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Price behaviour of selected non-timber forest products in Kerala

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Abstract
This article delves into an in-depth exploration of the pricing dynamics surrounding specific Non-Timber Forest Products (NTFPs) within the region of Kerala. A substantial quantity of 39.24 lakh kilograms of NTFPs yielded an impressive annual revenue of ₹ 3.33 crores. Within this NTFP collection, a notable contribution of ₹ 63.57 lakh per year originated from honey, while the primary volume of production centered around *Sida cordifolia*, boasting an annual yield of 2.43 lakh kilograms. Employing the technique of multiple linear regression, the study pinpointed key determinants influencing the earnings derived from NTFP collection. The findings underscored that the annual income from agricultural pursuits, the number of man-days dedicated to agricultural activities, and the engagement in other income-generating ventures significantly impacted the revenue generated from NTFP collection.
Taking a broader perspective, the analysis also incorporated Compound Annual Growth Rate (CAGR) evaluation to dissect the price trends of NTFPs in Kerala spanning from 2000-01 to 2019-20. The outcomes unveiled a consistent downward trajectory of NTFP collection, experiencing an annual decline of approximately -11.6 percent over the designated period. In stark contrast, the revenue stemming from NTFP sales showcased an opposing trend, with an annual upswing of 4.55 percent within the same timeframe. This juxtaposition signifies an escalation in NTFP prices from 2000-01 to 2019-20, portraying a dynamic shift in the market landscape.

Keywords: Non-timber forest products, compound annual growth rate, multiple linear regression, price dynamics, income

1. Introduction
Kerala stands out as a notable 'hotspot' within India, boasting abundant and diverse biological wealth. The expansive forested region in Kerala encompasses 20,321 square kilometers, constituting a significant 52.30 percent of the state's total geographical expanse (FSI, 2017). Over the past two decades (2000-01 to 2019-20), the consistent average yield of Non-Timber Forest Products (NTFPs) in Kerala has amounted to an impressive 39.25 lakh kilograms, translating to an annual mean revenue of approximately ₹ 3.33 crore rupees. In this context, around 36 Tribal Service Cooperative Societies (TSCS) have actively participated in NTFP collection, spanning across 398 tribal settlements in Kerala.
Notably, the collection of NTFPs serves as the primary livelihood for over 68 percent of the tribal population in districts such as Palakkad, Thrissur, Wayanad, and Kannur, as highlighted by Shanker (1999) [77]. For those residing in remote hinterlands, these indigenous communities heavily rely on forest resources for sustenance, encompassing nourishment, medicinal needs, construction materials, firewood, religious rituals, and the commercial harvesting of NTFPs. Research indicates that the collection of NTFPs contributes significantly, comprising approximately 58 percent of the overall income for the tribal populace in Kerala (Thomas, 1996) [90], thus emphasizing the pronounced role of NTFPs in their livelihoods and income generation.
In light of this backdrop, it becomes imperative to thoroughly investigate the assortment of NTFPs collected and their substantial significance to the tribal communities. Thus, the present study seeks to delve into the profound impact of "Non-Timber Forest Product Prices" on Kerala's society, thereby addressing a critical aspect of the intricate relationship between the environment and the inhabitants.

2. Objectives of the study
1. Study the price behaviour of selected NTFPs.

2. Identify the factors influencing income from NTFP collection in Kerala.

3. Review of Literature

3.1 Price behaviour of selected NTFPs

Chopra's investigation in 2006 encompassed the assessment of the informal sector's contribution to India's GDP, resulting in an average NTFP value of ₹ 1671.54 per hectare and an estimated gross value of ₹ 41.89 billion for NTFPs harvested nationwide.

In Kumar's 2010 study, the interior forest regions of Karnataka witnessed *Acacia concinna* spearheading the total cash income from NTFPs with ₹ 998.16 (14.5%), closely trailed by honey at ₹ 913.26 (13.33%).

Ashish's 2012 study centered on the sustainable livelihood enhancement of western Attapady's tribal communities. The Kurumba group derived maximum income from *Solanum torvum* (13%) and honey (12%), whereas the Muduga group's primary income contributors were *Canarium strictum* (17%) and *Mangifera Indica* (16%).

According to Alex and Kattany's findings in 2016, the procurement price of major NTFPs exhibited an upward trend, albeit not consistently. NTFPs like honey and *Cyclea peltata* significantly boosted tribal revenue due to their elevated pricing. They also dissected the price behaviour of NTFPs marketed through the Kurumba society in Attapady, revealing higher price spread for *Holostemman adakodien* and lower spread for *Acacia concinna*.

Satpathy's 2017 study in Odisha delved into the livelihood dependency of forest fringe communities. The Tobit model analysis demonstrated that NTFP income shared a positive connection with livestock farming time but was negatively impacted by daily wage and other income sources.

Bhat *et al*. (2018) [14] unveiled trends in selected NTFP yields in the Western Ghats, displaying annual fluctuations and cyclical patterns. The Compound Annual Growth Rate (CAGR) for the Indian pharmaceutical market, inclusive of NTFP species, surged by 17.46 percent during 2015-16 and was projected to reach 15.92 percent by 2020.

Chiphang *et al*. (2020) [20] researched on NTFPs in Meghalaya and highlighted that business income (45.74%) preceded NTFP collection (22.05%). Factors like experience, NTFP collection hours, and landholding exhibited a positive correlation with NTFP income, while travel distance and age showed a negative relationship.

Dinda *et al*. (2020) [95] explored NTFP commercialization patterns and their contribution to tribal livelihoods. Employing multiple regression models, they determined that NTFP price spreads were more substantial in metropolitan and global markets compared to local ones. Notably, Sal leaves, Mahwa, and Haritaki exhibited the highest price spreads due to their significant market demand.

Chaudhari's 2021 study on forest produce in Gujarat employed CAGR to elucidate production growth rates, revealing a negative CAGR for all NTFPs over the period 1994-95 to 2018-19.

3.2 Factors influencing income from NTFP Collection

In their 1997 study, Pattanaik and Dutta explored Joint Forest Management (JFM) in South West Bengal, India. They categorized factors into distance, cost, availability, and management categories. Distance factors encompassed the distance travelled for NTFP collection, proximity to local markets, and urban market distances. Cost factors included labour, transportation, and management expenses. Availability factors considered collection period, collection time, and marketization duration. Management factors consisted of knowledge about value addition and conservation practices.

Suryaprakash and Girish's 1999 [88] economic analysis examined NTFPs in the tribal economy of the Western Ghats, Karnataka. Employing factor analysis and multiple linear regression, they identified significant determinants affecting NTFP collection and income. Income from agriculture, allied activities, and NTFP employment emerged as pivotal factors influencing income from NTFP collection. The study also highlighted the substantial influence of the dependency ratio.

Lakshmi's 2015 [96] research centred on the economic analysis of NTFPs in Karnataka's Kodagu district. Utilizing multiple linear regression, the study scrutinized various variables impacting income from NTFP collection. Remarkably, wage-earning income, allied activities' revenue, and employment from wage-earning activities surfaced as key variables shaping NTFP collection income.

In 2016, Sakai *et al*. delved into the social and ecological dimensions of NTFP utilization in rural Borneo. They combined land cover mapping and socio-economic data to explore the linkages. The findings unveiled correlations between the utilization of NTFPs and householder's education, age, gender, as well as agricultural engagement, showcasing the multifaceted relationships underpinning NTFP use.

4. Methodology

The research titled "Price Behavior of Selected NTFPs in Kerala" was conducted at the Department of Agricultural Economics, College of Agriculture, Vellayani, spanning the period from 2019 to 2021. This study took place within the geographical confines of Kerala and relied on a combination of primary and secondary data sources. The primary data collection phase specifically focused on the Wayanad district. Meanwhile, secondary data pertaining to NTFPs were acquired from various governmental entities, including the Kerala Forest Headquarters in Vazhuthacaud and the Kerala State Federation of SC/ST Development Co-operatives Ltd. (KSFSDCL) in Peroorkada, both located in Thiruvananthapuram.

In terms of primary data acquisition, the study strategically selected NTFP collectors from the Wayanad district. This district was deliberately chosen due to its prominent status as a major contributor to NTFP collection within Kerala. The district is segmented into two forest divisions, namely the South Wayanad forest division and the North Wayanad forest division. Upon evaluation, it was evident that the South Wayanad division played a more substantial role in NTFP collection and revenue generation, leading to its selection for the study.

Within the South Wayanad forest division, three forest ranges, namely Kalpetta, Meppady, and Chedalath, were identified as being pivotal in terms of NTFP production. These ranges were thus chosen for the study. From each of these selected ranges, a random sample of 20 NTFP collectors was drawn, resulting in a total sample size of 60 individuals. The primary data collection process involved employing a meticulously designed and pre-tested interview schedule administered to the NTFP collectors. The diagrammatic representation of the sampling frame is visualized in Figure 1.

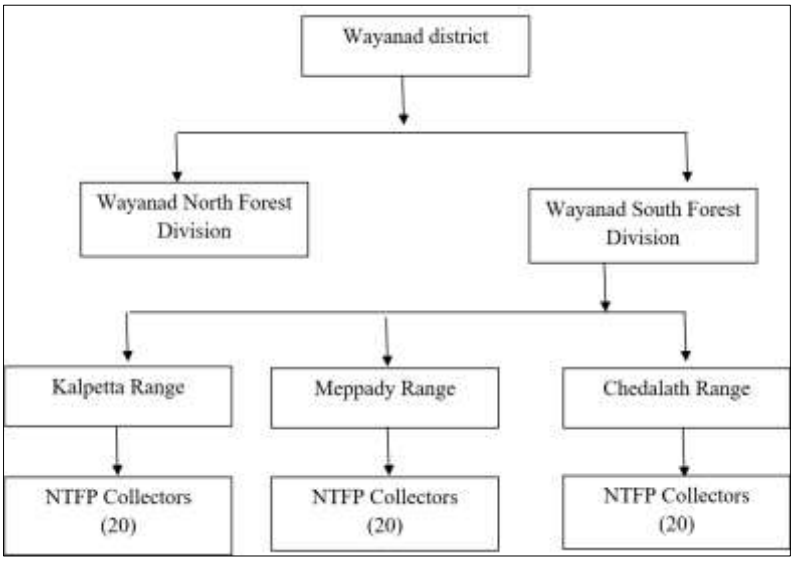

Fig 1: Sampling framework for the study

4. Results and Discussions

The data amassed for this study was strategically gathered to derive substantial insights aligned with the predefined objectives. A comprehensive analysis was undertaken, distinguishing between primary and secondary data, each subjected to distinct statistical methodologies. The culmination of these analytical efforts is encapsulated within this chapter, where the ensuing sections present the outcomes and discussions that ensued.

4.1 Trend in the total revenue from NTFPs in Kerala during 2000-01 to 2019-20

To examine the growth trajectory of total revenue generated from Non-Timber Forest Products (NTFPs) over the past two decades (2000-01 to 2019-20) in Kerala, the Compound Annual Growth Rate (CAGR) was meticulously calculated for each specific period. The revenue data for NTFPs during the span of 2000-01 to 2019-20 is presented in Table 1, providing a comprehensive overview of the revenue trends over this substantial timeframe.

Table 1: Total revenue from NTFPs during 2000-01 to 2019-20

Year	Total revenue (lakh ₹)
2000-01	54.88
2001-02	271.62
2002-03	243.92
2003-04	579.15
2004-05	314.65
2005-06	321.48
2006-07	267.86
2007-08	260.77
2008-09	261.79
2009-10	230.63
2010-11	255.95
2011-12	280.48
2012-13	390.61
2013-14	303.37
2014-15	463.24
2015-16	387.67
2016-17	437.46
2017-18	435.86
2018-19	607.25
2019-20	291.04
CAGR	4.55

Source: KSFSDCL, 2000-01 to 2019-20

The Compound Annual Growth Rate (CAGR) was meticulously calculated to assess the total revenue generated from NTFP sales within the period 2001-2020. Despite the declining trend in the quantity of NTFP collection, a notable upsurge in revenue from NTFP sales was evident, exhibiting a noteworthy annual increase of 4.55 percent. This increase was statistically significant at a 5 percent level of significance, underscoring the consistent nature of this upward trajectory in Kerala over the years.

Illustrated in Figure 2 below, the data confirms the escalating pattern in total revenue derived from NTFP collection in Kerala. This trend can be attributed primarily to the escalating prices of medicinal plants, spurred by their heightened demand in the market.

Notably, the revenue trend showcases an ascending trajectory from 2000-01 to 2003-04. This rise was primarily attributed to elevated production levels of *Acacia sinuata* and *Canarium strictum* during this time span. Additionally, a significant peak in revenue emerged in 2018-19 due to substantial honey production, a pivotal contributor to Kerala's revenue. However, a decline in revenue was observed in 2019-20 compared to the preceding year, attributed to heavy rains that posed challenges in NTFP collection and storage processes.

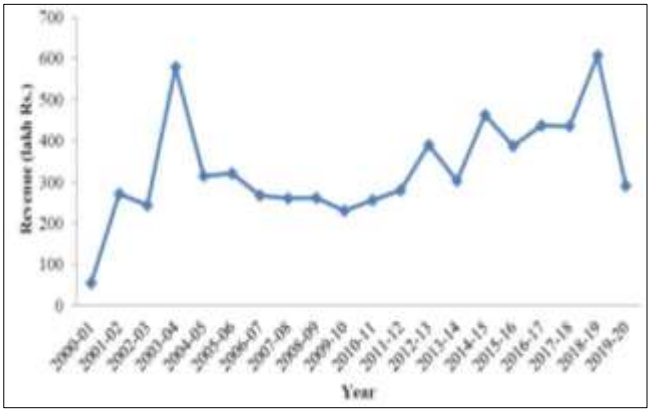

Fig 2: Total revenue from NTFPs in Kerala during 2000-01 to 2019-20

4.2 CAGR of price and revenue from major NTFPs in Kerala during 2000-01 to 2019-20

Table 2 presents the calculated Compound Annual Growth

Rates (CAGR) for both price (₹/kg) and revenue (₹) concerning ten major Non-Timber Forest Products (NTFPs) over the span of the past 20 years (2000-01 to 2019-20). A comprehensive analysis of these figures indicates noteworthy insights.

Remarkably, the NTFP with the highest demand, *Pseudarthria viscida*, exhibited the highest annual growth rate in price at an impressive 17.15 percent. This high demand is attributed to its utilization for controlling asthma and its prominence in both Ayurvedic and Siddha medicines.

Conversely, the NTFP with the lowest growth rate in price was *Strobilanthes ciliatus* Nees, showcasing a growth rate of 5.80 percent. This relatively lower growth rate is attributed to its lower demand compared to other medicinal plants.

Turning attention to production and revenue, it's evident that small honey emerged as the front-runner with the highest annual growth rate, while *Acacia sinuata* registered the lowest. These variations underscore the diverse dynamics within the realm of NTFP production and revenue generation.

Table 2: Compound Annual Growth Rate of revenue of major NTFPs over the last 20 years (2000-01 to 2019-20) in Kerala

Name	Price CAGR (%)	Revenue CAGR (%)
Honey (Vanthen)	8.22	9.49
Acacia sinuata (Cheenikka)	11.26	-30.93
Parmelia dilatata Vainio (Kalpasam)	11.78	1.74
Sida cordifolia (Kurumthotti)	13.14	17.60
Strobilanthes ciliatus Nees (Karimkurinji)	8.54	1.74
Small Honey (Cheruthen)	17.15	68.24
Symplocos racemosa (Pachottipatta)	11.29	5.12
Canarium strictum (Kunthirikkam)	9.56	-4.08
Cyclea peltata (Padakizhangu)	5.80	3.22
Pseudarthria viscida (Moovila)	13.81	49.55

Source: KSFSDCL, 2000-01 – 2019-20

The insights gleaned from Figure 3 elucidate a distinct pattern in the pricing dynamics of major Non-Timber Forest Products (NTFPs) within Kerala over a specific timeline. Notably, during the span from 2000-01 to 2013-14, the price fluctuations of major NTFPs remained relatively stable, showcasing limited variations.

However, a significant transition was observed from the year 2014-15 onward. During this period, there was a pronounced shift in the pricing landscape of NTFPs, marked by a substantial and noticeable alteration. This transformation can primarily be attributed to the implementation of the Minimum Support Price (MSP) for NTFPs, which was introduced by the Ministry of Tribal Affairs in India. The introduction of MSP for NTFPs effectively altered the pricing dynamics, leading to a distinct upward surge in prices starting from 2014-15.

As depicted in Figure 3, this change was quite evident, highlighting a substantial shift in the pricing structure of major NTFPs in Kerala, with a notable increase in prices stemming from the adoption of the Minimum Support Price mechanism.

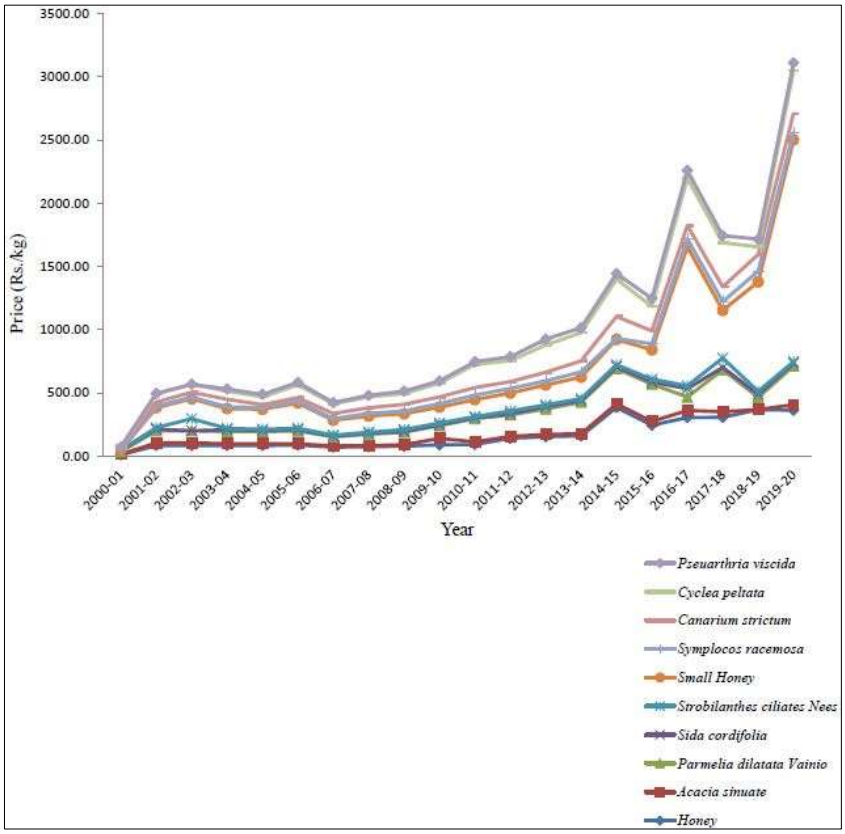

Fig 3: Price trend of major NTFPs in Kerala during 2000-01 to 2013-14

4.3 Factors influencing the income of NTFP collectors

The outcomes of the multiple linear regression analysis are meticulously outlined in Table 3. The analysis revealed that certain variables wielded a substantial impact on Non-Timber Forest Product (NTFP) collection. Particularly noteworthy were the variables including annual income from agriculture, the number of man-days dedicated to agricultural activities per year, and the man-days dedicated to other income-generating activities per year. These variables were identified as having a statistically significant influence on NTFP collection.

The study also indicated that the most appropriate regression model for this analysis was multiple linear regression, providing a robust fit to the data. This was further validated by a commendable goodness of fit, expressed through the coefficient of determination (R2), which stood at an impressive value of 0.8293. This indicates that the chosen regression model effectively captures a significant portion of the variability present in the data, offering substantial insights into the factors influencing NTFP collection within the context of the study.

Here, the regression equation obtained is,

$Y = -45276.46 + 7923.61\ X_1 + 1.48\ X_2 + 0.16\ X_3 - 0.27\ X_4 + 3502.69\ X_5 - 470.28\ X_6 + 461.01\ X_7 + 108.35\ X_8$

Where,

Y = Annual income from NTFPs (₹/yr)
X_1 = Size of the family (number)
X_2 = Annual income from agriculture (₹/yr)
X_3 = Annual income from wage-earning (₹/yr)
X_4 = Annual income from allied activities (₹/yr)
X_5 = Man days per year spent for agricultural activity (man-days/yr)
X_6 = Man days per year spent for other income-earning activities (man-days/yr)
X_7 = Man days per year spent for NTFP collection (man-days/yr)
X_8 = Size of land holding (ha)

Table 3: Factors influencing income from NTFP collection

	Variable	Coefficient	Standard Error	P-value
	Constant	**-45276.46**	**80459.7**	**0.576**
X_1	Size of the family (number)	7923.61	3989.39	0.052
X_2	Annual income from agriculture (₹ / yr)	1.48***	0.43	0.001
X_3	Annual income from wage-earning (₹/ yr)	0.16	0.12	0.196
X_4	Annual income from allied activities (₹/ yr)	-0.27	0.43	0.532
X_5	Man days per year spent on agricultural activity (man-days/yr)	3502.69***	634.69	0.000
X_6	Man days per year spent for other income-earning activities (man-days/yr)	-470.28**	233.20	0.049
X_7	Man days per year spent for NTFP collection (man-days/yr)	461.01	517.15	0.377
X_8	Size of landholding (ha)	108.35	173.51	0.535

Source: Primary household survey, 2021

Note: ** indicates values are significant at a 5% level of significance
*** indicates values are significant at a 1% level of significance

In a study conducted by Lakshmi (2015) [51], significant variables were identified including income from wage-earning, income from allied activities, and employment from wage-earning. Similarly, another study by Suryaprakash (1999) [88] reported that factors like income from agriculture, income from allied activities, employment from NTFP collection, and the dependency ratio significantly and positively influenced the NTFP income among tribal communities. Likewise, in the present study, the analysis revealed that certain factors held positive significance in relation to income from NTFP collection, such as annual income from agriculture and man-days per year spent on agricultural activities.

This pattern can be attributed to the seasonal nature of most NTFPs, which results in NTFP collectors not relying heavily on NTFPs as their primary income source. In the study area, men typically engage in NTFP collection, while women are more engaged in agricultural activities close to their households. Consequently, NTFP collection does not adversely impact agricultural pursuits. On the other hand, the study found that man-days per year spent on other income-earning activities exerted a negative and significant influence on income from NTFP collection. This can be attributed to the fact that NTFP collectors, engaging in other income-generating activities, allocated less time to NTFP collection. Consequently, as more time was directed towards other income-earning endeavours, income from NTFP collection decreased.

5. Conclusion and Policy suggestions

The analysis involved the use of Compound Annual Growth Rate (CAGR) to assess the price trends of Non-Timber Forest Products (NTFPs) in Kerala spanning the period 2000-01 to 2019-20. Simultaneously, the revenue derived from NTFP sales demonstrated a consistent and upward trend, registering an annual increase of 4.55 percent across the same time frame. This growth pattern underscored the escalating prices associated with NTFPs over the two decades from 2000-01 to 2019-20. Notably, this price escalation was attributed to the heightened demand for medicinal plants, further amplifying the positive price trend observed in NTFPs.

Furthermore, in tandem with the CAGR analysis, multiple linear regression was employed to meticulously identify and examine the factors influencing the income derived from NTFP collection. The findings gleaned from this regression model illuminated that key determinants like annual income from agriculture, the extent of man-days devoted to agricultural activities, and man-days allocated to other income-earning endeavours all held a substantial and significant influence over the income generated from NTFP collection. This comprehensive approach effectively provided insights into both the price and income dynamics associated with NTFPs in Kerala.

5.1 Policy Suggestions

Based on the insights derived from the aforementioned findings, several policy recommendations have been formulated and are outlined below:

1. **Incentive Programs for NTFP Collectors:** Given that a significant portion of NTFP collectors are engaged in other wage-earning activities, introducing incentives such as bonuses during special occasions could serve as a motivation for them to enhance their NTFP collection efforts. These incentives have the potential to stimulate increased collection rates, ultimately contributing to higher household income.
2. **Value Addition Initiatives:** Implementing value addition strategies for NTFPs can have multiple benefits. By incorporating value-added processes, the potential for damages to NTFPs can be minimized, leading to improved product quality. This, in turn, can positively impact the pricing of NTFPs in the market. Value addition efforts could involve processes such as refining, packaging, and branding, elevating the overall market appeal of these products.

These policy suggestions stem from the study's findings and aim to address critical aspects such as income enhancement for collectors and the augmentation of NTFP value through quality improvement. By taking these recommendations into account, policymakers can contribute to the sustainable development of NTFP-based livelihoods while also bolstering the economic viability of NTFP activities.

5.2 Future line of work

The current study conducted in the Wayanad district offers valuable insights into NTFP procurement and marketing dynamics within that specific context. To gain a comprehensive understanding, it is recommended that similar studies be extended to other regions. By undertaking studies in diverse areas, a more holistic and nuanced understanding of NTFP activities, procurement practices, and marketing patterns can be attained.

Furthermore, the scope can be broadened to encompass a study focused on the multifaceted role of NTFPs within the employment framework of tribal communities. This expanded research can delve into aspects such as income generation, consumption patterns, and the influential factors that shape NTFP activities among tribal groups. Such a comprehensive analysis will offer deeper insights into the intricate relationship between NTFPs and tribal livelihoods.

Additionally, given the significant impact of agricultural subsidies on the environment, there is an opportunity to undertake an in-depth study in this realm. Investigating the effects of agricultural subsidies on the environment, and subsequently formulating well-informed policies to address potential concerns, would contribute to sustainable and responsible agricultural practices.

By undertaking these suggested studies, a more holistic and comprehensive understanding of NTFP dynamics, tribal livelihoods, and environmental impacts can be garnered. Such insights are instrumental in shaping effective policies and interventions that foster sustainable development and equitable resource management.

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