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Analysis of Effective Factors in Sustainable Management of Forest Resources among Local Communities of Kerman Province

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Abstract

The main purpose of this study was to analyze the effective factors in sustainable management of forest resources (SMFR) among local communities. Given that forested areas form a major part of Faryab county, the focus of the present study was on natural resources which forested lands of the is located in rural district of Mehruyeh. Statistical population included all the exploiters in Mehruyeh village utilizing forest resources (N=7000). The sample size (173 individuals) was obtained using Cochran formula sampling technique based on simple randomized sampling method. The research instrument was a questionnaire which validity and reliability were confirmed by an expert panel and Cronbach's alpha coefficient (α>0.7). Data analysis was conducted using $SPSS_{win18}$ and $Lisrel_{8.54}$ whose results showed that the most important destructive causes in the village were overgrazing and deforestation to create arable lands; furthermore, most of the studied exploiters followed sustainable management of forest resources at a low level. Also, there was a significant difference between sustainable management of forest resources and variables age, forest working record, education level, and the kind of forest exploitation system. The correlation analysis results showed a significantly positive relationship between political-supporting factors, psychological-training factors, cultural-social factors, economic-supporting factors, and sustainable management. Moreover, regression results indicated that the foregoing factors accounted for 78.9% of variance changes associated with sustainable management of forest resources.

Keywords: Forest destruction; Forest resources; Local communities; Sustainable livelihood; Forest management

1. Introduction

Forest and farm producers are the primary producers and suppliers of food, forest products, and other resources for domestic consumption and trade in international markets (FAO and Agricore, 2016). However, they encounter a myriad of challenges such as insecure land rights, poor access to finance, poor quality infrastructures, remoteness and isolation from markets and decision-making powers, poor access to information, and exploitation by middlemen (Demarsh *et al*., 2014; Pasiecznik and Savenije, 2015). Rapid population growth, increased life standards, and the necessity to meet the increasing requirements of human societies have led to an increase in the exploitation of natural resources (Lambin and Geist, 2016). However, development planning and providing for human needs were based on infinitive natural resources in the past (Kennedy and Kock, 2004). As a renewable and environmentally-friendly raw material, wood has played a major role throughout human history (Rowell, 2013). Over the past decades, the term "sustainability" has become very common in the description of resource utilization intentions (Hahn and Knoke, 2010). Increased human interventions in ecosystem and unlimited exploitation of resources have resulted in more destructions (Lachapelle *et al*., 2003) and environmental crises (Giljum *et al*., 2011) so

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much so that some experts hold that the sixth great extinction is about to occur (Steffen *et al*., 2004).

A fundamental determinant of key ecosystem processes is the status of woody plants in dry-land systems. It is important to monitor this status in order to understand the dynamics of woody plants in arid and semi-arid ecosystems (Karkon *et al*., 2017). For several hundred years, human beings have been the main driving force for the transformation of the Earth's surface (Vitousek *et al*., 1997). People have had a significant part in landscape changes. Transformations have occurred to meet the needs of society and its individual units. Today, we can only observe the effects of many historical changes in the landscape. Over the last few decades, these changes have intensified due to strong socio-economic changes in agriculture, industry, or transport (Antrop, 2004). Changes in forest landscapes have been connected with human activity for centuries and can be considered as one of the main driving forces of change from a global perspective. The spatial distribution of forests changes along with the geopolitical situation, demographic changes, intensification of agriculture, urbanization, or changes in land use policy (Krajewski *et al., 2018*). Therefore, it seems necessary to utilize natural resources wisely (Rezaie-Moghadam and Karami, 2008; Vaccaro and Norman, 2008). In this regard, the point neglected by many exploiters is unsustainable exploitation; even if forest resources are employed to provide fossil fuels, plantation and harvesting must be employed in a sustainable manner (Stupak *et al*., 2011). Today, unsustainable exploitation and destruction of forest resources are global issues (Velaiati and Kadivar, 2006). Over the past decade, approximately 146 million ha, as much as 36% of the destruction rate, has been regenerated (Heidarpur *et al*., 2008). The total area of Iranian forests is 14.2 million ha, covering 8.6 percent of the total area in the country with a forest per capita of 0.19 ha based on the population. This value is low compared with the global forest per capita of 0.8 ha, indicating the severe paucity and lack of forests in the country, such that Iran ranks 45 among the 56 countries owning forests (Karami *et al*., 2009).

1.1. Sustainable management of forest resources (SMFR)

For long, forest sustainable management for wood production has been one of the most controversial and, at times, divisive issues regarding natural resources (Yaffee, 1994; Puettamann *et al*., 2008), with many disagreements being over the diverse impacts of cutting trees on other forest values as well as protecting bio-diversity (Lindomayer and Franklin, 2012; Gibson *et al*., 2011). Forest sustainable management denotes the production, exploitation, and distribution of products as well as performing practices and organizational or institutional arrangements (social dimension). During these three steps carried out by exploiters, technical and social aspects associated with forest management are regarded as part of a united system (Pei *et al*., 2009). The technical dimension of forest management includes actions such as harvesting, distribution, protection, reforestation, and continuous forest regeneration (Tamang, 1990). Concerning the social dimension, the local knowledge of native people is counted as the main element of forest management system in developed countries. Not only is this knowledge a valuable asset for the future culture of local communities, but it also aids scientists and plan makers in ameliorating the livelihood of local people (Piet *et al*., 2009). Nowadays, due to problems associated with deforestation, as mentioned above, forest management is developing beyond economic production and social issues so much so that the topic of forest sustainable management has been introduced and discussed in international societies for the past two decades. Similar to the development concept, there exist a variety of interpretations and definitions in regard to forest sustainable management in different countries, regions, and even local communities (Angelstam *et al*., 2005; Kenedy *et al*., 2001). However, many experts attribute its concept to the sustainable development theory which was formally accepted worldwide in the late 1980; in summary, forest sustainable management helps balance wood sustainability and other services provided on one hand, and contributes to the well-being of forest environment on the other (Cerutti *et al.,* 2006; Dennis *et al*., 2008). In practice, forest sustainable management exerts environmental procedures, helping maintain the health and integration, fertility, flexibility, and bio-diversity of forested ecosystems (Kotwal *et al.,* 2008). However, forest management is not simply capable of satisfying all exploiting groups, sustainability supporters, forest organizations, and institutions. In this regard, we need to follow a dynamic and sustainable planning and management which concentrates on production, preserving the environment, and reforestation (Carvalho-Riberio *et al*., 2010). Attaining forest sustainable development is tied to realizing five critical pre-requisites:

-Existence of forest resources
- Continuing the production flow
- Considering economic and social factors and implications
- Provision of appropriate institutional structures (Tajbar *et al.*, 2008).

Iran's forests are divided into five categories with regard to their vegetation areas:
1- Hirkani area (Caspian) forming the green belt in the north of the country
2- Iran and Turan area distributed mainly in the centre of the country
3- Zagros area which mainly constitutes oak forests in the west of Iran
4- Arsbani area which embodies rare and unique spices (Hasanzad Navardi, 2015). In different areas of Iran, forestry is traditionally performed in the form of a variety of activities compatible with nature in order to meet human society's needs such as provision of human food, livestock food, medical materials, and fuel, soil conservation, sand dune stabilization, preservation of genetic materials and shelter for wildlife, and landscapes. These needs are accounted for through incorporating forestry, agronomy, pasture, and exploitation with regard to the capacity of the vegetation area and maintaining sustainable production along with income enhancement (Kuch, 2016). Deforestation in Iran is caused by the local people's heavy reliance on forests due to their low income which is the most obvious challenge (Imani Rastabi *et al*., 2014). Other such factors as utility change, fuel provision, general destitution of local people, and lack of social and economic development threaten these forests more than ever (Zendebasiri and Parvin, 2016). Therefore, it is, without a doubt, necessary to develop sustainable strategies for Iran's forests (Afrough *et al*., 2018).

1.2. Literature Review

Researchers established long ago that if people fully understood forest advantages in short-term and long-term, they would attempt to conserve it (Ranjit, 2016). A study conducted in India revealed that families' tendency to pay a monthly deposit for forest conservation might be an integral factor for achieving sustainable exploitation (Jane *et al*., 2014). Another research showed that human and economic factors are were the most effective in stockholders' participation in forest management (Salehpour *et al*., 2018). A study on effective factors in local Iranian community's participation in forest management suggested that economic factor is more important than social and infrastructure factors (Afrough *et al*., 2018). Another research on local community's management in natural resources indicated that social, economic, institutional, and structural factors are significantly associated with local community's participation in forest sustainable management (Aligholizadeh firouzjaei *et al*., 2016). Research suggests that demographic features such as population size (Agrawal and Gibson 1999; Vaccaro and Norman, 2008; Timah *et al*., 2008; Giljum *et al*., 2011) and spatial distribution of population (Vaccaro and Norman, 2008) are factors affecting the destruction of natural resources. There was a significantly positive relationship between the attitude and age of exploiters and forest sustainable exploitation. Moreover, the five managerial-observatory, economic, motivational-encouragement, training-informative, and attitude-cultural factors affected forest sustainable exploitation in Zagros areas (Mirakzadeh *et al*., 2011). Furthermore, three variables of political-legal, membership in corporations, and exploitation type were effective variables regarding exploiters' participation in the development process of Hara forests in southern Iran (Asadi, 2005). Rural facilities, training courses, exploiters' economic situation, and employment further influenced the participation of animal farmers in sustainable exploitation of forests (Shahidizand, 1997). The conclusion reached after evaluating the forest sustainability of Lorestan region was that to prevent deforestation in forest management, applying local knowledge and using local traditions are the best means to maintaining forest sustainable conservation (Adeli, 2009). A study on 263 forested farms throughout Ireland suggested that economic motivations, lifestyle, and multi-purpose advantages of the forests significantly affected forest exploitation by farmers. Other variables such as age of forest-resident farmers, land quality, plantation system, and employment outside the forest were also significant (Rasethe *et al*., 2013). Another investigation showed that variables of age, farming work record, and animal husbandry record were negatively related to sustainable exploitation while income, education, participation rate in agricultural and husbandry practices, days number of attending the forest and attitude towards and knowledge of the forest had a significantly positive association (Rahimian *et al*., 2016). In addition, Mc Gregor (2011) reported that governments played could increase local individuals' participation in forest sustainable management as well as create psychological positive effects. Araiesh and Hoseini (2010) evaluated the effective factors

concerning participation in conservation, regeneration, development and exploitation of renewable natural resources. They found a relationship between the legal-political and cultural-social variables, abilities of natural resources propagators, structure and planning of extension facilities, psychological and economic variables and variables of people's participation.
In this regard, the general purpose of this paper was to examine effective factors in terms of forest resources sustainable management among exploiters in Faryab County located in southern Kerman Province. Sustainable management was considered in economic, social, and environmental dimensions with effective factors being personal, economic, social-cultural, psychological-educational and political-legal (Figure 1). Therefore, the most important research objectives were:

- Evaluation of the professional and personal characteristics of the exploiters under study
- Search for destruction causes among local communities
- Examination of the sustainable management conditions among local communities
- Investigation of the impact of study independent variables on SMFR
- Strategic practices for SMFR in Mehruyeh Village of Faryab County

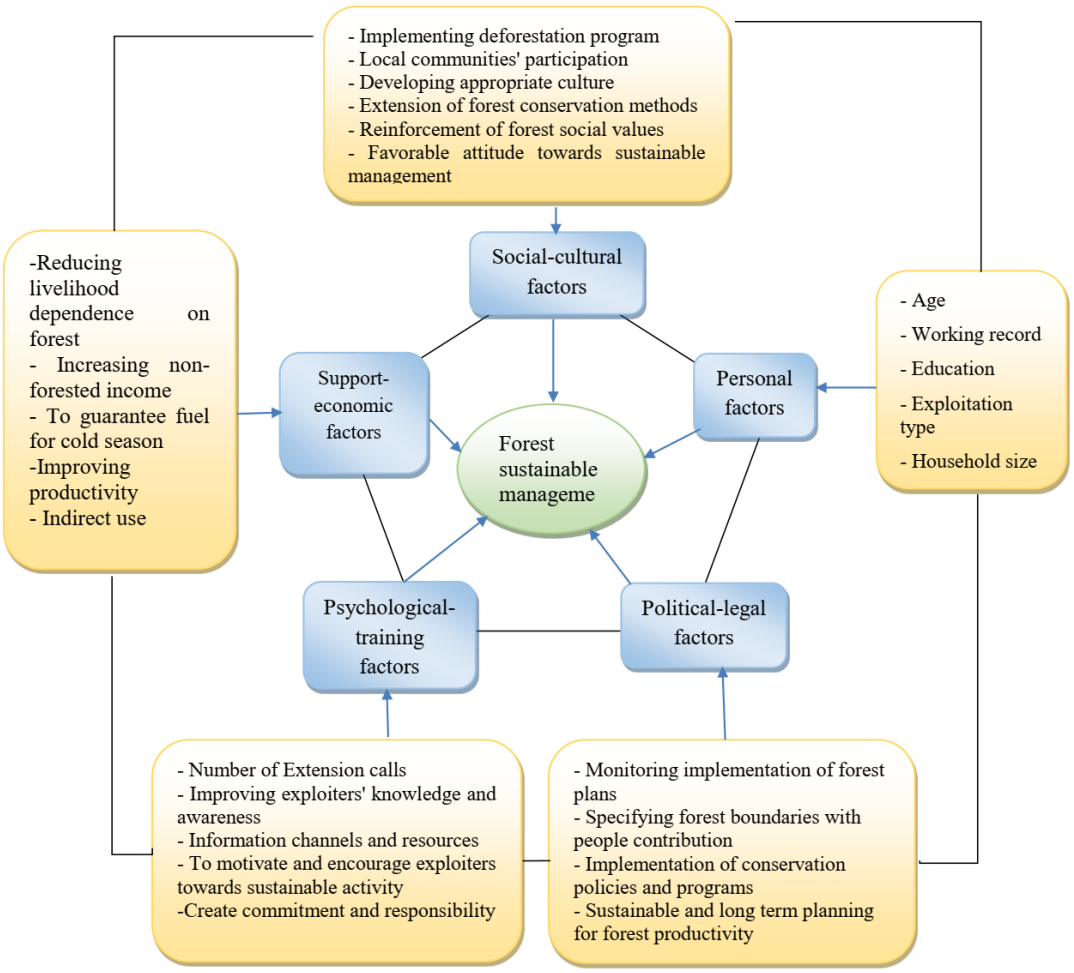

Fig. 1. Conceptual model of effective factors on forest resources management

2. Materials and Methods

2.1. study area

Given that a considerable part of natural resources in Faryab county are forested lands, the focus of the study was on forested resources located in Mehruyeh village. Therefore, the statistical population included all exploiters of Mehruyeh village who utilized forested resources (N=7000). The sample size (173 individuals) was obtained using Cochran's sampling technique and based on simple randomized sampling method.

$$n = \frac{N(t.s)^2}{Nd^2 + (t.s)^2} = \frac{7000(1.96.1/35)^2}{7000.0/2^2 + (1.96.1/35)^2} = 173$$

Mehruyeh Forest with an area of 5.400 hectares is located 24 Km from Faryab County, 45 km from Kahnouj County, and 100 Km southwest of Jiroft city in Kerman province. The main reason for protecting this shelter is to preserve the remains of tropical forests. Mehruyeh has a warm dry desert climate. The northern and western parts of the region include desert lands while other parts are covered with tropical forests and rangelands. Mehruyeh Wildlife Refuge, like other parts of the southern province of Kerman, particularly Kahnouj, has a tropical climate with an average rainfall of 148 mm and no rivers. This area is a rare and protected bird habitat in Jiroft.

The "Kalmorad" mountain, home to the Black Asian Bear, is one of the highlands close to the area. This shelter is covered with prosodies cineraria trees. It is actually the last remaining prosopis cineraria fores in the southeastern part of Iran. Owing to its particular climatic conditions, it is considered as one of the rare natural ecosystems. In addition to the Prosopis Cineraria of the plants such as Prosopis Farcta, Zizipus Spina, Zygophyllum and Calligonum are present in this area. Local communities' inattention to the natural values of the region and its ecological significance has led people to occupy, start planting in parts of these forests, and allocate parts of these natural shelters to agriculture (Figure 2).

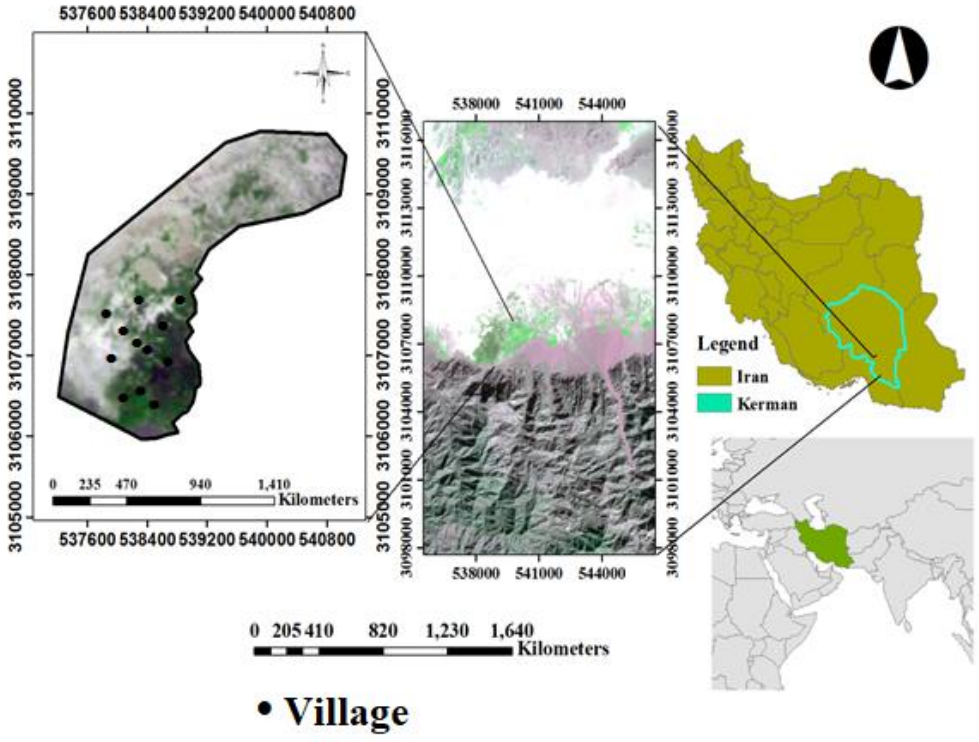

Fig. 2. Study area

2.2. Study design

The main instrument of the study was a researcher-made pre-tested questionnaire with three parts: (i) professional and personal characteristics of the rural head of the household, and (ii) 18 items for assessing the sustainable management of forest resources. As mentioned earlier, this concept stems from the context of substantial development. This sector comprises three components: the first one is economic substantial management which refers to the indirect exploitation of the forest and the reduced dependence of local community's livelihood on the forest; therefore, forest exploitation has to meet the needs of the current generation without lowering the next generations' capability to meet theirs. The second component is social exploitation, including planning, supervision, implementation, and evaluation of practices and activities which require the participation of governmental and non-governmental sectors to exploit, conserve, and revive the forest. Finally, environmental exploitation implies resources

conservation and protecting forest resources against humans' destructive operations such as utility change and conflagration to name a few (Perkins, 2010; Zandebasiri and Parvin, 2012; Yaghoubi Farani *et al*., 2016). Each of the foregoing three components was assessed using six items by Likert scale (1=very low to 5=very high). (iii) The third part of the questionnaire included 15 items evaluating the strategic practices of the substantial management of forest resources. These practices were investigated in short-term, mid-term, and long-term levels based on a Likert scale (1=very low to 5=very high).

To confirm the validity of the study instrument, an expert panel was created consisting of the faculty members of Agriculture and Natural Resources Universities of Khuzestan and Tehran. In addition, construct validity and index calculation (AVE) were adopted. To examine the reliability of the questionnaire, alpha coefficient test and composite reliability were used, both of which were proven to have an acceptable rate (Table 1). $SPSS_{win18}$ and Lisrel 8.54 were employed to perform data analysis in either descriptive or inferential sectors. Finally, to classify and group the rural households under study based on sustainable management level of forest resources, we utilized the difference of standard deviation from average (ISDM) as follows: (Gangadharappa *et al.*, 2007).

Low: A<Mean- $\frac{1}{2}$Sd

Medium: Mean- $\frac{1}{2}$Sd<B<Mean+ $\frac{1}{2}$

High: C>Mean+ $\frac{1}{2}$Sd

It should be noted that in the above formula, A, B, and C indicate levels in which sustainable management of forest resources are applied, with A being low, B representing medium, and C showing a high level. The mean in the formula also indicates ordinary mean or arithmetic mean (sometimes called average) obtained all the added values were divided by their number. Furthermore, Sd, considered as one of the dispersion indicators, implies how data are spread on a set of values, specifying their distance from the mean value. A high Sd for a set of data close to zero indicates that they are close to the mean with low dispersion while a low Sd denotes a substantial data dispersion.

Coefficient of variation was used to prioritize the questionnaire items. It is a normed criterion used for measuring the distribution of statistical data calculated as Sd divided by the mean as follows:

$$CV = \frac{\mathrm{Sd}}{\mu}$$

In other words, it demonstrates the dispersion rate per unit of the mean provided the mean is not zero (Tables 2 and 3).

To compare the questionnaires' classes (groups), mean comparison of Kruskal-Wallis was adopted. It is a non-parametric statistical test corresponding to F test, used when groups numbers are higher than 2. The measuring scale in this method must at least be ordinal. The test is calculated as below:

$$H = \frac{\mathrm{SSbr}}{\mathrm{N}(\mathrm{N}+1)/12}$$

In the above, SSbr represents the sum of ranking squares among groups, N refers to the number of total ranks or amounts in the groups under assessment, and H shows the value of Kruskal-Wallis test calculated for each ranking mean class. Differences are meaningful if the significance level is lower than 0.01 or 0.05. The class status can be determined according to the ranking mean (Table 4).

$SPSS_{win18}$ and $Lisrel_{8.54}$ were employed for data analysis in both descriptive and inferential sectors. In so doing, frequency, percentage, mean, and standard deviation were used in the descriptive statistics while mean comparisons, correlation coefficient, regression analysis, and confirmatory factor analysis were adopted for inferential statistics.

Table 1. Calculating Chronbach's alpha

Factor	Item number	Chronbach's alpha
Short term strategic practices	5	0.80
Mid-term strategic practices	5	0.83
Long term strategic practices	5	0.82
Economic sustainable management	6	0.87
Social sustainable management	6	0.82
Environmental sustainable management	6	0.87
Support-economic	5	0.80
Psychological-training	6	0.78
Political-legal	5	0.77
Social-cultural	6	0.79

3. Results

3.1. Evaluation of the professional and personal characteristics of the exploiters under study

Based on the results, the average age of the studied exploiters was 50.20 years with Sd 13.96. The youngest and the oldest participants were 18 and 88 years old and most of them aged between 45 and 60 years. The mean of working record in the forest was 24.25 with Sd 15.04, and the employment record was 15 to 25 years. Furthermore, the mean household number was 6.46 with 1.822 Sd people, with most of the studied households including three to five people. Figure 3 presents other characteristics of the people under study.

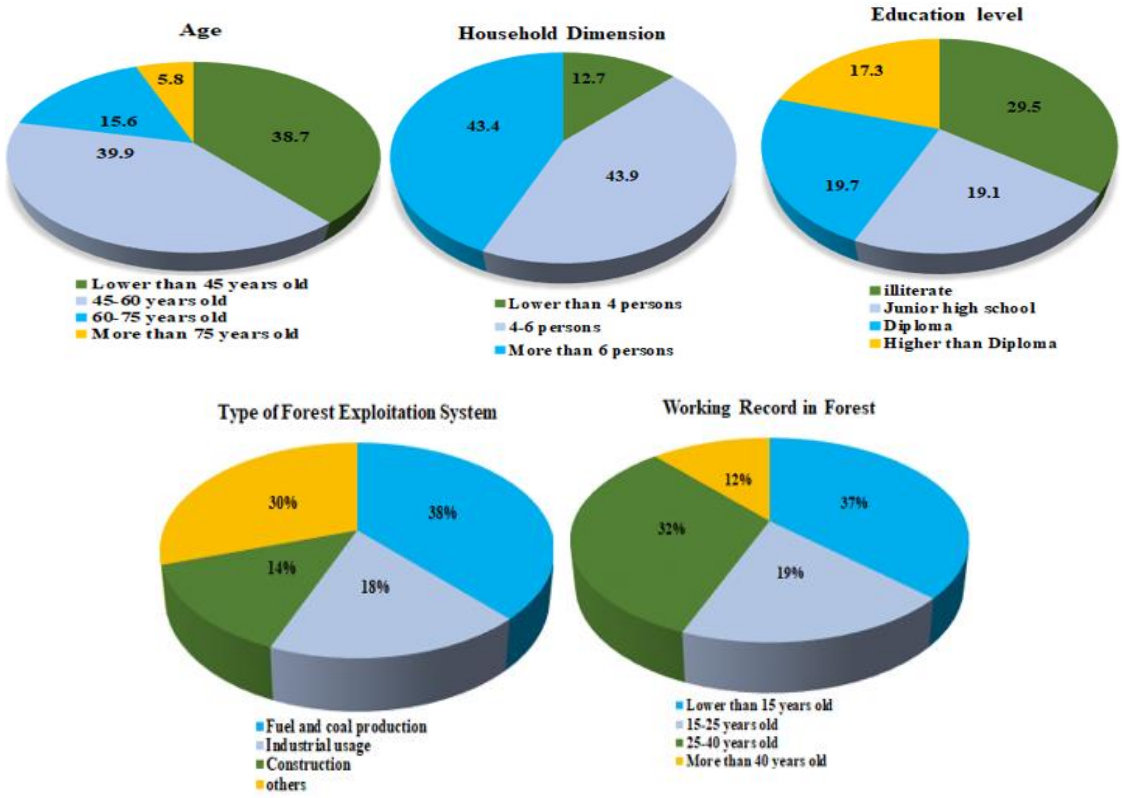

Fig. 3. Frequency distribution of personal characteristics of exploiters under study

3.2. Exploring the destruction causes among local communities

As stated in the research methodology, in order to prioritize the causes of forest destruction among local communities, the variance coefficient statistic was adopted. Table 2 indicates the most important causes in this region: overgrazing and deforestation to convert forested areas into agricultural land.

Table 2. Destruction causes among communities under study

Items	Mean	Sd	CV	Priority
Livestock overgrazing	2.42	0.971	0.401	1
Deforestation to create agricultural land	2.99	1.201	0.401	1
Natural calamities such as drought	2.86	1.214	0.424	3
Destroying forest for construction	2.42	1.057	0.436	4
Event made by humans	2.97	1.305	0.439	5
Changing forest utility to other ones	2.68	1.214	0.454	6
Harvesting by factories for industrial purposes	2.71	1.266	0.467	7
Soil erosion	2.44	1.142	0.468	8

3.3. Examination of sustainable management condition among local communities

Variance coefficient statistic was further utilized to prioritize sustainable management in economic, social, and environmental dimensions. Results revealed that «developing indirect activities related to forest utilization such as tourism» in economic dimension, «attracting public participation and developing private

organizations active in forest protection» in social dimension, and «safe-guarding forest bio-diversity and water resources» in environment dimension had higher prioritizations (Table 3).

Table 3. Examining sustainable management situation among local communities

Dimensions	Items	Mean	Sd	CV	Priority
Economic sustainable management	Development of indirect exploitation activities of forest such as tourism	2.28	1.04	0.456	1
	Financial support of special types or valuable spices	2.23	1.231	0.552	2
	Supervision of employment activities in forests with a conservative approach	2.26	1.283	0.567	3
	Developing forest by-products rather than forest direct harvesting	2.13	1.323	0.578	4
	Reducing annual harvest of forest productions	2.28	1.362	0.597	5
	Utilizing other fuels instead of wood	2.37	1.447	0.610	6
Social sustainable management	Attraction of people's contributions and developing active non-governmental organizations in forest conservation	2.08	1.373	0.660	1
	Maintaining regions with recreational value	2.13	1.441	0.675	2
	Regenerating destroyed forests	2.14	1.445	0.675	3
	Extension and instructing how to appropriately exploit and conserve forest	2.20	1.494	0.679	4
	Expanding cultural and protective behavior in sustainable protection of forest	2.25	1.556	0.691	5
	Cooperation to implement regulations, instructions and protective executive policies	2.01	1.435	0.713	6
Environmental sustainable management	Safeguarding bio-diversity and forest water resource	2.21	1.480	0.669	1
	Protecting forest appearance	2.09	1.411	0.675	2
	Preventing fires and throwing garbage in the forest	2.09	1.438	0.688	3
	Keeping balance between livestock and forest	2.09	1.452	0.694	4
	Attempt for preventing construction projects in forests	2.08	1.456	0.700	5
	Plantation on natural resources week	2.08	1.490	0.716	6

As stated in the research procedure, to group the sustainable management levels, ISDM criterion was applied. The related results are shown in Figure 4.

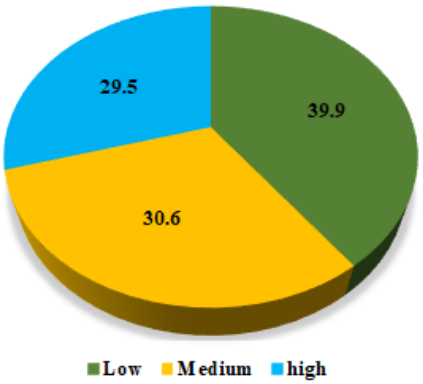

Fig. 4. Grouping management levels of sustainable forest resources

According to Figure 4, as 122 people (70.50%) followed sustainable management forest resources at a low and medium levels while merely 37 individuals (29.5%) adopted it at a high level; it could be concluded that the sustainable management of forest resources is not properly carried out among exploiters under study. Therefore, it is necessary to examine effective factors in SMFR.

Kruskal-Wallis test was applied to compare SMFR based on the variables of age, working record, household dimension, education, and the type of exploitation system (Table 4). As mentioned in the research methodology, H represents the amount of the test, Sig implies the significance or non-significance of the difference among classes, and the ranking mean is applied to rank the classes.

As shown in Table 4, there is a significant difference between SMFR and variables of age, forest working record, education level, and the type of forest exploitation system. This means that those with lower age and working record, but higher education who utilized the forest for recreation and tourism, more effectively applied SMFR; however, no statistically significant difference was observed for SMFR based on household dimension.

Table 4. SMFR analysis according to exploiters personal features

Dependent variable	Independent variable	levels	Number	Ranking Mean	H	sig
Sustainable management of forest resources	age	Lower than 45 years old	67	116.68	43.774	0.000
		45-60 years old	69	76.40		
		60-75 years old	27	57.40		
		More than 75 years old	10	51.41		
	Working record	Lower than 15 years old	64	124.62	61.496	0.000
		15-25 years old	33	75.03		
		25-40 years old	56	65.64		
		More than 40 years old	20	46.18		
	Household dimension	Lower than 4 persons	22	121.00	29.275	0.000
		4-6 persons	76	99.05		
		More than 6 persons	75	64.81		
	Education level	illiterate	51	52.29	79.896	0.000
		elementary	33	63.88		
		Junior high school	34	90.19		
		Diploma	30	116.52		
		Higher than Diploma	25	148.56		
	The type of forest exploitation system	Fuel and coal production	66	70.67	52.814	0.000
		Industrial usage	31	72.92		
		Construction	24	85.09		
		others	52	154.23		

Subsequently, Pearson correlation coefficient was employed to examine the relationship between other study variables and sustainable forest management levels among the exploiters, (Table 5). In this table, r indicates the correlation between independent and dependent variables and Sig shows the significance levels for r values which always range between 1 and 0. Therefore, the closer they are to 1, the stronger the correlation will be.

Table 5 shows that a significant positive relationship existed between political-legal, psychological-training, cultural-social, and economic-support factors and sustainable forest management level.

Table 5. Correlation between the study variables and SMFR

Variable	SMFR	
	r	Sig
Political-legal factors	0.780	0.000
Psychological-training factors	0.846	0.000
Cultural-social factors	0.806	0.000
Economic-support factors	0.571	0.000

3.4. Investigation of the impact of study independent variables on SMFR

Simultaneous-entry multiple regression analysis was used to examine the impact of the independent variables on SMFR. It is a method in which all independent variables are simultaneously entered in the analysis and their impact on dependent variables is evaluated (Kakantari, 2010). In our study, all variables having a significant relationship with sustainable management as well as nominal variables (after removing the scale difference and forming a combination index) were entered as predictor variables, and sustainable management was applied to regression as criterion variable. Tables 6 and 7 contain relevant results. Of note, R in these tables shows multiple correlation between independent and dependent variables, which is always between 1 and 0; thus, the closer it is to 1, the stronger the correlation will be. R square indicates the specified variance amount of the dependent variable by independent variables. It is different from the adjusted R square since R ignores the degree of freedom where the lower the dependent variable is, the closer the two parameters will be. Furthermore, the statistical F implies the significance and fit of the regression as well as the linear relationship among variables, and Sig denotes the significance level. According to Table 6, the value of multiple correlation coefficient (R) among personal (after removing the scale difference and forming a combination index), political, legal, cognitional-educational, cultural-social and economic support factors equaled 0.888. This indicates a relatively strong correlation between independent variables and SMFR. The obtained coefficient of determination (R) was 0.789, meaning 78.9% of the variance of dependent variable (SMFR) is predictable by independent variables (namely personal, political-legal, cognitional-educational, cultural-social and economic-support factors). It is a medium and considerable amount and the remaining variance

(21.1%) is related to other factors and variables applied to the analysis

Table 6. Estimation of regression model fitness using ANOVA

Variance resources	Total squares	df	Squares mean	F	Sig
Regression	52142.558	5	10428.512		
Residual	13967.442	167	83.637	12.687	0.000
Total	66110	172			

R: 0.888 R Square: 0.789 Adjusted R Square: 0.782

According to Table 6, linear regression model as a simultaneous-entry method of independent variables was able to determine variance changes related to SMFR; in this regard, the obtained F-value (12.687) was significant at 1% level. As already mentioned, personal, political-legal, cognitional-educational, cultural-social, and economic-support factors accounted for 78.9% of the variance changes. Additionally, the results of Table 7 indicated regression meaningfulness as well as linear relationships among the variables; the statistic F confirmed regression meaningfulness at 1% level.

Table 7. The impact rate of independent variables on sustainable management of forest resources

Predictor variables	B	Std. Error	Beta	t	Sig
Fixed coefficient	-8.159	5.262	-	-1.550	0.123
Political-legal factors	1.195	0.284	0.273	4.123	0.000
Psychological-training factors	1.074	0.266	0.322	4.042	0.000
Social-cultural factors	0.904	0.185	0.277	4.897	0.000
Economic-support factors	0.594	0.268	0.098	2.217	0.028
Personal factors	0.680	0.125	0.048	-1.131	0.045

In the above table, B constitutes the prediction coefficient in the regression equation, Beta shows the role and importance of independent variables in prediction regression equation, t denotes the significance of the effect of independent variables on the dependent ones, and Sig implies the significance level.

Given the aforementioned explanations and the results shown in Table 7, the linear regression equation is:

$$Y= -8.159+ 0.904_{x1}+ 1.704_{x2}+ 1.195_{x3}+ 0.594_{x4}+ 0.680_{x5}$$

Where Y: SMFR, X1: political-legal factors, X2: Psychological-training factors, X3: cultural-social factors, X4: economic-support factor, and X5: personal factors.

As observed in Table 10, the t-value of each regression coefficient was meaningful at 1% level. This implies that independent variables had a strong impact regarding the prediction of SMFR in the southern parts of Jiroft city. The fact that F-test and t-test are significant denotes the meaningfulness of the regression equation. However, the regression equation indicated nothing as to the relative importance of independent variables. Therefore, beta value must be noted because it shows the impact of each independent variable on dependent variable, separately from the impact of others. Accordingly, it could be stated that among independent variables, psychological-training factors with a beta value of 0.322 had a higher share in predicting the dependent variables (SMFR) compared to other variables. This can be attributed to the fact that a unit change in standard deviation resulted in a change as much as 0.322 in the standard deviation of the dependent variable (SMFR). Other independent factors effective on dependent variables were social-cultural, political-legal, economic-support, and personal factors with beta values of 0.277, 0.273, 0.098, and 0.048, respectively.

4.4. Strategic practices for SMFR in Mehruyeh Village of Faryab County

In the following section, the strategic practices of local communities in the context of SMFR will be addressed. First, dispersion indicators and their prioritization were examined. Based on the results, the most important short-term practice was «creating balance between livestock and forest through the animal husbandry sector»; concerning mid-term practices, «submitting a greater share of responsibilities and forest protection to people» was the most important. Finally, in the long term, «provision and legislation of a comprehensive set of rules to promote forest protection and development» was the most significant practice. The symbols of indicators are further presented in the model (Table 8).

Table 8. Evaluation of strategic practices of sustainable management of forest resources

dimensions	markers	Symbol in the model	Mean	Sd	CV	Priority
Short term actions	Making balance between livestock and forest through animal husbandry sector	STA1	3.88	0.685	0.176	1
	Reduction in the forest wood harvesting and establishment of fire departments with proper distribution	STA2	3.90	0.702	0..180	2
	Giving subsidies to procure part of fuel cost	STA3	4.02	0.763	0.189	3
	Introducing other substitutions of livelihood	STA4	3.98	0.784	0.196	4
	Reinforcement of rangers to thoroughly protect and control forests	STA5	3.80	0.755	0.198	5
Medium-term actions	Assigning most of responsibilities and forest conservation to people	MTA1	3.82	0.687	0.179	1
	Providing cultural contexts and extending public training	MTA2	3.88	0.784	0.202	2
	Implementation of forestry plan in economic non-dry farming lands	MTA3	3.87	0.842	0.217	3
	Exploring regional characteristics to find proper spices	MTA4	3.24	0.754	0.232	4
	Designing forestry cultural websites and equipping rangers with conservation methods	MTA5	3.30	0.777	0.235	5
Long term actions	Legislation of new and comprehensive rules as a support and backing for forest protection and development	LTA1	3.91	0.683	0.174	1
	Manufacturing industrial wood in agricultural lands	LTA2	3.47	0.657	0.189	2
	Continuous and true monitoring on implementation of Protected plans	LTA3	3.21	0.688	0.214	3
	Extending exploiters' cooperatives and assigning long term planning and protection in the forest	LTA4	3.50	0.753	0.215	4
	Presenting forest conservation plans based on extensive research results	LTA5	3.47	0.777	0.223	5

The strategic practices of SMFR and their indicators and dimensions are clear; therefore, extracted equation modeling is used in this section to model validation because there is a predetermined theory in this section that has to be tested for the correctness of the model. Thus, model fitness was assessed using statistics and fitness indicators. In addition, the results of factor loading, t, and R^2 indicated the appropriate precision of the applied markers to assess strategic practices (short-term, mid-term and long-term) (Table 9).

Table 9. Investigating the markers validity of strategic practices indexes

Dimension	Symbol in model	Factor loading	t	R^2
Short term actions	STA1	0.73	-	0.53
	STA2	0.71	13.89	0.50
	STA3	0.75	14.69	0.56
	STA4	0.70	13.75	0.49
	STA5	0.64	12.83	0.41
Mid-term actions	MTA1	0.70	-	0.49
	MTA2	0.94	19.52	0.88
	MTA3	0.91	18.96	0.83
	MTA4	0.77	16.07	0.59
	MTA5	0.50	10.97	0.25
Long term actions	LTA1	0.70	-	0.49
	LTA2	0.77	12.53	0.59
	LTA3	0.56	11.10	0.32
	LTA4	0.65	12.56	0.42
	LTA5	0.86	11.76	0.74

In this table, factor loading signifies the strength of relationship between the factor (latent variable) and visible variable, ranging between 0 and 1. If lower than 0.3, the relationship is considered as weak, hence ignored. A factor loading amount between 0.30 and 0.6 is acceptable, and if higher than 0.6, it is highly desirable. In fact, R^2, the signified variance, shows how the variation percentage of the dependent variable is signified by independent variables. Moreover, t value denotes the significance level. Values higher than 1.96 indicate significance at 5% level while those higher than 2.54 indicate significance at 1%

level. In this table, standard coefficient represents the same factor loading which shows how the variable and factor loading are related; S.E indicates the standard error rate and t and R^2 show the importance of independent variables in assessment on strategies; t values higher than 1.96 imply a high accuracy in selecting the questionnaires items; furthermore, R^2 values (showing the variation variance amount) closer to 1 indicate a higher accuracy.

Latent variable of strategic practices for SMFR is composed of three dimensions, namely short-term, mid-term, and long-term, each comprising five markers; generally, the latent variable of SMFR was entered in factor analysis with 13 markers and three dimensions. Table 10 reports standardized factor loading values pertaining to sustainable management indicators and their meaningfulness in regard to t-value in the second order confirmatory factor analysis.

In this table, α and CR develop the reliability of study tool and show the accuracy of questionnaire items in assessing different factors of the study. With α values higher than 0.7, CR values above 0.6 were acceptable under this condition, AVE is applied to examine the credibility and quality of the measuring tool, the questionnaire which if higher than 0.5, is acceptable.

Table 10. Values of the factor load are standardized and the level is significant SMFR

Construct	Index	Standard Coefficient	S.E	t	R^2	α	CR	AVE
Practices	Short term	0.82	0.06	13.98	0.67	0.80	0.83	0.51
	Mid-term	0.99	0.07	16.17	0.98	0.83	0.88	0.61
	Long term	0.70	0.06	13.94	0.49	0.82	0.87	0.58

As seen in Table 10, all markers (indicators) owned a t-value higher than 1.96. Furthermore,α, Composite Reliability (CR) and Average Variance Extracted (AVE) proved to have acceptable amounts for the impacts construct. Therefore, it could be claimed that with their validity and reliability confirmed, all the indicators selected for the assessment of the strategic practices of SMFR showed a suitable and sufficient precision. Figure 5 shows the standardized model for the strategic practices of SMFR .

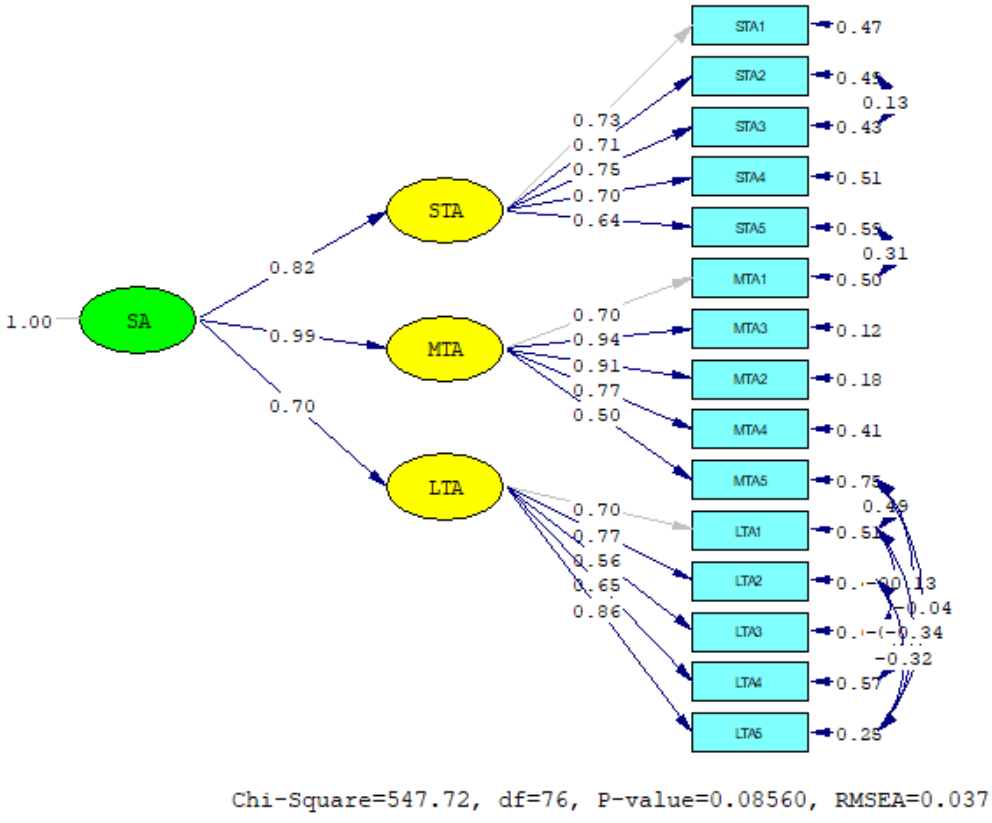

Fig. 5. Standard Model Strategic Action SMFR

There exist different fitness indicators for the assessment of confirmatory factor analysis. In this study, to assess the fitness of the measurement model of strategic practices for SMFR, we considered indicators such as Chi-square with freedom degree (X^2-df), confirmatory factor analysis, root mean square error of approximation (RMSEA), and RMR index. Both the criteria value (suitable limit) and the value reported for each of the above mentioned indices related to the measurement model of the SMFR strategic practices are pre-entered in Table 11.

Table 11. Fit indexes of measurement model of strategic practices

index	criterion	Reported value
X^2/df	3 and below	2.48
PMR	Below 0.05	0.047
GFI	0.9 and above	0.91
AGFI	0.9 and above	0.90
NFI	0.9 and above	0.96
NNFI	0.9 and above	0.98
IFI	0.9 and above	0.98
CFI	0.9 and above	0.98
RMSEA	Below 0.08	0.059

Resource: Kalantari (2010)

According to Table 11, the confirmatory model of the SMFR strategic practices showed an acceptable and satisfactory fitness. Thus, it could be asserted that the study data presented a favorable fit with factor structure and the theoretical foundation of this research, corroborating the consistency of the markers (indexes) with the theoretical construct of the SMFR strategic practices. Therefore, in future research, items might be utilized to assess the strategic practices of SMFR among the exploiters of Mehruyeh village as depicted in Figure 6 with meaningfulness status.

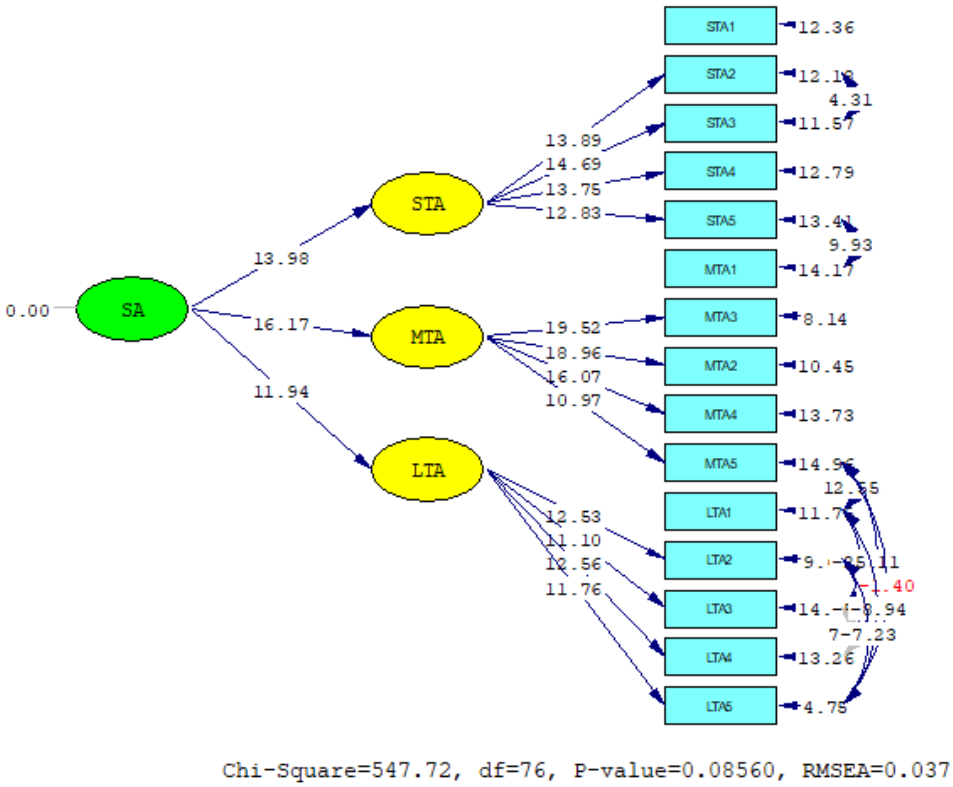

Fig. 6. Model Strategic Action SMFR in meaningful state

5. Conclusions

The objective of this study was to examine the SMFR effective factors in Mehruyeh Village of Faryab County in Kerman County. The results identified overgrazing and deforestation as the most important causes of destruction in Mehruyeh village. Furthermore, the studied

exploiters did not appropriately follow sustainable management operations since approximately 80% adopted SMFR at a low rate. This necessitates identifying the factors enabling us to improve sustainable management operations. Our findings indicated a significant difference between SMFR and variables of age, forest working record, education level, and the type of forest exploitation system. In this regard, lower age and working record, higher education, and utilization of forest for recreation and tourism, indicated a more efficient use of SMFR; however, no significant difference was observed for SMFR based on household dimension. In addition, the results obtained from correlation analysis showed that political-legal, cognitional-educational, social-cultural, and economic-support factors had a significantly positive association with forest sustainable management. These findings well comparable with many other studies (Rasethe *et al*., 2013, Grawal and Gibson, 1999; Vaccaro and Norman, 2008; Timah *et al*., 2008; Girjum *et al*., 2011; Mirakzadeh *et al*., 2011; Arajesh and Hoseini 2010; Rahimian *et al*., 2016). According to the regression analysis, independent variables, namely personal, legal-political, cognitional-educational, social-cultural, and economic support factors had a significant and positive impact on SMFR, accounting for 92.7% of the variance changes in terms of SMFR. These results are also consistent with other studies (Mc Gregor, 2011; Rasethe *et al*., 2013; Shahidizand, 1997; Mirakzadeh *et al.*, 2011; Araiesh and Hoseini, 2010; Rahimian *et al*., 2016). Our research further determined the strategies for SMFR; based on the results, the most important measure in short-term practices was «creating balance between livestock and forest through animal husbandry sector»; as far as mid-term practices are concerned, «submitting a greater share of responsibilities and forest protection to people» was the most optimal action. Ultimately, in the long term, «provision and legislation of a comprehensive set of rules as a supporter for forest protection and development» was the best course of action. All markers belonging to short-term, mid-term, and long-term practices were entered in confirmatory factor analysis; according to the results, assessment items of strategic practices were correctly selected and highly validated. In this regard, the recommendations offered in different parts of the research are as follows:

- Announcing the implications of destroying and the destruction factors to improve exploiters' attitudes (through the cooperation of natural resources and environment department, agricultural sectors, and mass media)
- Declaring regulations and rules related to forests to raise the local communities' knowledge (with the cooperation of natural resources and environment department, judiciary system, agricultural sectors, and mass media)
- Teaching how to prevent forest fires and how to extinguish fire (natural resources and environment department and mass media)
- Teaching how to prevent the pollution of forest water and soil (natural resources and environment department, agricultural sectors, and mass media)
- Issuing crop identification for exploiting units and registering the characteristics of available trees (natural resources department in cooperation with the agricultural sectors)
- Equipping the software center of information base through the use of specialized software (natural resources department in cooperation with agriculture department)
- Inspecting all agricultural activities (cultivation, harvesting) intrusively and immediately to prevent forest destruction (natural resources department in cooperation with agricultural sectors)
- Considering penalties and punishment for exploiters in case of tree-cutting and lack of consistency between the recorded number of trees and the guidelines available in the information base (natural resources department with the cooperation of agricultural sectors and the judiciary system).

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