



# **Factors Promoting and Impeding Diversification of Forestry Resource-based Livelihoods in the Leh Himalaya of Ladakh Union Territory, India**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Livelihood diversification through strengthening forestry resource-based interventions is an effective strategy for poverty alleviation and socioeconomic upliftment for downtrodden people. The study investigated the promoting and impeding factors that are crucial for the diversification of forestry resource-based livelihoods in Leh Himalaya of Ladakh Union Territory. The study is based on personal interviews with the selected 185 respondents through a structured interview schedule and non-participant observations carried out in the 9 sample villages of 5 blocks using a multi-stage random sampling technique. Descriptive statistics, including frequency, percentage, average, and simple ranking technique, were used to analyze the data. The findings based on their weighted mean score (WMS) and percentage score (PS) revealed that among the factors promoting the diversification of forestry resource-based livelihoods, forest resource self-sufficiency (WMS-1.98, PS-12.28%) was perceived as the most effective, while utilization of free time (WMS-0.73, PS-4.53%) was considered the least effective. Conversely, the most effective impeding factor for the diversification of forestry resource-based livelihoods considered among the people was labor-intensive and less remunerative livelihoods (WMS-1.96, PS-11.80%), while lack of cold storage facilities (WMS-0.74, PS-4.46%) was opined as the least effective. The insights into the promoting and impeding factors for diversification of forestry-based livelihoods highlighted in the study will be the basis for the planning and implementation of forestry programmes for forestry resource production and livelihood diversification in the Leh district of Ladakh. To make forestry-based livelihoods sustainable and reduce vulnerability, the prominent promoting and impeding factors must be exploited efficiently.

*Keywords: Promoting factors; impeding factors; forestry resources; livelihood diversifications; Leh, Ladakh.*

## 1. INTRODUCTION

The indigenous populations in the Leh area of Ladakh share forestry resources as a common thread in all facets of life, including birth, marriage, livelihood, and death [1]. The district's residents depend heavily on the forestry resources for their survival and progress. Forestry resources are crucial tools for tackling poverty challenges for marginalized rural populations because they support livelihoods such as food security, income, health, and sustainable human development [2]. Forestry resources have multifarious uses, constituting an important source of livelihood among local people in the district, and are the source of revenue, employment, shelter, housing materials, cloth, ornament, fuel, fodder, grazing, timber, food, vegetables, medicines, fertilizer, fibre, floss, oilseed, cottage industries, handicrafts, and other forestry resources, besides playing a vital role in the environmental amelioration in the district [3]. Forestry resources comprised eleven types of plant parts, which were extensively collected from 167 herbs, shrubs, trees, and climbers and consumed under eighteen different use categories [4]. Forestry resources are the 3rd major component of the household economy, contributing overwhelmingly to the gross annual income and employment opportunities, besides acting as a safety net in cases of exigency [4].

The forestry resources play a crucial role in the livelihood security of the local people by sustaining food security, livestock production, agricultural support, bio-energy security, housing, cottage industry, health care, socio-culture, income, and employment [1].

The rural communities in the district are socially, educationally, economically, and politically backward, with accompanying impediments of low literacy, poverty, and malnutrition [5]. They have their own ways of life, traditions, cultural identities, and customary modes of living closely intertwined with nature [6]. Unemployment and underemployment features are inherent in the district, causing low income and a miserable life for the households [7]. The forestry resources are an important contributor to the livelihoods of the local communities in the district [1]. The forestry resources are an imperative part of the traditional life style in Leh district of Ladakh. Traditional and ancient knowledge about the utilization of forestry resources still exists in the Leh district. The forestry resource development integrated with agricultural and industrial progress has great potential to enhance livelihood security, food security, and poverty reduction for vulnerable sections of society, including the illiterate, unskilled, resource-poor, jobless, landless, and labourers in the area [3].

The diversification of forestry resource-based livelihoods is now a prioritized means of poverty alleviation and socio-economic development [4]. As all of the total population of Leh is overwhelmingly dependent on forestry resources for livelihood security, it is inevitably true that no economic breakthrough is possible without the diversification of forestry resource-based livelihoods [8]. Now a day, the forestry resource-based petty enterprises the people start are generally for survival and struggle against poverty, but a little support from the GOs, NGOs, CBOs, and other agencies can set them up beyond the boundary and they can come to the mainstream of the economy. The rural vulnerable groups become empowered due to monetary access from the diversification of forestry resource-based livelihoods, get control over their resources, and gain respect in society as human beings [8]. However, diversification of forestry resource-based livelihoods depends mainly on some promoting and impeding factors. The potential impacts of promoting and impeding factors in the diversification of forestry resource-based livelihoods are often underestimated or unknown. With this background, the current research was undertaken to identify the factors promoting and impeding the diversification of forestry resource-based livelihoods in the Leh Himalaya and assess their effectiveness and contributory impacts on the diversification of forestry resource-based livelihoods.

## 2. MATERIALS AND METHODS

### 2.1 Description of Study Area

Leh district (Fig. 1.), with an area of 45110 sq. km, which probably makes it the largest district in the country in terms of area, is one of the coldest and most elevated inhabited regions of the world, having 112 inhabited villages and one uninhabited village with an altitude ranging from 2900 to 5900 metres [9]. The district is situated roughly between 32- and 36-degrees north latitude and 75- and 80-degrees east longitude, with an altitude ranging from 2300 metres to 500 metres above sea level. The district is bounded by Pakistan-occupied Kashmir in the west, China in the north and eastern part, and Laquan Spite of Himachal Pradesh in the south. The district is at a distance of 434 km from Srinagar and 474 km from Manali (HP). Topographically, the whole of the district is mountainous, with three parallel ranges of the Himalaya. The district consists of nine (9) blocks, viz., Leh, Khalsi, Khru, Nyoma, Durbok, Saspol, Panamic, Chuchot, and

Nubra. Due to its location and high altitude, the Leh district experiences heavy early precipitation (snow), which results in its being cut off from the rest of the country for six months of the year. The district remains inaccessible, as the road links from Srinagar as well as Himachal Pradesh remain closed due to the closure of Zojila and Rotang passes due to heavy snowfall in the winters. The human population of Leh district is 117232 [10]. The density of population is 3 people per sq. km. Leh district is one of the places where population density is lowest on the inhabited part of the earth. Approximately 23.30% of the of the population is semi-urban, and the remaining 76.70% is rural. The main occupations engaged by the working force are cultivation, agriculture labour, household industry, and other works. The Ladakh Autonomous Hill Development Council emerged in September 1995 as the main development agency of the district.

### 2.2 Sampling Technique and Sample

The current investigation was carried out in the Ladakh Union Territory's Leh area. The villages and the respondents were chosen using a multi-stage random sampling technique [11]. The first phase was the random selection of five (5) blocks from the Leh district: Leh, Nyoma Chochot, Panamic, and Khaltsi. The second phase involved random sampling of ten (10) villages, viz., Saboo from Leh Block, Chumathang and Mud from Nyoma Block, Stakna and Nang from Chochot Block, Lakjung and Panamic from Panamic Block, and Dha, Lamayuru, and Nurla from Khaltsi Block. In the third phase, 185 households in total were selected using a simple random selection technique for the field study, with a sampling intensity of 15% from the sample villages. The interviewees were either the head of the household or the oldest family members. The flow chart, shown in Fig. 2, summarizes the procedure used to choose the samples.

### 2.3 Data Collection

In order to achieve the research objectives, the present study included both qualitative and quantitative methods. Data were collected by using both secondary sources and primary field surveys. Secondary sources included literature from various journals, forest department records, village records, the internet, previous research, annual reports and other related documents, and different governmental and non-governmental

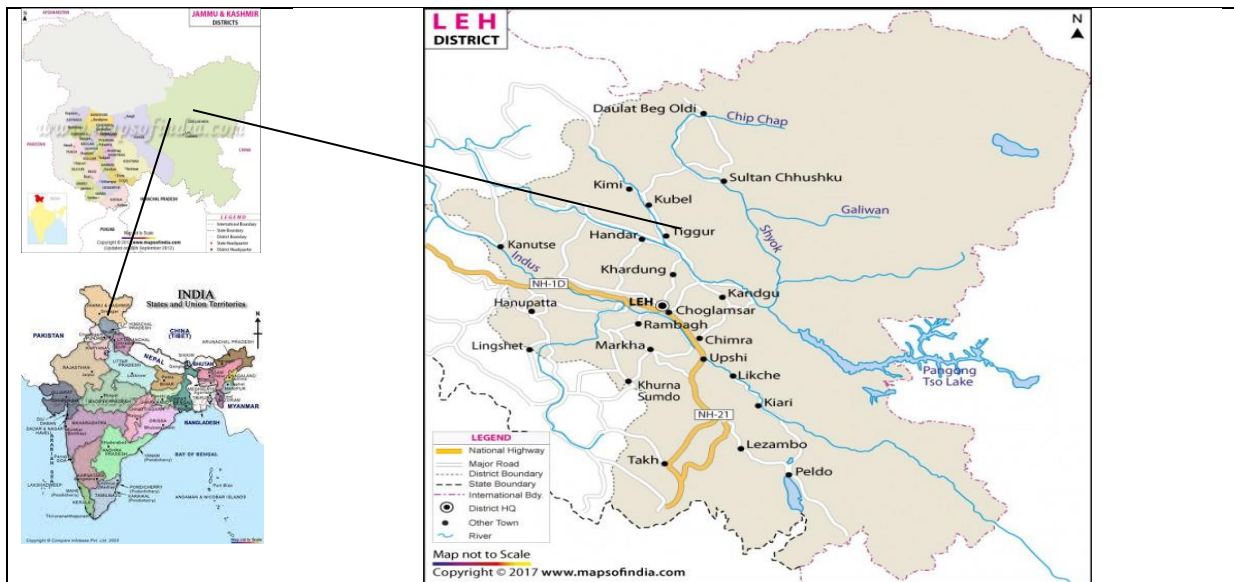


Fig. 1. Location map of the study area

Purposive selection

State

Jammu and Kashmir

District

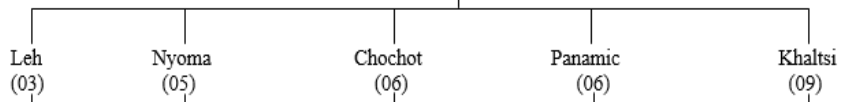
Leh

(No. of Blocks)

(12)

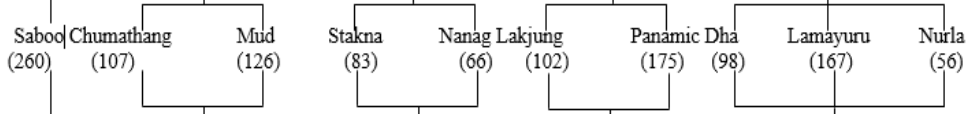
Random selection

Blocks (05)



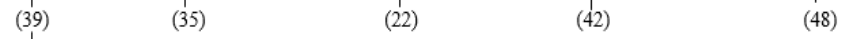
(No. of villages)

Sample villages (10)



(No. of households)

Sample households



Total

(185)

Fig. 2. Sampling procedure

agencies. Primary sources included structured interviews with selected respondents and non-participant observations [12]. The primary data were collected at the household level, whereas the secondary data were collected at the block, village, and household/individual level.

**2.3.1 Structured interview**

The primary data were collected by the personal interviews of the respondents through a well-

structured pre-tested interview schedule at household level. Interview schedule for household survey was prepared on the basis of literature referred, reconnaissance survey of the study area, and discussion with local people and consultation with the experts. The interview schedule so prepared was employed to collect information on people's perceptions of factors promoting and impeding diversification of forestry resource-based livelihoods in the locality. The data, thus generated through these approaches,

was used in exploring the impacts of factors in promoting and impeding diversification of forestry resource-based livelihoods to put forth strategies to keep pace with current development and future challenges in the locality.

### 2.3.2 Non-participant observation

The qualitative analysis was done on the basis of personal observation and interaction with the respondents. This technique helped to have firsthand on-the-scenes contact with the respondents, examine the behavior in natural situation and study the situation-based features of conduct.

## 2.4 Data Analysis

Descriptive statistics, including frequency (f), percentage (%), average (x), standard error, and range [13], were used to summarize the socioeconomic variables of the forestry farmers. The findings were calculated as a weighted mean score (WMS) for each of the promoting and impeding factors using the simple ranking technique. The weighted mean score (WMS) for each factor was obtained by multiplying the frequencies with their respective scores, adding them up, and dividing by the total number of people as follows:

$$\text{Weighted mean score (WMS)} = \frac{(\text{No. of HE} \times 2) + (\text{No. of ME} \times 1) + (\text{No. of LE} \times 0)}{\text{Total no. of HI} + \text{MI} + \text{LI}}$$

Where, HE = Highly effective, ME = Moderately effective, and LE = Least effective

Data were processed and analyzed with MS Excel and SPSS software and displayed through table and graph.

## 3. RESULTS AND DISCUSSION

### 3.1 Factors Promoting the Diversification of Forestry Resource-based Livelihoods in the Leh Himalaya

The ranking of promoting factors for the diversification of forestry-based livelihoods based on their weighted mean score (WMS) and percentage score (PS) revealed that the most important promoting factor (Rank 1<sup>st</sup>) as perceived by the local people was forest resource self-sufficiency (WMS-1.98, PS-12.28%) followed by support for livestock rearing (WMS-1.92, PS-11.90%), income generation

(WMS-1.64, PS-10.17%), employment generation (WMS-1.62, PS-10.04%), support to agriculture (WMS-1.52, PS-9.42%), food and nutrition security (WMS-1.46, PS-9.05%), migration decline (WMS-1.34, PS-8.31%), assets creation for emergency (WMS-1.21, PS-7.50%), poverty alleviation (WMS-0.99, PS-6.14%), socio-economic development (WMS-0.97, PS-6.01%), sustenance to traditional and religious activities (WMS-0.75, PS-4.65%) and utilization of free time (WMS-0.73, PS-4.53%), which were ranked from 2<sup>nd</sup> to 12<sup>th</sup> respectively (Table 1 & Fig. 3).

The analysis of WMS and PS of promoting factors for diversification of forestry resource-based livelihood security, viz., forest resource self-sufficiency, support to livestock rearing, income generation, employment generation, support to agriculture, and food and nutrition security (WMS, 1.46 to 1.98 & PS-9.05% to 12.28%) indicated that these factors were considered 'highly effective' by most of the respondents because of their direct impact on their subsistence, income, standard of living, well-being, and survival. On the other hand, the promoting factors namely, migration decline, assets creation for emergency, poverty alleviation, socio-economic development, sustenance to traditional and religious activities and utilization of free time (WMS, 0.73 to 1.34 & PS-4.53% to 8.31%) were considered 'moderately effective' in promoting the diversification of forestry resources-based livelihoods among most of the respondents in the sample villages. Such rating of these promoting factors by the respondents might be due to the fact that accrual of these benefits to the households is difficult to value in economic terms. None of the promoting factors has been expressed as 'least effective' having WMS < 0.50 by the respondents in the surveyed area. The studies [14,15,16,17] had the support of present findings.

### 3.2 Factors Impeding the Diversification of Forestry Resource-Based Livelihoods in the Leh Himalaya

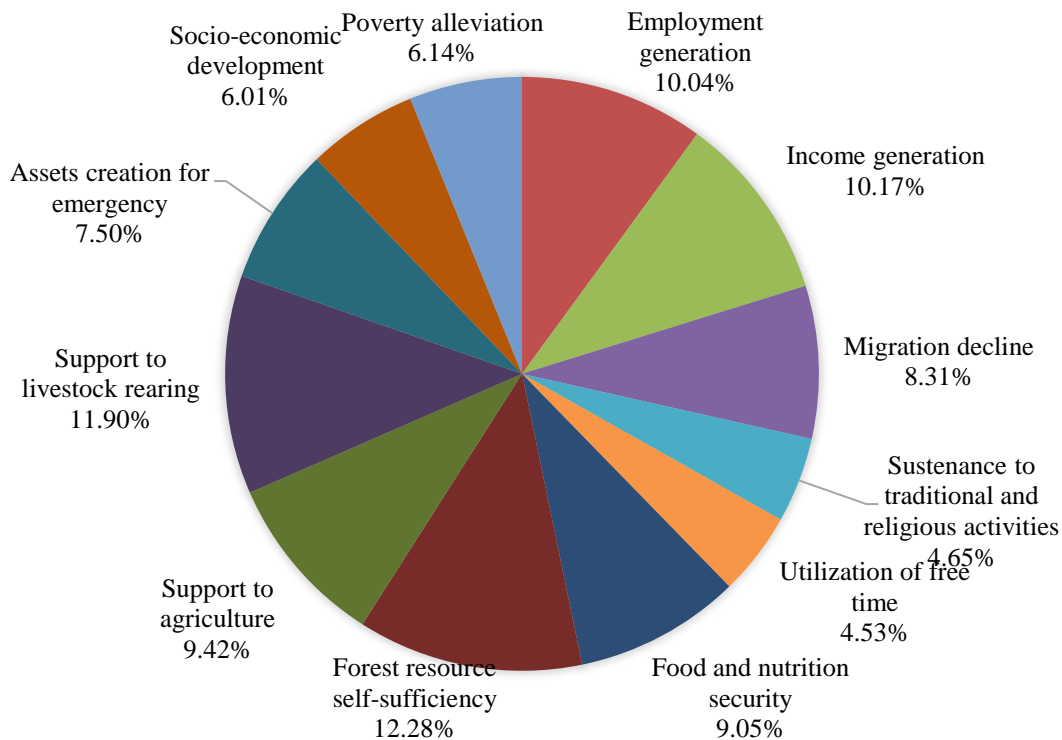
The ranking of impeding factors for the diversification of forestry-based livelihoods using WMS and PS indicated that the most important factor (Rank 1<sup>st</sup>) as opined by the local people, was labour-intensive and less remunerative livelihood (WMS-1.96, PS-11.80%) followed by seasonal subsistence (WMS-1.93, PS-11.62%), supplementary income (WMS-1.71, PS-10.30%),

limited marketing facilities (WMS-1.68, PS-10.11%), lack of co-operative societies (WMS-1.56, PS-9.39%), lack of modern techniques (WMS-1.44, PS-8.67%), influence of middlemen (WMS-1.31, PS-7.89%), harassment by officials in forestry resources collection and marketing (WMS-1.22, PS-7.34%), scarcity of

**Table 1. Promoting factors of the diversification of forestry resource-based livelihoods (N=185)**

Promoting factors	Degree of effectiveness			Weighted mean score	Rank
	Highly effective	Moderately effective	Least effective		
Employment generation	135 (72.97)	30 (16.21)	20 (10.82)	1.62	4 <sup>a</sup>
Income generation	137 (74.05)	29 (15.67)	19 (10.28)	1.64	3 <sup>a</sup>
Migration decline	103 (55.67)	42 (22.70)	40 (21.63)	1.34	7 <sup>b</sup>
Sustenance to traditional and religious activities	26 (14.05)	87 (47.02)	72 (38.93)	0.75	11 <sup>b</sup>
Utilization of free time	23 (12.43)	89 (48.11)	73 (39.46)	0.73	12 <sup>b</sup>
Food and nutrition security	117 (63.24)	36 (19.46)	32 (17.30)	1.46	6 <sup>b</sup>
Forest resource self-sufficiency	181 (97.83)	04 (2.17)	0.00 (0.00)	1.98	1 <sup>a</sup>
Support to agriculture	121 (65.40)	39 (21.08)	25 (13.52)	1.52	5 <sup>a</sup>
Support to livestock rearing	170 (91.89)	15 (8.11)	0.00 (0.00)	1.92	2 <sup>a</sup>
Assets creation for emergency	87 (47.02)	49 (26.49)	49 (26.49)	1.21	8 <sup>b</sup>
Socio-economic development	54 (29.18)	71 (38.37)	60 (32.45)	0.97	10 <sup>b</sup>
Poverty alleviation	60 (32.45)	64 (34.59)	61 (32.96)	0.99	9 <sup>b</sup>

Note:- WMS= Weighted mean score; Figures in the parentheses indicate percentages; WMS followed by different superscript letters within the column are significantly different ( $p < 0.05$ )

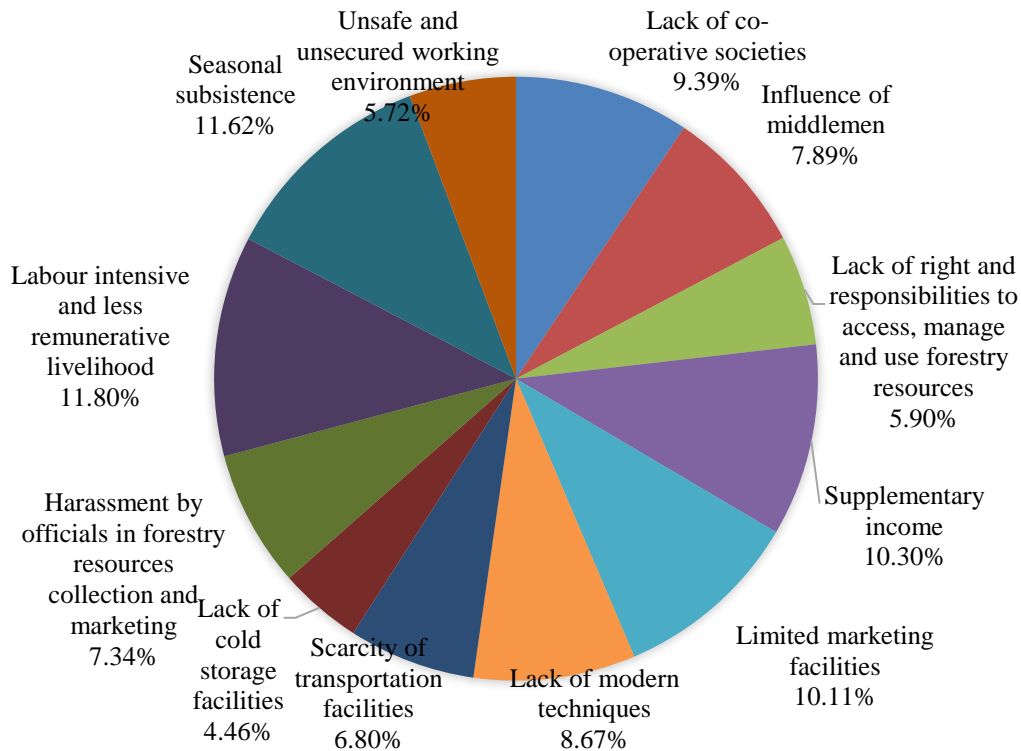


**Fig. 3. Contribution of promoting factors to the diversification of forestry resource-based livelihoods**

**Table 2. Impeding factors of the diversification of forestry resource-based livelihoods (N=185)**

Impeding factors	Degree of effectiveness			Weighted mean score	Rank
	Highly effective	Moderately effective	Least effective		
Lack of co-operative societies	130 (70.27)	29 (15.67)	26 (14.05)	1.56	5 <sup>a</sup>
Influence of middlemen	97 (52.43)	48 (25.94)	40 (21.63)	1.31	7 <sup>b</sup>
Lack of right and responsibilities to access, manage and use forestry resources	59 (31.89)	63 (34.05)	63 (34.06)	0.98	10 <sup>b</sup>
Supplementary income	147 (79.45)	23 (12.43)	15 (8.12)	1.71	3 <sup>a</sup>
Limited marketing facilities	143 (77.29)	25 (13.51)	17 (9.20)	1.68	4 <sup>a</sup>
Lack of modern techniques	117 (63.24)	32 (17.29)	36 (19.47)	1.44	6 <sup>b</sup>
Scarcity of transportation facilities	83 (44.86)	43 (23.24)	59 (31.90)	1.13	9 <sup>b</sup>
Lack of cold storage facilities	28 (15.13)	81 (43.78)	76 (41.09)	0.74	12 <sup>b</sup>
Harassment by officials in forestry resources collection and marketing	81 (43.78)	63 (34.05)	41 (22.17)	1.22	8 <sup>b</sup>
Labour intensive and less remunerative livelihood	178 (96.21)	07 (3.78)	0.00 (0.00)	1.96	1 <sup>a</sup>
Seasonal subsistence	172 (92.97)	13 (7.02)	0.00 (0.00)	1.93	2 <sup>a</sup>
Unsafe and unsecured working environment	53 (28.64)	69 (37.29)	63 (34.07)	0.95	11 <sup>b</sup>

Note:- WMS= Weighted mean score; Figures in the parentheses indicate percentages; WMS followed by different superscript letters within the column are significantly different ( $p < 0.05$ )



**Fig. 4. Contribution of impeding factors to the diversification of forestry resource-based livelihoods**

transportation facilities (WMS-1.13, PS-6.80%), manage and use forest resources (WMS-0.98, PS-5.90%), unsafe and unsecured working

environment (WMS-0.95, PS-5.72%) and lack of cold storage facilities (WMS-0.74, PS-4.46%) which were ranked from 2<sup>nd</sup> to 12<sup>th</sup> respectively (Table 2 & Fig. 4).

The WMS (1.56 to 1.96) and PS (9.39% to 11.80%) of the impeding factors for the diversification of forestry resources-based livelihood security, namely, labour intensive and less remunerative livelihood, seasonal subsistence, supplementary income, limited marketing facilities, and lack of cooperative societies, showed that these are the 'highly effective' factors encountered by the local people in the sample villages, as these factors seem to have alienated some people from undertaking the forestry resources-based livelihoods. The impeding factors for the diversification of forestry resources-based livelihood security, viz., lack of modern techniques, influence of middlemen, harassment by officials in forestry resources collection and marketing, scarcity of transportation facilities, lack of rights and responsibilities to access, manage, and use forest resources, unsafe and unsecured working environments, and lack of cold storage facilities (WMS, 0.74 to 1.44 and PS, 4.46% to 8.67%), were experienced as 'moderately effective' among the sampled population. Such perceptions of these impeding factors by the local people might be due to the fact that these factors seem to have hindering and adverse effects on the forestry-based livelihoods of the local people in the surveyed area. No impeding factor has been perceived as 'least effective' with a WMS < 0.50 by the local people sampled during the survey. The observations made by earlier studies by [14,15,16,17] supported the present findings.

#### 4. CONCLUSION

The study led to the conclusion that certain factors, both promoting and hindering, have substantially contributed to the diversification of forestry resource-based livelihoods in the locality. The promoting factors motivate the people and catalyse the establishment of forestry resource-based businesses, while the hindering factors restrict the start of these enterprises, and these need to be overcome. This study gives insight into the different promoting and hindering factors of the diversification of forestry-based livelihoods, which can be used to strengthen forestry enterprises. To make the forestry resource-based livelihoods sustainable and reduce their vulnerability, the prominent promoting and hindering factors must be given due importance

during the decision-making, implementation, and execution of livelihood strategies for the all-round development of society in the locality. Appropriate measures should be taken to exploit the promoting factors of forestry resource-based livelihoods in the motivation of local people, and efforts should be made to minimize the effectiveness of the impeding factors of forestry resource-based livelihoods. The promoting and impeding factors having substantial impacts on forestry resource-based livelihoods should be given due consideration for policy implications during the planning and implementation of specific strategies for improving and strengthening forestry resource-based livelihoods.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of manuscripts.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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