties so as to decline serious injuries (Norum & Elsbak, 2011), which is consistent with the results of this study about air relief.

Regarding human resources it must be said that in Kerman province, they could overcome the weaknesses of Bam earthquake and turn into a facilitator factor in this regard by planning programs like calling out for emergency team members and the successors, education programs in all levels, and organizing the volunteers and implementation of provincial maneuvers. Earthquake studies in Italy (De Bruycker et al., 1983), Mexico (Villazon-Sahagun, 1986), Armenia (Noji et al., 1990), and California (Olson et al., 1990), suggest that the provision of quick services of human resources and the existence of planned program are crucial so as to organize them in disasters, which is consistent with this study. Siegel in a study, argues that two points must be noticed about human resources: the first is to enhance the ability and science of human resources and the second is to predict and estimate the demand rate and preparedness in the face of disaster. It also carried out a study and stated that human resources usually in disaster take action without any preparation, organization and control (Siegel, 1985) that is not consistent with the present results.

One of the obstacles, is the lack of volunteers. As a result, in the Kerman province, different methods should be used and planned in this regard to motivate volunteers, especially students under 29 years. Hagger and colleagues suggest that people should be encouraged to volunteer work and an incentive should be created for them (Hagger-Johnson et al., 2006). Kunii et al argue that in the Japan crisis, low number of volunteers and the lack of a program for organizing human resources and volunteer are among problems that they faced in the management (Kunii et al., 1995) Due to the importance of the issue, planning in this regard is essential.

Regarding the coordination element, lack of a written program for coordination of agencies involved is one of the major obstacles in the planning of the supply chain. In terms of analytical data in a study it has been shown that more coordination, increases the efficiency and success of rescue operations (Anbari et al., 2003). In 2011 Japan crisis, a list of challenges, including: 1- poor coordination at the local level and 2-absence of early warning system are provided (Zaré & Afrouz, 2012) that is consistent with our results.

Regarding the importance of coordination in information and communication, which is another component of coordination, the results indicate that communication is considered one of the obstacles of these components. Hanshin crisis experience suggests that coordinated efforts to collect information and share that with proper communication with the experts due to lack of systematic planning in this regard was not performed correctly, and this caused false information to be provided about the needs and health teams (Kunii et al., 1995) which is consistent with the results of the present research.

Bani ni et al. for the logistics implementation in relief scenes, need important types of information, such as transportation capacity on the day of the accident, distance from the center, and road access based on which they can handle the needs (Da Costa et al., 2012). Results of this study shows the absence of a pre-determined program to transport goods to the affected area as well as the assessment of the cost of transporting and storing which is considered as other weaknesses. However, Prater et al. suggest that speed of the time required to carry or receive goods and the speed of adjusting the distance and volume are two major components in the supply chain (Mendonça Tachizawa & Giménez Thomsen, 2007).

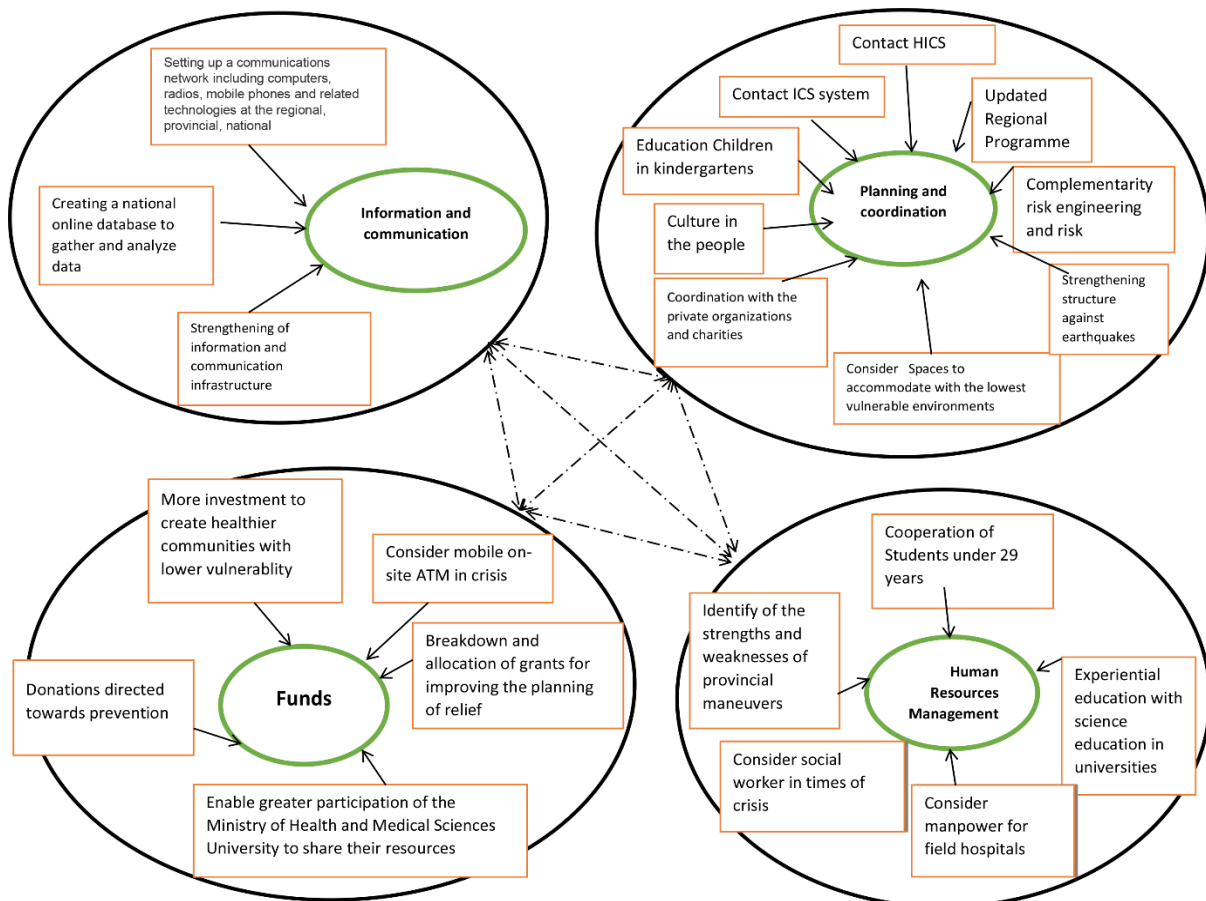
But one of the strengths of the coordination in this study, can be noted as communication with international agencies which are other components of coordination. Aflatoonian in a research suggests that the Bam earthquake in 2003 and Zarand earthquake in February 26, 2004 taught useful lessons to everyone, with the rare presence of NGO and UN from around the world and countries. Bam and Zarand experiences in health sector coordination and international assistance was very effective (Aflatoonian, 2006), which indicate the effectiveness of communication with international organizations which are consistent with this study. Telford also noted that in 2004crisis in India, wide international aids has decreased the damages and that's a reason for the effective international communication range (Davodi et al., 2013).

CONCLUSION

The results showed that planning in the relief supply chain has solved many problems of Bam earthquake, but there are still some obstacles in this regard that the authorities and planners are asked to give them serious consideration. Human resources management component, is among strengths in relief supply chain in Kerman, yet the existence of programs to attract volunteers is essential. Coordination component on supply chain planning is one of the major obstacles in Kerman, and that the major causes of which are a lack of coordination between the relevant organizations and lack of coordination in information and communication. Air ambulance, the damage assessment team, and written programs in order for separation of medical and non-medical needs are considered among facilitating factors in planning supply chain management in Kerman in order for the component assessment. Field hospital is also in itself a facilitator in this regard. However, it should be noted that the action plan is essential to use these hospital. But it should be noted that the action plan is essential to use these hospitals. Also the existence of a written management program and strategic plan in this regard are among the strength of design component to aid in relief supply chain and the lack of written programs to accommodate, are obstacles of such component. Some of these problems have existed since the Manjil earthquake, although the reforms may be time consuming but requires further efforts in this regard.

Executive Strategies

Executive strategies based on research results and experts' opinion are divided in 4 parts of Planning and Coordination, information and communications, human resources management and financial resources and are expressed in graph format (figure 1-1) in the following.



Conflict of interest

The authors declare no conflict of interest.

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