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Factors affecting sustainable rangeland management: Experts' attitudes towards livelihood cornerstones in the Bazoft region

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Abstract:
Sustainable rangeland management (SRM) considers several dimensions of human life through recognition of sustainable livelihoods approach, in which livelihood cornerstones are acknowledged. In spite of this fact, research has not addressed this subject sufficiently. It has been recognized that analysis of the main drivers, allows for more appropriate strategies which are not the mere understanding of livelihoods, but rather ways towards sustainable development of rangelands. In this study, experts' attitudes towards factors underpinning SRM were elicited. Data were collected using survey in order to analyze the livelihood cornerstones, in the Bazoft region in Chaharmahal and Bakhtiari province, Southwestern Iran. The participants were consulted to characterize the relative importance of each driver in approaching SRM. A five-point Likert scale was used to rank the three main influencing factors, including livelihood capital, vulnerability contexts as well as policies, institutions and processes (PIPs). We found that experts associated the main drivers with PIPs, vulnerability contexts and livelihood capital, respectively. Then, they prioritized policy, human capital and trends as the factors extracted from the main drivers in a more detailed assessment. Through these findings, we would offer policy makers should initially pay more attention to drivers that experts prioritized.

Keywords: Sustainable development of rangelands, livelihood cornerstones, experts' attitudes, human capital, policy, Bazoft region, Iran.

1. Introduction

Arid and semi-arid rangelands are defined as areas falling within the rainfall zones of 0-300 mm and 300-600 mm, respectively (FAO 1987). These rangelands cover at least 10 million km² of the earth's land surface and range from desert to mountainous or highland regions. They are characterized by low and highly variable precipitation, unpredictable rainfall patterns and unsuitable conditions for cultivation. Historically, these rangelands have provided great ecosystem functions and services, supported wildlife, and have long been places for rangeland users including pastoralists and their livestock. Accordingly, rangeland users have been able to more freely use the services that these ecosystems provide and adapt to changes in ways that have improved their livelihoods (Boone *et al.* 2011). Further, they have traditionally coped with highly variable

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conditions through choosing a wide range of strategies that allow maximum flexibility and dealing with changing and uncertain conditions (Klein *et al.* 2011). Thus, it could be claimed that traditional systems of rangeland management and adaptive livelihood strategies supported and guaranteed inhabitants in these areas.

However, during the second half of the 20th century in many countries, new changes and challenges emerged, which, disrupted the well-adapted strategies and demised the traditional systems of rangeland management. Consequently, rangeland degradation followed by livelihoods' vulnerability of rangeland users affect sustainable rangeland management (SRM) (Bedunah and Angerer 2012; Khedri Gharibvand *et al.* 2015). So that rangelands which recently, directly support about 200 million pastoralists living in close association with about 960 million ruminant livestock are under serious threats and jeopardizing their services and benefits (World Bank, 2006; SCBD, 2010).

It can be deduced that rangeland users' livelihoods and SRM as a whole, are presently confronted with a number of problems and there still remain some unresolved challenges. Accordingly, achievement of SRM has become of a great interest among policy makers scholars, and rangeland users (Janssen *et al.* 2000; Miller 2001; Klein *et al.* 2011; Bedunah and Angerer 2012; Dong and Sherman 2015; Khedri Gharibvand *et al.* 2015). In line with this, the general goal of SRM has been recognized as "the long term productivity of rangelands while ensuring rangeland users' livelihoods in the short term" (Khedri Gharibvand *et al.* 2015). According to Khedri Gharibvand *et al.* (2015) "achieving this goal is impossible if rangelands are degraded and livelihoods are vulnerable". Eventually, these issues have increased conflicts between different rangeland stakeholders that have worsened the achievement of SRM (Bedunah and Angerer, 2012; Khedri Gharibvand *et al.* 2015).

In the 1970s and 1980s, the focus of development shifted to the people, stressing the importance of intangible aspects, such as education, health, and population through the development of human resources including knowledge, skills, and attitudes, still it has not been paid attention to the experts' attitudes towards SRM in an integrated and comprehensive approach (Dong and Sherman 2015; Khedri Gharibvand *et al.* 2015; Vallejo and Wehn 2016). Moreover, although, in the 1980s and 1990, the focus of development shifted towards the major stakeholders, government, non-governmental organizations, and private organizations, as well as their networks and external environment, however, many conflicts have still remained unresolved and have thus affected SRM (Bedunah and Angerer, 2012; Khedri Gharibvand *et al.* 2015; Vallejo and Wehn 2016). Although some studies have tried to address SRM concern, they have less investigated it in a way which can simultaneously include ecological, human, social, economic and physical aspects in policies, strategies and programs.

In this paper, first an effort is made to address some major policy deficiencies behind the issue of SRM. Afterwards, experts' attitudes towards livelihood cornerstones are analyzed in the Bazoft region in Chaharmahal and Bakhtiari province, Southwestern Iran. Through applying the sustainable livelihoods (SLs) approach, the three main influencing factors, including livelihood capital, vulnerability contexts as well as policies, institutions and processes (PIPs) along with their relevant criteria such as natural, human, social, financial and physical capital, PIPs as well as seasonality, shocks and trends are analyzed.

A five-point Likert scale was used to rank the livelihood cornerstones.2. Policy deficiencies behind the SRM

2.1. From a single to multi-faceted concept and approach

Over the past decades, lack of attention to factors affecting rangeland users' livelihoods and SRM as a whole, has resulted in more pressure on pastoralism as a system of livestock production and a way of living which supports the livelihoods of 200 million people, covers about 25% of the earth's terrestrial surface and provides 10% of the world's meat production (SCBD, 2010). On other hand, the range management as a source of employment is no more able to meet basic requirements of rangeland users that has led to a significant reduction in the value of rangelands (Bedunah and Angerer 2012). The possible consequences of devaluation of pastoralism and range management are less income, decreased well-being, increased vulnerability, unsustainable use of rangeland, and food insecurity (Harris 2010; Squires 2009). This indicates that livelihoods are vulnerable and should increasingly be understood as a global concern and crucial issue that needs to be treated comprehensively. Accordingly, to acquire a holistic perspective on SRM, all possible factors influencing SLs should be considered.

Some studies and policies on rangelands have focused purely on "ecological" issues. For example, applied policies in rangeland enclosures and fencing for conserving biodiversity and increasing productivity have been resulted in overgrazing and increased rangeland degradation by more presence of livestock and grazing pressure especially in adjacent fields. Despite the acknowledgment of the need for SRM, the conventional rangeland management tends to optimize short-term benefits from the production of food and fiber and little understanding was given to ecosystem services that support rangeland users' livelihoods (Teague *et al.* 2010). In this concern, a major challenge which rangeland ecologists and managers are facing is the ability to respond faster to rapid changes of rangeland environments that affect rangeland users' livelihoods (Karl *et al.* 2012). However, to achieve a promising SRM, rather than solely studying the relation between plants and animals (ecology), well-being of rangeland users in these environments should also be observed. To consider the well-being of the users, it is important to meet some socio-economic aspects such as governing the users' access to rangelands that further realizes the recognition of property rights and strengthening local institutions.

In the interest of income, food security, well-being and reducing poverty which are the main goals of livelihood sustainability, it is necessary to secure rangeland users' access to land as an important "socio-economic" issue. In this regard, policymakers and scholars insist on making policies and exploring feasible ways of rangeland users' access. Property rights are the ways through which pastoralists have access to land. These may be determined to prevent possible conflicts between land users including pastoralists to decide about better land productivity and increased income. Moreover, the solutions of access to rangelands are understood through an adequate level of per capita or common rights in most countries (Elhadary, 2010). Due to this reason, some countries aim to assume property sizes as a touchstone to consider the economic size of rangeland units to improve rangeland users' livelihoods. However, utilization systems of small sizes of property in Australia and the household level in China for instance, have not supplied the desired economic level of household and have been economically non-viable

(Richard et al. 2006; Janssenet *et al.* 2000)). Moreover, in Iran, small rangeland units have been known uneconomic (Abolhassani, 2011). So, lack of supplying the optimum size of rangeland units per household accompanied with high number of users and high stocking rate have resulted in non-economic and vulnerable life for pastoralism as a profession.

Besides, the development of local institutions can be noted as one of other important socio-economic aspects. Dong *et al.* (2009) cited that institutional development is one of the possible solutions to approach SRM. Meantime, they indicated that public services and technical supports act as main barriers to SRM and recommended reformulating the policies to tackle rangeland degradation. In a recent work, Lerman (2012) suggested that institutional solutions and user associations dedicated to SRM can improve rangeland management by planning and monitoring rangelands. In this regard, Bennetta *et al.* (2012) highlighted that traditional authorities play an important role in many aspects of local people's lives, particularly land access and control. Despite the fact that the notion of sustainable development clarifies that the existence of social, economic and ecological conditions is essential at a certain level of welfare to support human life and some studies have assessed some of these dimensions simultaneously, the challenge is still to create a comprehensive framework which includes also "human factor and infrastructures" simultaneously.

Miller (1999) pointed to the need for recognition of indigenous knowledge as one of the main human factors to approach SRM. Later, Squires (2009) stated that the notion of sustainability is associated with human problems which may ask for policy instruments such as improved legislation, income re-distribution and subsidies. In a recent work, Hosseininia *et al.* (2013) mentioned that if SRM is a goal, human factor should be considered as a key element. In the view of Ho and Azadi (2010), to achieve SRM, extension and educational programs for pastoralists should be promoted. In addition, Oba (2012) highlighted the implication of harnessing indigenous rangeland knowledge to promote practical rangeland management. Moreover, Ghorbani *et al.* (2013) noted that indigenous knowledge of rangeland plants and principles of SRM is based on centuries of experience and observation that are indispensable in sustainability of pastoralists' livelihoods and maintenance of rangelands. Moreover, it has been suggested that poorly designed facilities (infrastructure) can exacerbate rangeland degradation and the vulnerability of rangeland users' livelihoods (Lerman, 2012). In a study, Bedunah and Angerer (2012) claimed that fences and water development without adequate livestock control would increase rangeland degradation. Also, Lerman (2012) noted that the management of common rangelands can be improved through maintaining rangeland infrastructure (e.g., water points, sheds, and road).

Bedunah and Angerer (2012) stated that rangeland practitioners should help policy makers with a better understanding of complex interactions between human and environment to maintain ecosystem services, develop proper policies and institutional mechanisms as well as focusing on infrastructure development, human factors, and financial issues. The above mentioned argument clears that SRM is a multi-faceted concept that needs an integrative approach which can inclusively study ecological, social, economic, and human and infrastructure aspects to achieve SRM (Wallace 2007; Emadi 2012). Such a comprehensive approach can provide policy makers to make inclusive

decisions (Dong *et al.* 2010; Teague *et al.* 2010; Milner-Gulland 2011). Moreover, such an inclusive approach should be able to respond the following question: which conceptual framework or scientific approach can best address the multiple dimensions of SRM (where in itself embed SLs as one the most important of its goals)?

2.2. Looking for an integrated and interdisciplinary approach

In recent years, some approaches and frameworks have been proposed to achieve SRM (Mitchell 2010; Ngaido 2010; Teague *et al.* 2010). They have made a biased assessment toward socio-economic, ecological and human issues and often have neglected the rangeland users' livelihoods as one of the most important aims to approach SRM (Khedri Gharibvand *et al.* 2105). Further, most of studies have not applied an inclusive approach and framework and they exclusively consider some aspects. In other words, in any frameworks of previous studies, have not been applied successfully an integrated approach that embraces all dimensions of influencing factors the SRM. Lack of attention to different multiple factors affecting SRM in a frame-based approach in previous researches and wrong perceptions of SRM have resulted in impractical policies and caused a failure in approaching SRM (Khedri Gharibvand *et al.* 2105). In this way, disregarding the main aspects affecting SRM, all together, made them incomplete approaches rather multi-faceted; eventually, they proposed limited and piecemeal solutions. This clears that SRM is a multi-faceted concept that needs an integrative approach which can inclusively study ecological, social, economic, and human and infrastructure aspects to achieve SRM. Thus, to have a better perception and understanding of rangeland users' livelihoods and SRM, it is initially essential to look at an approach that includes several aspects including social, ecological, economic, human, and physical (infrastructure) all together. Moreover, the new approach must consider interdependencies between institutions, environmental dynamics, economic processes, applied technologies and dominant cultures (Rammel *et al.* 2007). In line with this, Sayre *et al.* (2012) argued that to bridge scientific gaps; approaches and frameworks that respond to multiple issues and problems should be taken into consideration, and these approaches must significantly be different from the past approaches. In this context, new formal approaches can help structure decision making (Karl *et al.* 2012).

Accordingly, to acquire a holistic perspective on SRM, all possible factors influencing SLs and SRM should be considered. Therefore, to address these issues, an integrated approach is needed whereby practitioners, different experts, and stakeholders including pastoralists themselves worked together to design and implement a study to identify livelihood strategies. Such an approach can provide additional incomes resources or benefits to the rangeland users, which help improve livelihoods and avoid rangeland degradation. Accordingly, the main challenge facing the SRM should be realized as lack of an integrated and interdisciplinary approach in order to ensure SLs and therefore SRM. To overcome such policies deficiencies, Khedri Gharibvand *et al.* (2015) suggested a new policy perspective in which the promotion of SLs is placed at the center of the policy-making agenda.

3. Towards a policy-making framework: recognition of SLs as a holistic framework

According to Khedri Gharibvand *et al.* (2015) "the need for new approaches in SRM policies emerges in line with the evolving concept of SLs". They (SLs) have been known as the core of socioeconomic systems such as the systems of rangeland management and livelihood strategies of rangeland users. Thus, to have a better understanding of SRM, it needs to have an approach towards SLs as a dynamic objective and primary source of living. Therefore, the importance of the SLs approach to achieve SRM should be acknowledged, because the SLs approach, in addition to the five dimensions livelihood capitals, considers policy, institutional and structural changes as well as the vulnerability context within the frame of the so-called SLs framework. Accordingly, the SLs approach should be embedded in SRM that pursues livelihood objectives as one of the important SRM goals. In other words, "the SLs lay in the heart of SRM, because the survival and livelihoods security are more important to rangeland users due to economic necessities" (Khedri Gharibvand *et al.* 2015). Consequently, SRM could be approached, if rangeland users' livelihoods were sustainable. In other words, realizing SLs should be the most important goal to achieve SRM. The SLs approach integrates the dimensions and some other factors together and evaluates them to achieve SLs and helps us apply a proper and useful policy and practice in our research. These dimensions could be gained through the use of "natural", "human", "social", "financial" and "physical" capitals accompanied with PIPs and vulnerability contexts in the framework of livelihoods analysis. Figure 1 shows all these pentagon capitals, mediating factors including PIPs and vulnerability contexts in the SLs approach.

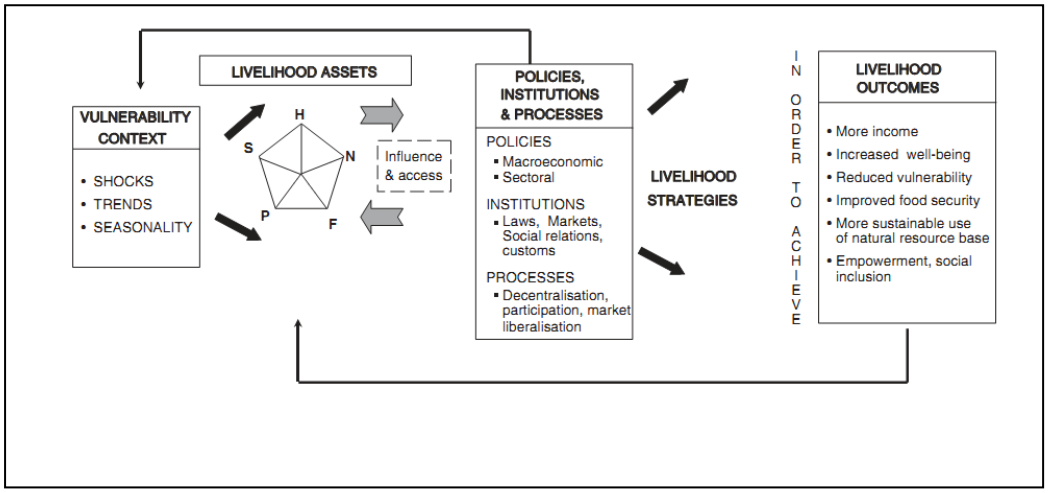

Fig. 1. Sustainable livelihoods framework (Adapted from DFID, 2001)

Chambers and Convey (1992) introduced the concept of SLs for the first time. They stated: "for policy and practice, new concepts and analysis are needed". Five years later, the Department for International Development (DFID) emphasized on the SLs

approach in the white paper (DFID 1997). A year after, Scoones (1998) presented SLs approach and applied the analytical framework of SLs. Further, DFID (2001) created an outline for SLs framework and suggestions to apply it in practice. In the SLs approach, the interrelationship between livelihood capitals which are accompanied with human, social, natural, financial and physical capitals, PIPs and vulnerability contexts should be appreciated and taken into account by decision makers. This approach has increasingly been applied in many disciplines including fisheries development policy (Allison and Horemans 2006) and sustainable energy (Cherni *et al.* 2007; Cherni and Hill, 2009; Henao *et al.* 2012). Davies *et al.* (2008) applied the SLs approach in remote desert Australia. They highlighted its potential as a tool for collaborative engagement of researchers, local people and other stakeholders, to promote sustainability of livelihood systems in the Australian desert aboriginal development. In connection with the SLs in rangeland management, LaFlamme (2011) developed a framework for sustainable rangeland livelihoods called Sustainable Rangeland Framework, in which all groups of different rangeland stakeholders were described in six similar categories of assets including landscape, biodiversity, flexibility, skills, information, and networks. Recently, Khedri Gharibvand *et al.* (2015) applied the SLs approach to develop the Appropriate Livelihood Framework for SRM in which a set of appropriate livelihood alternatives along with relevant factors, as livelihood cornerstones, are recognized. In this paper, we aim at analyzing these livelihood cornerstones.

4. Methods and material

4.1. Study area

The study was conducted in the northwest of Chaharmahal and Bakhtiari province which is the largest high mountain area namely Bazoft region (Fig. 1). The Bazoft region extends between 49° 34´-50° 30´ E and 31° 37´—32° 39´ N. Mean annual precipitation is approximately 966 mm, more distributed in spring and autumn, the average annual temperature is 10.4 C. Maximum and minimum of elevation are 4135 m (Zardkuh mountain) and 844 m (southern part), respectively, hosting a high variety of microclimatic and topographic features as well as seasonal rainfall with high inter-annual variability. Average land slope of the basin is 42 %. The region spans of Oak forests and deferent types of rangelands, interspersed with a set of streams and a river namely Bazoft river. Approximately 56 % of the watershed is covered by rangelands and the rest is covered by forest and bare lands (Besalatpour *et al.* 2012; Almasi and Soltani 2016).

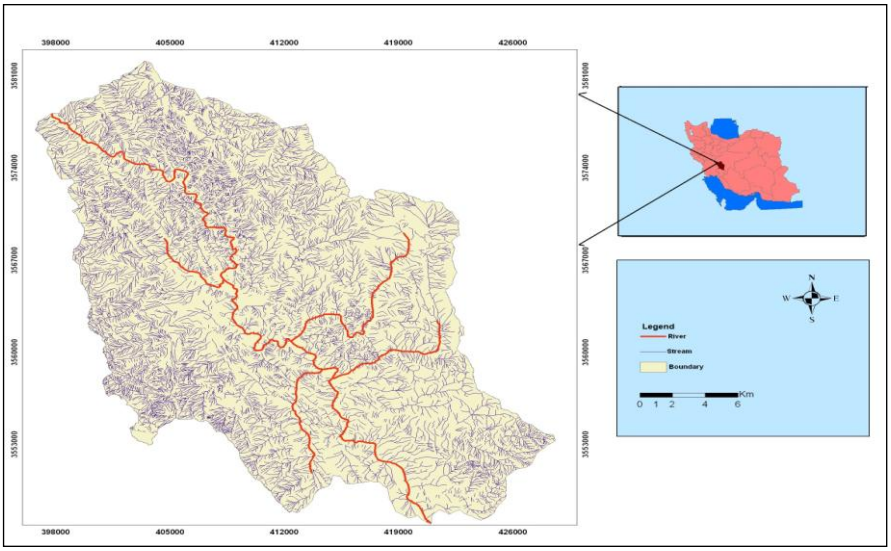

Fig. 2. Location of the study Area

4.2. Target groups

Here, we focus on a group of key informant stakeholders i.e., leaders refer who has a stake, which are either knowledgeable about the region or representative of a particular group in the region. Local and regional experts as well as academic and agency scientists have been known other participants who have been involving SRM programs. Thus, we worked with all experts to understand their attitudes, knowledge, preferences, and opinions on livelihood cornerstones. Figure 3 illustrates a conceptual diagram for eliciting experts' values.

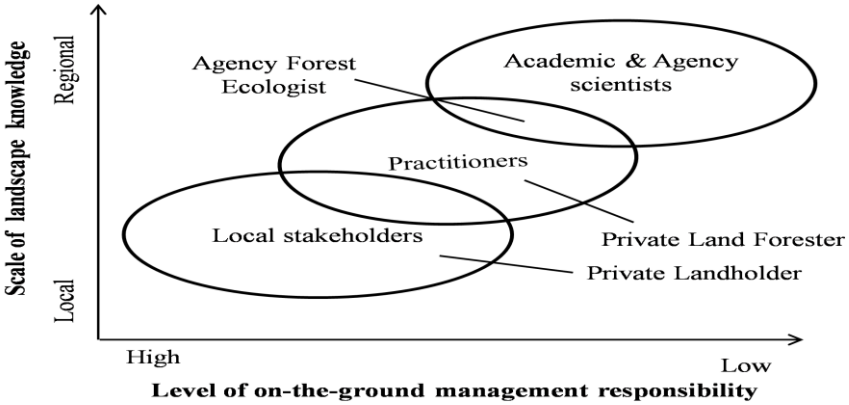

Fig. 3. A conceptual diagram of the different types of experts –local stakeholders, practitioners, and academic or agency scientists – who can provide input for the livelihood cornerstones (adopted from Price et al. 2012).

4.3. Sampling Strategy

Among non-probability sampling methods, the judgmental sampling methodology was used to ensure adequate representation of people having local, expert and scientific knowledge and also they are knowledgeable of SRM. Through applying this methodology, we collected survey data from forty experts. Through working with stakeholders and regional and local practitioners, we examined to what extent participants agree with a series of livelihood drivers? To do so, the study built on a broad and practical conceptual framework of SLs that embraces three dimensions of influencing factors, including livelihood capital, PIPs and vulnerability contexts and their relevant factors.

In this study, the experts participated from different groups include key informant stakeholders, practitioners, and academic and agency scientists. The research question was: what are their opinions regarding the recognitions of livelihood cornerstones as "factors affecting SRM" and how much they agreed with each factor. Five-point Likert scale, frequency, total cumulative weighted values, and weighted mean were the statistical tools used in the interpretation and analysis of data. All quantitative data were measured on a five-point rating scale from 1 to 5 (“Very low ” (1), “Low ” (2), “Medium ” (3), “High ” (4) and “Very high ” (5). The results are presented in Tables 1-4 and Figures 4-7.

5. Results

Table 1 shows the results of frequency of experts' values and the total cumulative weighted values of the main factors. According to the figure 4, the cumulative weighted averages of main factors are between 3.50-10.30. The main factors affecting SRM, in order of priority, include PIPs, vulnerability contexts and livelihood capital, respectively.

Table 1. Frequency and total cumulative weighted values elicited for the main aspects

Main aspects/values	Very low	Low	Medium	High	Very high	Cumulative weighted value
Livelihood capital	4	2	20	3	11	140
PIPs	2	12	5	15	8	401
Vulnerability contexts	6	7	16	11	0	332

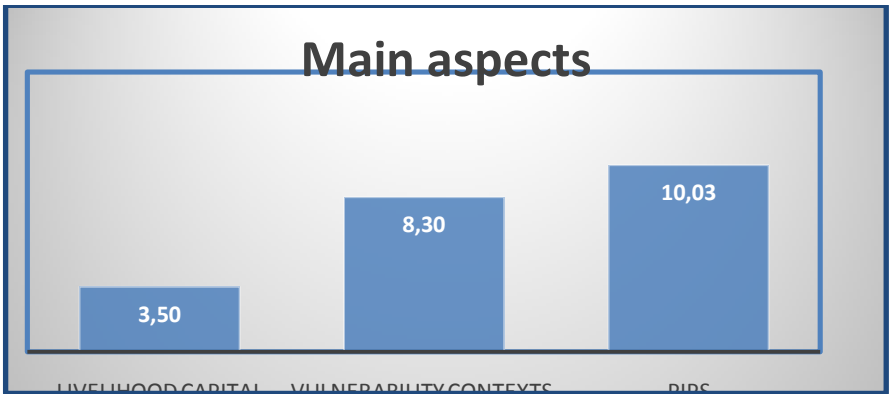

Figure 4. The weighted mean of the main aspects

Table 2 shows the results of frequency of experts' values and the total cumulative weighted values of livelihood capital. According to the figure 5, the cumulative weighted averages of livelihood capital are between 1.75- 3.93. They increase in order of priority to affect SRM, human, financial, natural, social and physical capital, respectively.

Table 2. Frequency and total cumulative weighted values elicited for the livelihood capital

Livelihood Capital/ values	Very low	Low	Medium	High	Very high	Cumulative weighted value
Human	2	1	2	1	23	129
Financial	8	4	13	5	9	157
Natural	14	7	10	7	4	120
Social	11	13	13	12	3	155
Physical	5	15	2	15	1	70

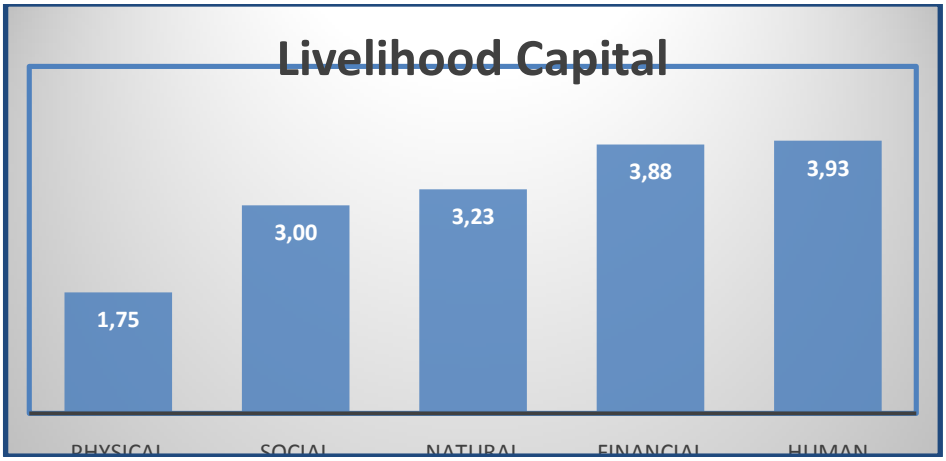

Figure 5. The weighted mean of the livelihood capital

Table 3 shows the results of frequency of experts' values and the total cumulative weighted values of PIPs factors. According to the figure 6, the cumulative weighted averages of PIPs factors are between 2.75 -3.73. The PIPs factors affecting SRM, in order of priority include policies, processes, and institutions, respectively.

Table 3. Frequency and total cumulative weighted values elicited for the PIPs

PIPs/values	Very low	Low	Medium	High	Very high	Cumulative weighted value
Policies	2	4	12	7	15	149
Institutions	8	7	14	9	2	110
Processes	5	11	11	12	1	113

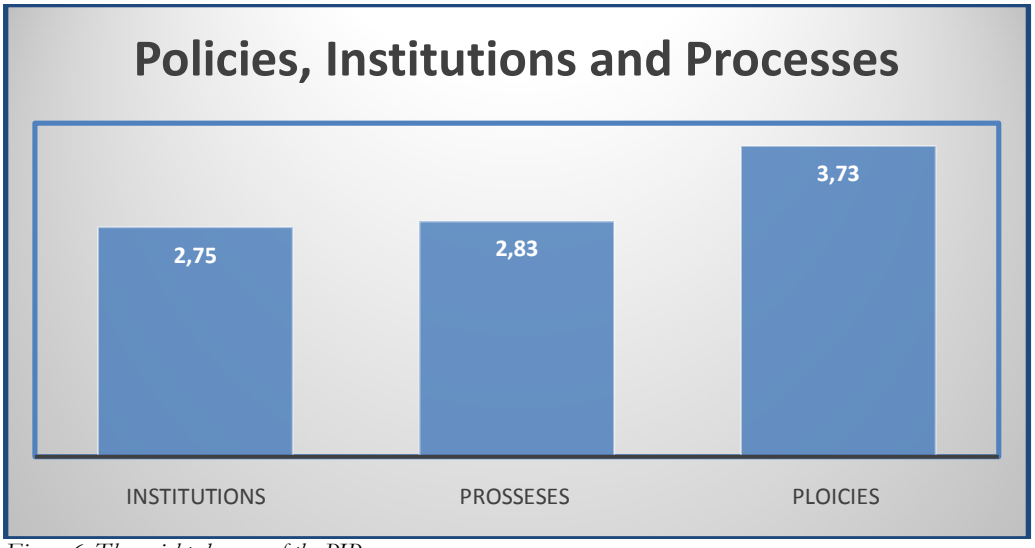

Figure 6. The weighted mean of the PIPs

Table 4 shows the results of frequency of experts' values and total cumulative weighted values of vulnerability contexts. Regarding to the figure 7, the cumulative weighted averages of vulnerability contexts are between 2.85- 3.1. They increase in order of priority affecting SRM, trends, shocks and seasonality, respectively.

Table 4. Frequency and total cumulative weighted values elicited for the vulnerability contexts

Vulnerability contexts/values	Very low	Low	Medium	High	Very high	Cumulative weighted value
Trends	4	7	15	9	5	124
Shocks	6	8	12	12	2	116
Seasonality	8	9	10	7	6	114

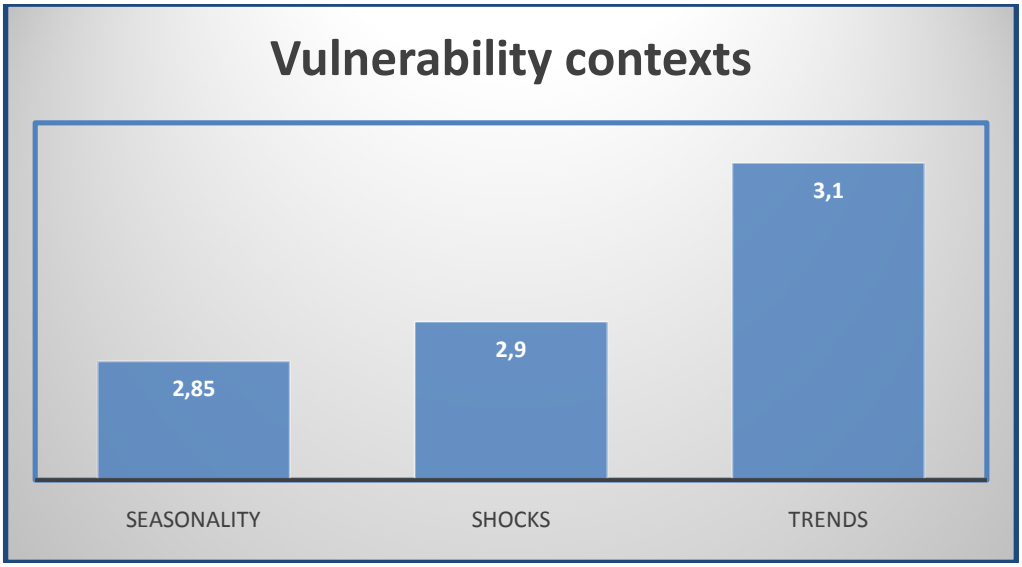

Figure 7. The weighted mean of the vulnerability contexts

6. Discussion and conclusion

While meeting rangeland users' livelihoods has been recognized as one of the most important goals of SRM, there is a growing recognition that SRM, in turn, is affected by livelihood cornerstones such as livelihood capital, policies, institutions and processes (PIPs) as well as vulnerability contexts (Khedri Gharibvand *et al.* 2015). The livelihood cornerstones, generally, remain the same in most arid and semi-arid rangelands. Nevertheless, there are several important differences affected by the "willingness and attitudes of the rangeland users, climate variability, socio-ecological systems and economic-political contexts of each country" (Bedunah and Angerer, 2012; Khedri Gharibvand *et al.* 2015). In many arid and semi-arid areas where rangelands are the major land use and pastoralists rely on this resource, these livelihood cornerstones are prominent issues that policy makers and rangeland users facing with (Azadi *et al.* 2007; Harris, 2010; Bedunah and Angerer, 2012; Khedri Gharibvand *et al.* 2015). Some of developed countries could able to deal with the problems, but others (i.e. some developing countries) are still challenging with factors that affect rangeland users'

livelihood and SRM.

Accordingly, as most studies point out, on the one hand, rangelands inhabitants suffer from improper policies, political instability, institutional weakness, ineffective processes, and deficiency or lack of livelihood capital, on the other hand, they are affected by vulnerability contexts such as stochastic abiotic factors including variable rainfall which result in highly variable and unpredictable primary production (Votter, 2005; Khedri Gharibvand *et al.* 2015). Consequently, inherent characteristics of these rangelands and the emergence of new changes and challenges have resulted in new serious challenges of rangeland degradation and livelihood vulnerability which are posed as most concerns in arid and semi-arid rangelands. In this way, political systems and their institutions, policies, and administrative structures, coping with vulnerability contexts, enhancing livelihood capital, can play crucial roles in mitigating and adapting to the above-mentioned problems. However, these effective aspects have not been analyzed in sufficient detail to determine which factors affect more a livelihood or SRM as a whole.

In this regard, Huber *et al.* (2013) suggested that alternative policies, governance structures and congruent management strategies for mitigating the impact of such changes and enhancing SRM practices must be identified and developed in a way that not only economically is sound and ecologically sustainable, but also institutionally feasible and socially acceptable. Following this point of view, the present study sought to assess all main factors together for the SRM. It indicated experts associated the main drivers affecting SRM, with PIPs, vulnerability contexts and livelihood capital, respectively. In a more detailed assessment, and in the second level, some other dimensions of SRM were included and among them policy from PIPs, human capital from livelihood capital and trends from the vulnerability contexts identified as the most important drivers affecting SRM. This clears that policy makers should not only adjust their policies against over rangeland degradation and vulnerability of livelihoods, but also they need to pay attention to the others aspects and factors influencing SRM. Through these findings, we would offer policy makers should initially pay more attention to drivers that experts prioritized. Future research can extract more drivers, in third level, from natural, human, social, financial and physical capital, PIPs as well as seasonality, shocks, and trends, and analyze them in a more detailed assessment. In the third level, the effects of policies, programs, research approaches, scientific frameworks applied for the SRM as well as livelihood capital and vulnerability contexts can be addressed in more detailed.

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