Adapting to Drought from Sustainability Dimensions in Nomads via Factor Explaining

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ABSTRACT

This purpose of this research is to explain adaptation with drought from sustainability dimensions in nomadic societies. A questionnaire was developed from a review of literature, observations and open and semi-structural interviews with public and informant Nomads, local leaders and with experts from the local and provincial institutions. Prior to the application of factor analysis, two internal reliability and validity were undertaken. In this regard, a pilot study was conducted with 21 Nomadic families in four townships (Iranshahr-Zabol-Jiroft-Anbarabad) that were not included in the sample population to determine the reliability of the questionnaire for the study through which 82/96 percent was obtained for different parts of research instrument which indicated that the questionnaire was highly reliable. Face and content validity of the instrument were established, refined and finally confirmed using an expert panel, which consisted of research committee, a number of university professors and some senior experts in the Nomadic organization of Iran. The research population consisted of total population of Nomads in the southern of Kerman Province of Iran included between 8314 to 10995 families according to winter and summer quarters population, of whom 374 families were selected stratified sampling with proportional assignment (n=374). Factors respectively based on the nature of their constituent questions, were named as educational, economic, service, political and institutional factors.

Keywords: Adaptation; Factor Explaining; Kerman; Nomads; Sustainability.

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INTRODUCTION

Economic crisis and natural disasters have been a recurrent phenomenon in the developing world. For the period 2000-2004, one in 19 people living in the developing world was affected by a climate disaster and the forth assessment of the IPPC asserts that the impact of drought has dramatically increased in the past 37 years (UNDP, 2007; Fuentes & Seck, 2007; ICSU, 2005). World Bank predicted that by the year 2035, three billion people will live in the tough conditions because of water shortage (World Bank, 2009). According to the Human Development Report, by the year 2080, climate change affects the life of many people throughout the world (UNDP, 2007). Drought tends to occur less frequently than other hazards, but for example more than 80 percent of people in Africa have been affected by drought and other natural disasters (UN/ISDR, 2007). Droughts, floods and other extreme weather events are becoming more common, and it is projected to increase both in frequency and severity (Fuentes & Seck, 2007). On the other hand, among the principal natural hazards affecting society, drought receives less scientific and political attention. This is due largely to its slow-onset nature; cumulative, nonstructural impacts; low death toll directly attributable to drought; and extensive areal coverage (Wilhite & Vanyarkho, 2000).

Drought phenomena have occurred regularly in Iran over the past centuries and have negatively affected the people and society. According to United Nations Development Program (2004: 67) in the Islamic Republic of Iran, the negative effects of severe drought that affected the country from 1999 through 2002 were magnified by non-climate factors. In 2000, it was estimated that there were losses of US $ 1.7 billion in livestock and crop production. In 2001, it was estimated that these losses increased to US $ 2.6 billion. Additional effects of the drought included displacement from rural to urban areas, deterioration of public health and outbreak of water borne diseases, increased unemployment, the disappearance of wetlands, and increases in related hazards such as fires, wind and soil erosion, flood and landslide hazards. According to a study that was conducted by Abbaspour and Sabetraftar (2005), in Iran the recurring phenomena of drought have to be accepted as part of the normal life. Moreover as Wilhite and Vanyarkho (2000) mentioned drought is the result of interplay between a natural event and the demand placed on water and other natural resources by human-use system. So it should not be viewed as merely a natural event (Wilhte, 2000).

In Iran, geographic distribution of drought showed that southern and southeastern of Iran are more sensitive to drought both in intensity and frequency (Iran Meteorological Organization, 2008; Daneshvar, 2007). Nomads in the Kerman province, located in south-east of Iran, have been particularly vulnerable to prolonged episodes of drought and the severity and persistence of the latest droughts has produced a wide range of impacts across the region. According Adger *et al*., (2003), societal vulnerability to the risks associated with climate change may exacerbate ongoing social and economic challenges, particularly for those parts of societies dependent on resources that are sensitive to changes in climate.

Estimation of the damage of drought crisis in a period of ten years (1989-1999) in Kerman province, showed that the majority of cities and more than 1500 villages damaged, 56857 head of livestock killed, and 250000 hectares of land damaged.

Although drought is a natural hazard, the term drought management implies that human intervention can reduce vulnerability and impacts. Nevertheless past attempts to manage drought and its impacts thorough a reactive, crisis management approach have been ineffective, poorly coordinated, and untimely in both developed and developing country (Wilhite, 2000; Wilhite *et al*., 2005). But Individual, community and institutions often make strengthening shorter-term responses to current climate variability a priority and totally lack of risk management and emphasis on crisis management alone, had no contribute to

stabilizing nomad livelihood (Range Technical Office, 2000). The primary challenge, therefore, posed at both the scale of local natural resource management and at the scale of international agreements and actions, is to promote adaptive capacity in the context of competing sustainable development objectives. As well as active adaptive management is a useful tool for resilience building in social-ecological systems (Adger *et al*., 2003; Folke *et al*., 2002). It has been emphasized that, in societies which are chronically drought-prone and where this has a significant development impact need to be more aware that their decisions may actually increase vulnerability at household and higher impacts from droughts. On the other hand, the impact of drought largely depends on societal vulnerability and adaptive capacity at the time and place where drought occurs. This implies that chronically drought-impacted societies need to put drought near the centre of their sustainable development priorities (UNDP-DDC/BCPR, 2005; Wilhite *et al*., 2007). In this regard, reducing vulnerability is an effective precautionary step towards adaptation (Eriksen *et al*., 2009). The goal of sustainable development is to create and maintain prosperous social, economic, and ecological systems (Folke *et al*., 2002).

This purpose of this research is to explain adaptation with drought from sustainability dimensions in nomadic societies. Among the 30 province of Iran, Kerman in the second province in terms of nomadic population after the Fars province and the first province in terms of diversity of tribe and clans including 31 tribes and 55 clans who are distributed in 56 percent of the Province. Records from the Provincial Nomadic Office showed that there are more than three million livestock including cattle, sheep, goat and camel which are distributed in 65 percent of total rangelands.

MATHERIALS AND METHODS

This research is quantitative in its nature and applied in kind which was anticipated that would be exploratory, aiming to drive the factor structure of adaptation strategies with drought in the base on the sustainability in Nomad society.

A questionnaire was developed from a review of literature, observation and open and semi-structural interviews with public and informant Nomads, local leaders and with experts from the local and provincial institutions. Prior to the application of factor analysis, two checks of internal reliability and validity were undertaken. In this regard, a pilot study was conducted with 21 Nomadic families in four townships (Iranshahr-Zabol-Jiroft-Anbarabad) that were not included in the sample population to determine the reliability of the questionnaire for the study through which 82-96 percent was obtained for different parts of research instrument which indicated that the questionnaire was highly reliable. Face and content validity of the instrument were established, refined and finally confirmed using an expert panel, which consisted of research committee, a number of university professors and some senior experts in the Nomadic organization of Iran.

The research population consisted of total population of Nomads in the southern of Kerman Province of Iran included between 8314 to 10995 families according to winter and summer quarters population, of whom 374 families were selected stratified sampling with proportional assignment (n=374).

RESULTS AND DISCUSSION

At this stage of the study, exploratory factor analysis (EFA) was applied. EFA is a complex, multi-step process. Factor analysis attempts to bring intercorrelated variables together under more general, underlying variables. In other word, EFA attempts to discover the nature of the constructs influencing a set of responses. More specially, the goal of factor analysis is to reduce “the dimensionality of the original space and to give an interpretation to

the new space, spanned by a reduced number of new dimensions which are supposed to underlie the old ones". (Costello & Osborne, 2005; DeCoster, 1998). This consisted of principal component analysis (PCA) and orthogonal rotation (varimax) performed with the 46 actual items. Factor rotation is a process of manipulating or adjusting the factor axes to achieve a simpler and pragmatically more meaningful factor solution (Da Costa, 2007). The ratio of sample size to number of measurement constructs (>8:1). Field (2005) pointed out correlation coefficients fluctuate from sample to sample; therefore the reliability of factor analysis is also dependent on sample size. In general over 300 cases are probably adequate but communalities after extraction should probably be above 0.5.

After the first order factor analysis, average score of each specified factors, were into the second stage. As in the table 1, the two extracted factors together explain 53 percent of the variation in the six factors extracted in the previous step, and the sampling adequacy is 0.535, along with a significant p-value <0.0001.

The extracted factor loadings are presented in table 4.

Table 1: Second order factor analysis for six factors

		1	2	Communality Extraction
1	Educational Factor	0.589	0.471	0.569
2	Economic Factor	0.206	0.825	0.723
3	Services Factor	0.711	0.103	0.517
4	Political Factor	0.690	0.004	0.476
5	Institutional Factor	0.322	- 0.648	0.523
6	Nutritional Factor	0.578	0.201	0.375

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Nutritional Factor removed due to to low communality extraction (0.375), and refinement was performed again. Finally two extracted factors together explain about 60 percent (60.155) of the variation in the five extracted factors (table 2).

Table 2: Second order factor analysis for five factors

		1	2	Communality Extraction
1	Educational Factor	0.624	0.420	0.565
2	Economic Factor	0.277	0.807	0.728
3	Services Factor	0.816	-0.046	0.669
4	Political Factor	0.683	-0.054	0.470
5	Institutional Factor	0.292	-0.701	0.576

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

In this stage, the third order analysis was performed on two latent factors extracted from the previous stage. The extracted factor loadings are presented in table 3.

Table 3: Third order factor analysis

No	Factor	1
1	Extensional Factor	0.784
2	Eco-Institutional Factor	0.784

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

As shown in above table, one latent factor extracted from EFA and both the factors have equal loading on identified factor (0.748). Finally the extracted factor explains about 61

percent (60.465) of the variation in the two extracted factors from the previous stage (table3).

CONCLUSION

This purpose of this research is to explain adaptation with drought from sustainability dimensions in nomadic societies, which were clustered into six latent variables in the first stage. These factors respectively based on the nature of their constituent questions, were named as educational, economic, service, political and institutional factors. In other words the variance of observed variables could be explained by these factors. In relation to political factor Eriksen and Lind (2009) pointed out that adaptation may need political solutions and there are political obstacles to developing effective adaptation policies. Nelson *et al*., (2008) indicated that interactions between government and resource users in local communities need to be supported by regionally distributed scientific support capable of integrating local knowledge and informing the livelihood outcomes of critical importance to both rural communities and policy advisers. This finding emphasizes development through education that encompasses political and institutional aspects. Results of research conducted by Marchildon *et al.,* (2008) and Berkes *et al*., (2000) showed that institution-building may be of value in helping the residents adapt to predicted climate changes in the future as well as anticipate some of the barriers to effective institutional adaptation. Economic factor addresses strategies of livelihood and income diversification among pastoralists. The results from a study conducted by Jahromi (2008) about the production characteristics of Nomads in Darzeh, Kahnooj township of Kerman province, showed that due to drought, the quality and quantity of agricultural production have been decreased and obviously it has a unfavorable consequence such as: unemployment, poverty, migration and social difficulties on people specially youth. Therefore economic development can play an effective role in increasing the adaptation capacity in drought conditions (Little *et al.*, 2001; Jahromi, 2008). Finally Smith (2003) pointed out that while it is possible to debate separately the biophysical elements that create drought, the social factors that structure producer's experiences and responses to it, and the policy environment that helps define those experiences and responses, ultimately the interactions between all these elements must drive the development of better drought policy in the future.

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