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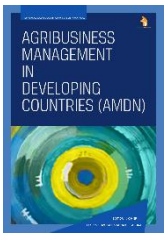

RESEARCH ARTICLE

ASSESSING THE SOCIO-ECONOMIC IMPACTS AND VALUE CHAIN DYNAMICS OF SWEET ORANGE CULTIVATION IN RAMECHHAP, NEPAL

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ABSTRACT

This study examines the value chain of sweet orange cultivation in the Ramechhap district of Nepal, aiming to identify key actors, production costs, marketing dynamics, and opportunities and constraints in the sector. Conducted between March and June 2024, the research utilized a combination of primary and secondary data collection methods, including surveys, interviews, and field observations. The sample comprised 60 farmers, 10 traders, 5 retailers, and 2 key informants, ensuring a comprehensive understanding of the value chain. Findings reveal that sweet orange farming is economically significant but faces challenges such as inefficiencies in the value chain, limited irrigation facilities, and inadequate post-harvest infrastructure, leading to substantial post-harvest losses. Major outcomes include the identification of significant socio-economic factors impacting production, the need for improved farming practices, and enhanced market infrastructure. Correlation and regression analyses indicate that family size, education level, and orchard size significantly affect productivity. The study highlights the need for targeted training programs, improved access to modern agricultural technologies, and better market infrastructure to enhance productivity and profitability. The conclusions and recommendations emphasize policy interventions for fairer profit distribution, greater inclusion of women and marginalized communities, and the development of robust post-harvest facilities. By addressing these challenges, Nepal can realize the full potential of its sweet orange sector, contributing to regional economic growth and development.

KEYWORDS

Sweet Orange, Socio-economic factor, Correlation, Regression, Post-harvest loss

1. INTRODUCTION

Citrus fruits represent one of the most vital cash-generating crops in the mid-hills of Nepal, recognized as high-value crops under the Agriculture Perspective Plan (APP) (Koirala et al., 2018). This category encompasses a variety of fruits adaptable to diverse climatic and geographical conditions, making them particularly suitable for the varied topography of Nepal (Ghimire et al., 2006). Among these, sweet oranges (locally known as Junar), mandarins, limes, lemons, and grapefruits stand out due to their economic and nutritional value. In Nepal, citrus fruits occupy about 22% of the total fruit cultivation area and production. The hilly regions, with their favorable climatic conditions, dominate citrus fruit production (Pandey et al., 2017). Sweet orange has gained significant prominence and is extensively cultivated in 47 districts across the country. The appeal of sweet orange lies in its unique sweet taste and high nutritional content, earning it the distinction of being a special fruit of Nepal, with some even considering it as the national fruit (Tomiyasu et al., 1998). The agricultural landscape of Nepal, especially in the mid-hill regions such as Ramechap and Sindhuli, is well-suited for sweet orange cultivation. The region's geographic positioning and climatic conditions are conducive to high-quality sweet orange production (Bhandari et al., 2022). Farmers in these areas have shown a keen interest in cultivating this fruit to meet the rising consumer demand (MoAD, 2016). The productive land for sweet orange in Nepal spans approximately 3,443 hectares, yielding a total production of 33,558 metric tons and a productivity rate of 9.7 tons per hectare (MoAD, 2016). Sweet orange's versatility extends beyond fresh consumption; it is a key ingredient in the preparation of various value-added products such as jam, jelly, marmalade, cold drinks, and sauces (Chen et al., 2016). This versatility attracts numerous manufacturing industries, thereby generating substantial employment opportunities for the economically active population. The sweet orange of Sindhuli, widely known as Junar, is particularly celebrated nationwide for its delicious taste and high nutritional value (MoAD, 2011).

Despite the promising potential of sweet orange cultivation, several challenges hinder the full realization of its production capacity (Adhikari et al., 2016 ; Acharya et al., 2019). Traditional management practices, limited irrigation facilities, and a lack of advanced agricultural technologies are significant obstacles. Farmers often struggle with low productivity despite the favorable climate and environment (Bibash, 2011). Additionally, there is a considerable gap in the adoption of modern farming techniques and diversification into other crops, which is essential for spreading agricultural risk (Aurora, 2002 ; Dhakal et al., 2021). The Government of Nepal has recognized these challenges and has launched initiatives to address them. The 'One District One Product' (ODOP) program aims to enhance the production and marketing of sweet oranges

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by focusing on district-specific strengths and resources. Furthermore, the Prime Minister Agriculture Modernization Project (PMAMP) has established the Junar Superzone in Sindhuli district (Ghimire et al., 2006). This project is dedicated to research and development, aiming to create and disseminate suitable technologies for sweet orange cultivation (Kaini, 2013). The growing interest in sweet orange cultivation among Nepali farmers is also driven by its export potential. However, the current production levels are insufficient to meet both domestic and international demand. As a result, Nepal imports significant quantities of citrus fruits, including sweet oranges, from neighboring countries like India and China (Reddy, 2011). Addressing these production gaps could not only reduce dependency on imports but also position Nepal as a competitive player in the global citrus market. The total fruit production in Nepal has been expanding due to favorable governance, suitable climatic conditions, and robust market demand (Khadka et al., 2020). However, traditional farming practices and inadequate irrigation facilities continue to pose challenges. To mitigate these issues, initiatives such as the Junar Superzone focus on research and development to improve agricultural practices and enhance productivity (Subedi et al., 2002). In recent years, the adoption of modern agricultural technologies and better management practices has started to gain traction among Nepali farmers. These advancements are crucial for improving productivity and ensuring sustainable growth in the citrus sector (Regmi et al., 2018). Moreover, increasing awareness about the benefits of crop diversification is helping farmers manage agricultural risks more effectively (Shrestha et al., 2020).

The main objective of this study is to analyze the production and marketing scenario of sweet orange in the mid-hills of Nepal, with a specific focus on identifying the challenges and opportunities in this sector. By understanding the current state of sweet orange cultivation and the factors influencing its growth, this study aims to provide insights that can help enhance the economic viability of this important fruit crop in Nepal. In conclusion, sweet orange (Junar) holds significant promise for the agricultural economy of Nepal's mid-hills. With strategic initiatives, improved farming practices, and focused research, the production and market potential of this high-value crop can be substantially realized, benefiting farmers and contributing to the broader economic development of the region.

2. Materials And Methods

2.1 Description of experimental site

The study was conducted in Ramechap district of Madhesh Province for the in-depth study of value chain of sweet orange as it is the major sweet orange growing hub of the country. Ramechhap district of Bagmati province, is the largest producer of sweet oranges. In the district, ward number 4,6,9,13 and 14 of Manthali municipality and ward number, 1,2,4,5,6,7 and 8 of Ramechhap municipality are designated sweet orange zones. Preliminary discussion with the Prime-minister Agricultural Development Office, Program Implementation Office (PMAMP, PIU), Ramechhap suggested that ward number 6 Ramechhap Municipality is the major contributor to the district's production, therefore we considered this location as the origin of our study.

2.2 Selection of Respondents and Sample Size

To ensure a representative and comprehensive understanding of the sweet orange value chain in Ramechhap district, a methodical approach to respondent selection and sample size determination was employed.

2.3 Sweet Orange Farmers

The primary focus was on sweet orange farmers, who form the backbone of the production process. To select these farmers, a proportionate random sampling technique was utilized. This method ensures that the sample accurately reflects the population structure of sweet orange farmers in the district. The Agriculture Knowledge Centre in Ramechhap provided a comprehensive list of sweet orange farmers, which served as the sampling frame. From this list, 60 producers were randomly selected for the household survey. This sample size was deemed adequate to capture a diverse range of farming practices, production scales, and challenges faced by the farmers. The proportionate random sampling method ensured that each farmer had an equal chance of being included in the study, thereby minimizing selection bias.

2.4 Contract Farmers/Traders

In addition to the primary producers, the study also considered the role of contract farmers and traders who facilitate the movement of sweet oranges from farms to markets. To capture their perspectives, 10 contract farmers/traders were randomly selected from various areas within the designated sweet orange zones. This random selection process aimed to include a mix of individuals involved in different stages of the value chain, providing a holistic view of the trading dynamics and contractual arrangements in the sweet orange industry.

2.5 Retailers

Retailers play a crucial role in the final stage of the value chain, bridging the gap between producers and consumers. To understand their challenges and contributions, 5 retailers were randomly chosen for the survey. The inclusion of retailers aimed to shed light on market conditions, pricing strategies, and consumer preferences, thereby offering a complete picture of the value chain from production to retail.

2.6 Key Informants

To supplement the quantitative data and provide deeper insights into the value chain, 2 key informants were selected. These individuals were chosen based on their extensive knowledge and experience in the sweet orange industry. They included experts from agricultural extension services, local government officials, or industry leaders. Key informants provided qualitative information regarding policy frameworks, market trends, and potential areas for improvement in the value chain.

2.7 Data collection and observation

The research utilized both primary and secondary data, employing various sources and techniques to gather relevant information.

2.7.1 Primary Data Collection

Primary data was directly collected from main sources through interviews, surveys, and field observations. The methodologies employed included:

2.7.2 Questionnaire Surveys

Pre-tested questionnaires were prepared for the household survey, targeting the three major actors in the value chain: sweet orange farmers, traders/wholesalers, and retailers. The questionnaire was designed to gather comprehensive information on input supplies, sold products, labor costs, production and processing costs, marketing costs, demographic information, and socioeconomic information.

2.8 Interviews

2.8.1 Sweet Orange Farmers

Face-to-face interviews were conducted with sweet orange farmers at their individual homes and gardens during the daytime. These interviews aimed to capture detailed information on farming practices, challenges, and economic aspects of sweet orange production.

2.8.2 Key Market Actors

Interviews were also conducted with key market actors, including contract farmers, traders, and retailers. These interviews provided insights into the dynamics of the sweet orange market, including pricing strategies, market access, and distribution channels.

2.8.3 District-level Stakeholders

Key informant interviews were conducted with district-level stakeholders and leaders of cooperatives. Both structured and unstructured interviews were used to gather qualitative insights into the existing market scenario, upgrading strategies, opportunities, constraints, and other relevant information.

2.8.4 Field Observations

Before conducting the survey, field observations were carried out in the study area. These observations included visits to input suppliers, service providers, and cooperatives involved in sweet orange production and marketing. Field observations helped in understanding the operational environment and identifying key factors influencing sweet orange production and marketing in Ramechhap district.

The household survey was conducted between March and June 2024 in Ramechhap district. During this period, I visited the selected respondents' homes and gardens to collect data through face-to-face interviews and observations.

2.9 Secondary Data Collection

Secondary data was obtained through a comprehensive review of various sources, such as reports and articles from government agencies and non-governmental organizations provided valuable insights into policies, market trends, and production statistics relevant to sweet orange cultivation. Academic journals and books offered theoretical and empirical insights into agricultural practices, value chain analysis, and market dynamics. Relevant internet materials and publications from reputable organizations such as the Food and Agriculture Organization (FAO), Ministry of Agriculture and Livestock Development (MoALD), Nepal Agricultural Research Council (NARC), Prime Minister Agriculture Modernization Project (PMAMP), and Agriculture Knowledge Centre (AKC) were reviewed to gather additional data and contextual information.

2.10 Data Analysis

The data collected from the survey was systematically processed and analyzed to ensure accuracy and comprehensiveness. Initially, the survey data was coded and directly entered into the Statistical Package for Social Science (SPSS Version 26). To enhance data quality, meticulous detection and removal of errors and inconsistencies were conducted. Various graphs and charts were created using Microsoft Excel 2021 to visually represent the data. The quantitative data obtained from the survey was analyzed using both descriptive and analytical statistics. Descriptive analysis employed simple statistics such as sum, mean, relative frequency, maxima and minima, and standard deviation to summarize the data.

2.11 Economic analysis

Economic analysis was done using different formulas.

2.11.1 Cost of Production

Cost of production is the whole cost of producing and selling a good or service. Both fixed cost and variable cost are added where, fixed cost: sapling and land rent, similarly other expenses are variable cost.

Cost of production= Total fixed cost + Total variable cost

2.11.2 Benefit-cost Ratio

Benefit cost ratio is a financial metric used to evaluate the cost-effectiveness of a project or investment. It is a ratio of the benefits derived from a project compared to the costs incurred. Benefit cost ratio was also calculated to study the economic viability of sweet orange farming.

If B/C ratio is greater than 1, the farm business is considered to be profitable.

If B/C ratio is less than 1, the farm business is considered to be in loss.

If B/C ratio is equal to 1, the farm business is recovering cost of produced.

Benefit cost ratio of mandarin in the study area was calculated as Using undiscounted formula, where B/C ratio = Total benefit/Total cost

2.11.3 Gross Return, Gross Margin and Net profit

The gross margin is an easy and quick approach to schedule tasks or analyze a farm business. In order to demonstrate that the projects chosen are both technically and financially feasible and meet the needs of the intended beneficiaries, gross margin analysis is used (Sciences, 2011).

Gross return = Total selling production (kg)* average farm gate price (NRs.)

Gross margin = Gross return – Total variable cost

Net profit = Gross return- Total cost

2.11.4 Price spread, and producer shares

The gap between the price paid by the consumer and the price received by the farmer. It includes various costs spent by various intermediaries as well as their margins. Marketing costs are the actual charges incurred in transporting goods and services from the producer to the customer.

Price spread = Price paid by consumer - Net price received by producer i.e., farm gate price Producer shares = (Pf/Pr) × 100%

Where, Pf = Producer's price (farm gate price)

Pr = Retailer's price

2.11.5 Minimum support price

The government uses the Minimum Support Price (MSP) as a kind of market intervention to protect farmers from a sudden drop in farm prices. Minimum Support Prices (MSPs) in the agricultural sector are subsidy programs for governments to accomplish two main goals: (i) to protect farmers from a decline in crop market prices, and (ii) to increase availability of certain vital commodities (Prashant Chintapalli, 2022). The commission on agricultural cost and price makes the announcement so that farmers and grain dealers can grow and sell their products in a secure manner. Due to several factors, growers often end up selling their harvests below MSP, which can result in losses or extremely poor profits for the farmers (Sarthak Gupta, 2020). However, the MSP for mandarin has not been announced yet. So, the MSP for sweet orange was calculated by using the following formula.

MSP= (cost of production+25% of cost of production)/ Total yield

3. RESULTS

3.1 Response of respondents for the socio-economic characteristics:

3.1.1 Gender of respondents

The survey results indicate that males were the predominant contributors to the socio-economic characteristics. Out of 60 respondents, 49 (81.7%) were male, while 11 (18.3%) were female. This significant gender disparity highlights the higher participation of males in contributing to socio-economic conditions.

3.1.2 Age of Respondents

The survey included a total of 60 respondents, representing 100% of the sample population. Among these respondents, the distribution across different age groups varied significantly. Young adults, aged 20-34, constituted the smallest group with just 3 respondents, making up 5.0% of the total. Middle-aged adults, aged 35-49, were the largest group, comprising 26 respondents or 43.3% of the sample. Older adults, aged 50-64, followed closely with 24 respondents, accounting for 40.0%. Seniors, aged 65-79, formed the remaining segment with 7 respondents, representing 11.7% of the total. This diverse age distribution highlights a balanced representation across middle-aged and older adults, with fewer participants from the younger and senior age brackets.

3.1.3 Family size of respondents

The survey, which included 60 respondents representing 100% of the sample population, revealed distinct patterns in family size among the participants. A majority of respondents, 35 in total or 58.3%, reported having medium-sized families consisting of 5-7 members. Small families, with 2-4 members, were the second most common, with 19 respondents, accounting for 31.7% of the total. Large families, comprising 8-11 members, were the least represented, with 6 respondents making up 10.0% of the sample. These results underscore a predominance of medium-sized families among the surveyed group, with smaller and larger families being less common.

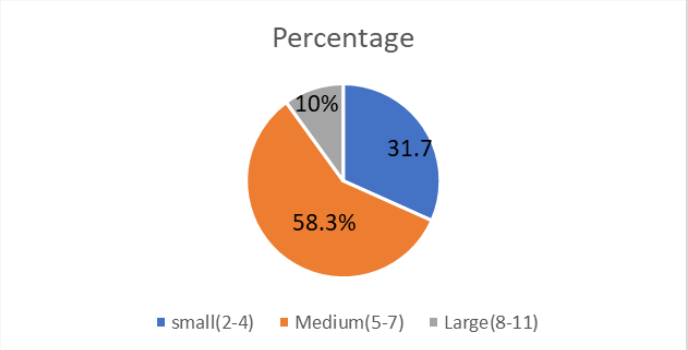

Figure 4: Showing the Family size respondent

3.1.4 Ethnicity of respondents

The survey, encompassing 60 respondents and representing 100% of the sample population, revealed notable trends in the ethnic and socioeconomic composition of participants. The overwhelming majority of respondents, 42 individuals or 70.0%, identified as Janajati. This

significant representation may reflect the broader socioeconomic diversity within the Janajati community. Chhetri participants constituted the second-largest group, with 17 respondents, making up 28.3% of the sample. This sizable proportion suggests a notable socioeconomic presence of the Chhetri community. Brahmin respondents were the least represented, with only 1 individual, accounting for 1.7% of the total. This minimal representation could indicate lower socioeconomic diversity within the Brahmin group in the surveyed population. Overall, these findings highlight a significant predominance of Janajati, with Chhetri also forming a substantial portion, while Brahmin representation remained minimal, reflecting varying socioeconomic statuses across different ethnic groups.

3.1.5 Religion of respondents

The survey, which included 60 respondents representing 100% of the sample population, revealed an equal distribution in religious affiliation among participants. Half of the respondents, 30 individuals or 50.0%, identified as Hindu, while the other half, also 30 individuals or 50.0%, identified as Buddhist. This balanced representation of Hindu and Buddhist respondents underscores the significant contributions of both religious groups to the socioeconomic fabric of the surveyed population. Hindus and Buddhists, each comprising half of the respondents, likely play crucial roles in various sectors such as business, education, and cultural activities, reflecting their substantial influence on the community's socioeconomic dynamics. Equal representation also suggests a harmonious coexistence and potential for collaborative efforts in socioeconomic development between the two religious groups. Overall, these findings highlight the vital and balanced contributions of both Hindu and Buddhist communities to the socioeconomic landscape.

3.1.6 Education of respondents

The survey findings, reflecting responses from a diverse group of 60 individuals, offer insights into the educational landscape that significantly influences socioeconomic dynamics within the community. Among the respondents, 14 individuals (23.3%) reported being illiterate, indicating a notable segment facing challenges in accessing formal education. Another 13 respondents (21.7%) had completed only primary school, underscoring a critical need for improved foundational education opportunities. Moving to higher educational levels, 14 respondents (23.3%) had completed secondary school, suggesting a moderate level of educational attainment that supports various semi-skilled roles within the community. In contrast, 16 respondents (26.7%) had achieved higher secondary school education, indicating a higher skill level and potentially better employment prospects. However, university-level education was notably underrepresented, with only 3 individuals (5.0%) reporting having obtained a university degree. This highlights significant barriers to accessing higher education, which is crucial for advancing into skilled professions and leadership roles. Overall, these findings illustrate the diverse educational achievements among respondents, emphasizing existing gaps and opportunities for enhancing socioeconomic development within the community.

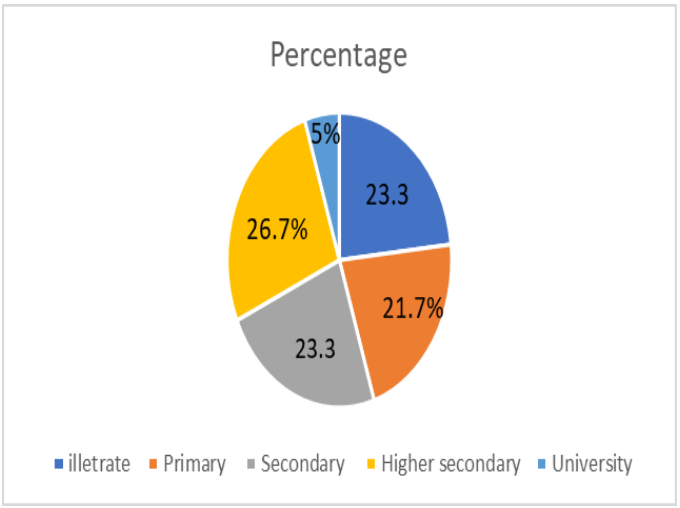

Figure 7: Showing the education of respondent

Table 1: Response of respondents for the socio-economic characteristics.

Socio-economic characteristics	Frequency	Percentage
Gender of respondents		
Male	49	81.7
Female	11	18.3
Total	60	100.0
Age of respondents		
Young adults (20-34)	3	5.0
Middle aged adults (35-49)	26	43.3
Older adults (50-64)	24	40.0
Seniors (65-79)	7	11.7
Total	60	100.0
Family size of respondents		
Small (2-4)	19	31.7
Medium (5-7)	35	58.3
Large (8-11)	6	10.0
Total	60	100.0
Ethnicity of respondents		
Brahmin	1	1.7
Chhetri	17	28.3
Janajati	42	70.0
Total	60	100.0
Religion of respondents		
Hinduism	30	50.0
Buddhist	30	50.0
Total	60	100.0
Education of respondents		
Illiterate	14	23.3
Primary school	13	21.7
Secondary school	14	23.3
Higher secondary school	16	26.7
University degree	3	5.0
Total	60	100.0

3.2 Response of respondents on the agricultural attributes for orange cultivation

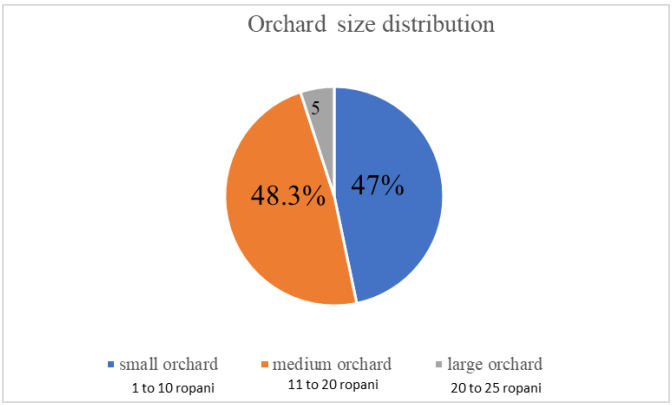

Figure 8: Showing the orchard size distribution

3.2.1 Area of orchards

The survey findings from 60 participants shed light on crucial agricultural attributes for orange cultivation, particularly focusing on orchard size. The results reveal that a significant portion of respondents, 48.3% (29 individuals), manage medium-sized orchards spanning 11 to 20 units. Additionally, 46.7% (28 respondents) oversee smaller orchards ranging from 1 to 10 units. In contrast, a smaller group of respondents, constituting 5.0% (3 individuals), operate larger orchards exceeding 20 units. These findings highlight a predominant emphasis on medium and small-scale orchards among respondents, showcasing the diverse operational scales within orange cultivation. This variation in orchard sizes is pivotal as it influences agricultural practices and economic outcomes associated with orange farming, underscoring the nuanced approaches and challenges in managing orchards of different sizes.

3.2.2 Organizational support

Insights gleaned from responses by 60 participants highlight the pivotal role of organizational support in enhancing orange cultivation practices. A majority of respondents, comprising 55.0% (33 individuals), acknowledged receiving support from PIU AKC (Project Implementation Unit of Agriculture Knowledge Center), indicating substantial backing from this organization. Additionally, 43.3% (26 respondents) benefited from support provided by PIU Ramechhap. In contrast, a mere 1.7% (1 individual) reported receiving no organizational support. These findings underscore how organizational support, particularly from PIU AKC and PIU Ramechhap, significantly influences the success and sustainability of orange farming efforts. Supportive initiatives likely include resources, expertise, and possibly financial aid, crucial for improving agricultural practices and boosting yields. The predominant reliance on PIU AKC underscores its widespread influence and effective assistance in agricultural development, while the representation of PIU Ramechhap highlights regional support efforts. The small proportion reporting no support indicates potential challenges or gaps that could impact agricultural productivity among respondents. Overall, these insights emphasize the critical role of organizational support in fostering successful orange cultivation practices and enhancing agricultural outcomes.

3.2.3 Knowledge for cultivation

Insights gathered from the survey highlight the various sources of knowledge crucial for successful orange cultivation. Among the respondents, neighbors emerged as the most significant source, with 56.7% (34 individuals) relying on local expertise and experience for agricultural know-how. Relatives also played a notable role, cited by 16.7% (10 respondents), underscoring the influence of familial agricultural traditions and practices. In terms of formal education, 10.0% (6 individuals) benefited from both extension training and farm visits, emphasizing the practical and educational aspects of hands-on learning. Additionally, 8.3% (5 respondents) indicated that extension training alone provided valuable agricultural insights, highlighting the impact of structured educational programs on farming practices. Furthermore, 5.0% (3 respondents) mentioned receiving knowledge from developmental organizations, illustrating the supportive role of institutions in enhancing agricultural knowledge and practices. These findings demonstrate the diverse and interconnected sources of knowledge that contribute significantly to improving orange cultivation techniques and fostering sustainable agricultural practices among respondents.

3.2.4 Reason for cultivation

The survey findings from 60 respondents illuminate the motivations behind orange cultivation, revealing diverse reasons driving agricultural practices. A significant majority of respondents, 86.7% (52 individuals), cited income generation as the primary reason for cultivating oranges. This underscores the economic importance of orange farming in enhancing household income and livelihoods. In contrast, a smaller proportion of respondents, 6.7% each (4 individuals), identified suitable agro-climate conditions as their reason for cultivation. Another 6.7% (4 respondents) mentioned both income generation and favorable agro-climate conditions as motivating factors, highlighting a combined focus on economic viability and environmental suitability in their agricultural endeavors. These findings underscore the multifaceted motivations for orange cultivation among respondents, emphasizing both economic incentives and environmental considerations. This dual focus reflects the strategic approach taken by farmers in leveraging local agro-climatic conditions to maximize income while ensuring sustainable agricultural practices.

3.2.5 Varieties used

The survey of 60 respondents reveals the predominant use of local orange varieties, with 83.3% (50 individuals) opting for indigenous breeds. A smaller percentage, 5.0% (3 respondents), specifically cultivate Dhankuta local oranges. Additionally, 10.0% (6 respondents) combine local varieties with Valancia late, indicating a blend of traditional and imported cultivars. A minimal 1.7% (1 respondent) reported cultivating Washington noble and Valancia late varieties. These findings underscore the preference for local orange varieties among respondents, with some adopting hybrid approaches to leverage diverse characteristics for cultivation.

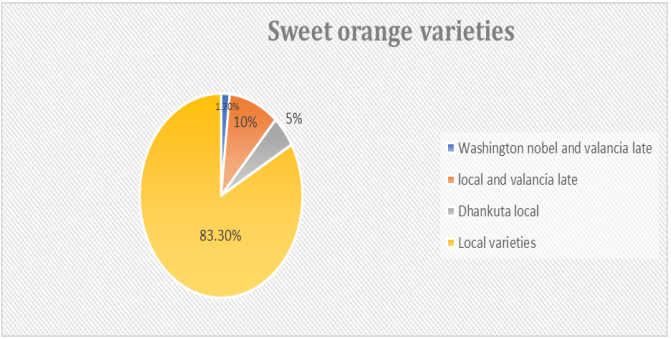

Figure 11: Showing the varieties used

3.2.6 Irrigation facilities

The survey results indicate that 90.0% of respondents (54 individuals) have access to irrigation facilities, underscoring the critical role of consistent water supply in orange cultivation. Conversely, 10.0% (6 respondents) reported lacking such infrastructure, potentially impacting agricultural productivity. These findings highlight the majority's reliance on irrigation for efficient water management, crucial for sustaining orange orchards and optimizing crop yields under varying climatic conditions.

3.2.7 Intercropping

Survey findings reveal that 68.3% of respondents (41 individuals) engage in intercropping practices, indicating the widespread adoption of this agricultural strategy alongside orange cultivation. Conversely, 31.7% (19 respondents) do not practice intercropping. These results underscore the significant preference for integrating multiple crops within orange orchards, reflecting efforts to maximize land use efficiency and diversify agricultural outputs.

3.3 Response of Respondents on the marketing factors of orange:

3.3.1 Marketing factors

The survey findings highlight the diverse responses regarding the marketing factors influencing orange cultivation among 60 respondents. The majority, comprising 76.7% (46 individuals), indicated that traders are their primary sales destination for oranges. Additionally, 21.7% (13 respondents) sell directly to consumers, suggesting a direct marketing approach. A small fraction of respondents, 1.7% (1 individual), reported village collectors as their sales destination. These results underscore the significant role of traders in the marketing chain of oranges, reflecting the predominant reliance on intermediary channels for distributing produce to wider markets.

3.3.2 Treader contact route

The survey responses from 60 participants provide insights into the contact routes used by traders in the marketing of oranges. The majority, 58.3% (35 individuals), reported engaging directly with traders for their orange sales, highlighting the central role of intermediary channels in marketing. Additionally, 18.3% (11 respondents) mentioned consumers as their contact route, indicating a direct sales approach to end-users. A smaller portion of respondents, 13.3% (8 individuals), cited relatives as their contact route, reflecting familial networks in marketing practices. Neighbors were mentioned by 6.7% (4 respondents) and international NGOs or JICA by 3.3% (2 respondents) as alternative contact routes. These findings underscore the varied strategies employed by respondents in engaging with different stakeholders to market oranges effectively.

3.3.3 Transportation mode

The survey findings from 60 respondents shed light on the transportation modes used for orange distribution. A significant majority, 51.7% (31 individuals), reported relying on traders to facilitate transportation, indicating a common practice of utilizing intermediary logistics for market access. Additionally, 30.0% (18 respondents) use tractors for transportation, showcasing mechanized methods to streamline distribution processes. A smaller yet notable proportion, 18.3% (11 respondents), employ carrying baskets for transportation, reflecting traditional means of transporting smaller quantities. These results underscore the diverse transportation strategies employed by respondents to ensure efficient orange distribution from farms to markets.

3.3.4 Market type

The market type preferences for orange sales among respondents show that 58.3% (35 individuals) prefer distant markets, indicating a preference for broader market reach and potentially higher sales volumes. In contrast, 41.7% (25 respondents) opt for proximal markets, emphasizing the convenience and potentially lower transportation costs associated with nearby markets. These preferences highlight varying strategic approaches to market access and distribution among orange cultivators.

3.3.5 Product sold phase

The survey results indicate diverse approaches among respondents regarding the phase at which oranges are sold. A majority, 58.3% (35 individuals), engage in contract trading before fruiting, emphasizing pre-sale agreements aimed at securing market access early in the cultivation cycle. In contrast, 41.7% (25 respondents) sell their oranges at maturity, highlighting a strategy of waiting until the fruit is fully developed before entering the market. These findings underscore the strategic variability among orange cultivators in timing their sales to optimize market conditions and ensure reliable income from their produce.

3.4 Response of respondents on the post-harvest processing and post-harvest loss of orange

3.4.1 Post-harvest processing and losses

The survey results from 60 respondents provide insights into post-harvest processing and losses in orange cultivation. Regarding cleaning practices, 60.0% (36 individuals) indicated they clean oranges post-harvest, highlighting efforts to maintain product quality. In sorting and grading, 73.3% (44 respondents) engage in these activities, essential for ensuring uniformity and market readiness. Packaging practices, however, are less common, with only 28.3% (17 individuals) opting for packaging, potentially impacting product presentation and shelf life. In terms of processing oranges after harvest, only 1.7% (1 respondent) reported engaging in such activities, suggesting limited value addition post-harvest. Storage facilities are similarly underutilized, with only 3.3% (2 respondents) employing proper storage methods, which could affect shelf life and market readiness.

Concerning post-harvest losses, 65.0% (39 respondents) reported minimal losses ranging from 0-5%, highlighting effective post-harvest management practices. However, 35.0% (21 respondents) noted losses between 5-10%, indicating potential areas for improvement in handling and storage practices. These findings underscore the varied approaches to post-harvest management among respondents, with opportunities for enhancing processing, storage, and minimizing losses to optimize orange cultivation outcomes.

Table 4: Response of respondents on the post-harvest processing and post-harvest loss of orange.

Post-harvest processing and losses	Frequency	Percentage
Cleaning		
Yes	36	60.0
No	24	40.0
Total	60	100.0
Sorting and Grading		
Yes	44	73.3
No	16	26.7
Total	60	100.0
Packaging		
Yes	17	28.3
No	43	71.7
Total	60	100.0
Processing		
Yes	1	1.7
No	59	98.3
Total	60	100.0
Storage		
Yes	2	3.3
No	58	96.7
Total	60	100.0
Post-harvest loss		
0-5 %	39	65.0
5-10 %	21	35.0
Total	60	100.0

3.5 Response of respondents on the farm inputs and certification of orange orchard:

3.5.1 Farm inputs and certification

The survey findings from 60 respondents provide detailed insights into farm inputs and certification practices related to orange orchards. Regarding fertilizer use, the majority (88.3%, 53 individuals) reported using their own supply, showcasing a preference for self-sufficiency in managing soil nutrients. A smaller proportion relied on agrovets (8.3%, 5 individuals) for fertilizer, with negligible contributions from cooperatives and minimal non-use.

In terms of manure, all respondents (100.0%, 60 individuals) indicated using their own resources, emphasizing the widespread practice of organic farming methods among orange cultivators. For tools and equipment, a significant majority (83.3%, 50 individuals) sourced these

from PIU Ramechhap, highlighting institutional support in enhancing agricultural efficiency. A smaller number (13.3%, 8 individuals) utilized their own tools, while a minimal percentage (3.3%, 2 individuals) relied on agrovets.

Capital investments were exclusively from personal funds for all respondents (100.0%, 60 individuals), underscoring the self-financed nature of agricultural operations among orange farmers. In other input categories, respondents reported diverse sources, with significant contributions from cooperatives (18.3%, 11 individuals), other farmers (13.3%, 8 individuals), and their own resources (60.0%, 36 individuals), indicating a collaborative approach alongside individual efforts. Minimal contributions came from agrovets and NGOs/INGOs.

Regarding farm certification, the vast majority of respondents (98.3%, 59 individuals) reported having farm certification, highlighting a commitment to quality assurance and possibly accessing markets that prioritize certified produce. Only a single respondent (1.7%) reported not having certification, suggesting potential opportunities or barriers in obtaining formal recognition. These findings underscore the varied and comprehensive strategies employed by respondents in managing farm inputs and ensuring quality standards through certification processes. The predominant use of own resources for inputs and high certification rates reflects a proactive approach towards sustainable and efficient orange cultivation practices among the surveyed farmers.

Table 5: Response of respondents on the farm inputs and certification of orange orchard.

Farm inputs and certification	Frequency	Percentage
Fertilizer		
Agrovet	5	8.3
Cooperatives	1	1.7
Own	53	88.3
Not used	1	1.7
Total	60	100.0
Manures		
Own	60	100.0
Tools and equipment		
Agrovet	2	3.3
Own	8	13.3
PIU Ramechhap	50	83.3
Total	60	100.0
Capital		
Own	60	100.0
Others		
Agrovets	4	6.7
Cooperatives	11	18.3
NGOS/INGOS	1	1.7
Other farmers	8	13.3
Own	36	60.0
Total	60	100.0
Farm certification		
Yes	59	98.3
No	1	1.7
Total	60	100.0

3.6 Descriptive analysis of sweet orange farmers and related parameters

The descriptive analysis of sweet orange farmers reveals a diverse range of characteristics and productivity levels among respondents. The average age of respondents is 50.23 years, with ages spanning from 29 to 74 years, indicating a broad demographic spectrum. Family sizes average 5.30 members per household, ranging from 2 to 11 members, highlighting typical family dynamics in farming communities. Orchards managed by respondents average 11.03 acres in size, varying from 1 to 25 acres, showcasing varied scales of agricultural operations. Productive orange trees average 198.02 per farmer, with counts ranging widely from 30 to 500 trees, indicating both small and larger-scale orchard management. In contrast, respondents manage an average of 41.60 unproductive trees, ranging from none to 200 trees, suggesting potential factors affecting orchard efficiency. Annual orange production averages 6817.75 oranges per farmer, with production levels varying significantly from 550 to 20700 oranges annually, reflecting diverse productivity outcomes among respondents. These statistics provide a detailed snapshot of the demographic, agricultural, and productivity characteristics among sweet orange farmers, highlighting the variability and dynamics within the farming community.

Table 6: Descriptive analysis of sweet orange farmers and related parameters

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Age of respondents	60	29	74	50.23	11.021
Family size	60	2	11	5.30	1.942
Orchard area	60	1	25	11.03	6.056
Productive tree	60	30	500	198.02	131.763
Unproductive tree	60	0	200	41.60	48.821
Total orange produced annually	60	550	20700	6817.75	5035.486

3.7 Financial indicators of sweet orange production in the study area

The financial analysis presented in **Table 7** illustrates key indicators of sweet orange production in the study area. The average total annual cost was 230,018.2, while the total annual return reached 436,970.1, resulting in a benefit-cost (BC) ratio of 1.89. These findings underscore the economic feasibility and profitability of sweet orange farming for local producers.

Table 7: Financial indicators of sweet orange production in the study area.

Indicators	Average value
Total annual cost	230018.2
Total return annually	436970.1
BC ratio	1.89

3.8 Measures of association between total annual orange production with socio-economic characters, agricultural attributes, and marketing factors

Table 8 presents detailed insights into the factors influencing total annual orange production among respondents, encompassing socio-economic, agricultural, and marketing variables. Key findings reveal significant associations that shed light on factors contributing to production variability. For instance, family size demonstrates a notable association ($F = 4.835$, $p = 0.011$), indicating that larger families tend to correlate with higher production levels. Education level emerges as highly significant ($F = 4.638$, $p = 0.003$), with higher education significantly enhancing

production outcomes (Eta squared = 25.2%), underscoring the role of knowledge and skills in agricultural management. Orchard area stands out as the strongest predictor (F = 9.664, p < 0.001), where larger orchards correlate with increased production (Eta squared = 25.3%), highlighting the importance of land resource management. Religious affiliation (F = 6.619, p = 0.013) and using traders as a contact route (F = 8.710, p < 0.001) also show substantial impacts, indicating that cultural and market factors play pivotal roles in production variability. These findings underscore the complex interplay of socio-economic factors, agricultural practices, and market dynamics in shaping orange production outcomes, providing critical insights for enhancing productivity and sustainability in sweet orange farming contexts.

Table 8: Measures of association between total annual orange production with socio-economic characters, agricultural attributes, and marketing factors.

Factors and attributes	F value	Significance	Measures of association	
			Eta	Eta squared
Gender of respondents	0.383	0.538	0.081	0.007
Age of respondents	1.940	0.134	0.307	0.094
Family size of respondents	4.835	0.011**	0.381	0.145
Ethnicity of respondents	0.450	0.640	0.125	0.016
Religion of respondents	6.619	0.013**	0.320	0.102
Education of respondents	4.638	0.003**	0.502	0.252
Area of orchards	9.664	0.000***	0.503	0.253
Organizational support	1.893	0.160	0.250	0.062
Knowledge for cultivation	3.716	0.006**	0.506	0.256
Reason for cultivation	0.482	0.620	0.129	0.017
Varieties used	0.294	0.829	0.125	0.016
Irrigation facilities	0.050	0.823	0.029	0.001
Intercropping	0.000	0.989	0.002	0.000
Sales destination	5.319	0.008**	0.397	0.157
Traders contact route	8.710	0.000***	0.623	0.388
Transportation mode	0.658	0.522	0.150	0.023
Market type	0.144	0.706	0.050	0.002
Product sold phase	2.472	0.093	0.283	0.080

3.9 Ranking of major orange production problems using indexing techniques

Table 9 presents a comprehensive ranking of major challenges in orange production as identified by respondents, utilizing indexing techniques to assess severity and impact. The most critical issue identified is the lack of irrigation facilities, rated severe by 46 respondents, underscoring significant challenges in water management crucial for orange cultivation (Index value = 0.896, Rank I). Diseases, insects, and pests follow, with varying degrees of severity: 3 respondents rated it severe, 31 moderates, and 25 slight, highlighting ongoing concerns in pest management (Index value = 0.650, Rank III). Low technical knowledge ranks next, noted as severe by 19 respondents, emphasizing the need to enhance technical skills among farmers (Index value = 0.721, Rank II). Insufficient labor is another significant challenge, rated severe by 7 respondents, impacting operational efficiency (Index value = 0.646, Rank IV). Limited access to fertilizers and other inputs, market price fluctuations, and post-harvest losses round out the rankings, each highlighting distinct obstacles faced by orange farmers. These findings provide valuable insights into priority areas for intervention and support to enhance productivity and sustainability in orange farming contexts.

Table 9: Ranking of major orange production problems using indexing techniques.

Problems	Severe	Moderate	Slight	No problem	Index value	Score
Diseases, insects and pests	3	31	25	1	0.650	III
Lack of irrigation facilities	46	6	5	3	0.896	I
Insufficient labor	7	25	24	4	0.646	IV
Low technical knowledge	19	19	18	4	0.721	II
Limited fertilizers and other inputs	6	21	21	12	0.588	V
Post-harvest loss	1	3	47	9	0.483	VII
Market price fluctuation	5	15	32	8	0.571	VI

3.10 Ranking of major orange marketing problems using indexing techniques

Table 10 offers a detailed ranking of significant challenges in orange marketing based on responses from respondents, using indexing techniques to gauge severity and impact. The foremost issue identified is the lack of processing technology, rated severe by 53 respondents, emphasizing the critical need for improved processing capabilities to enhance market competitiveness and product value (Index value = 0.929, Rank I). Following closely, the lack of post-harvest technology ranks as a severe concern for 49 respondents, highlighting deficiencies in handling practices crucial for maintaining orange quality and market value (Index value = 0.908, Rank II). Interference of middlemen is noted as severe by 17 respondents, with 15 indicating moderate and 9 slight concerns, illustrating challenges related to market intermediaries impacting profitability and market access (Index value = 0.625, Rank III). Issues such as low value at the farm gate, weak coordination with traders, and transportation problems also feature, each presenting distinct challenges affecting marketing efficiency and farmer incomes. These findings underscore the complex dynamics of orange marketing, highlighting key areas where targeted interventions and improvements could enhance market outcomes and support sustainable growth in the orange farming sector.

Table 10: Ranking of major orange marketing problems using indexing techniques.

Problems	Severe	Moderate	Slight	No problem	Index value	Score
Interference of middleman	17	15	9	19	0.625	III
Lack of processing technology	53	1	2	4	0.929	I
Low value at farm gate	2	36	12	10	0.625	III
Weak coordination and communication with traders	1	21	25	13	0.542	IV
Lack of post-harvest technology	49	5	1	5	0.908	II
Transportation problems	1	5	4	50	0.321	V

3.11 Correlations

Table 9 provides insights into the factors influencing sweet orange production. A strong positive correlation exists between orchard area ($r = 0.586$, $p < 0.01$) and orange yields, indicating that larger orchards significantly enhance production. Similarly, the number of productive trees strongly correlates with production ($r = 0.753$, $p < 0.01$), highlighting the importance of effective tree management practices, such as pruning and fertilization. Moderate positive correlations were found for family size ($r = 0.342$, $p < 0.01$), where larger families likely contribute more labor, and education level ($r = 0.502$, $p < 0.01$), suggesting that educated farmers adopt advanced techniques and better decision-making. However, religion negatively correlates with production ($r = -0.320$, $p = 0.013$), possibly reflecting socio-cultural practices that influence farming activities. Factors such as gender, caste, irrigation facilities, and transportation costs showed no statistically significant correlation with production, suggesting their impacts are either limited or context specific. These findings highlight the multifaceted nature of orange production and the need for strategies targeting orchard management, education, and socio-cultural challenges to improve productivity and sustainability in orange farming.

3.12 Correlations

Total orange produced annually			Gender	Age	Family size	Caste	Religion	Education	Area	Organization support	Varieties used	Intercropping	Irrigation facilities	Trasportation Cost Rs/k g	Productivetree
Total orange produced annually	Person Correlation	1	-.081	.342**	.241	.123	-.320*	.11 2	.586**	-.195	.06 1	.002	-.029	.024	.753**
	Sig. (2taile d)		.538	.007	.064	.350	.01 3	.39 5	.000	.135	.64 4	.989	.82 3	.855	.000
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Gend Peaerrson Correlation		-.081	1	-.184	-.029	.128	-.129	-.298*	.083	-.048	-.203	-.137	.15 8	-.052	.154
Sig. (2tailed)			.538		.160	.825	.330	.32 5	.02 1	.526	.717	.11 9	.295	.22 8	.696	.240
	N		60	60	60	60	60	60	60	60	60	60	60	60	60	60
Age	Pearson Correlation		.342**	-.184	1	.126	.249	-.281*	-.045	.208	-.127	-.168	-.162	.11 9	.145	.129
	Sig. (2taile d)		.007	.160		.338	.056	.03 0	.73 1	.111	.333	.19 8	.216	.36 5	.268	.328
	N		60	60	60	60	60	60	60	60	60	60	60	60	60	60
Famil y size	Pearson Correlation		.241	-.029	.126	1	.133	-.173	-.023	.191	.206	.09 0	.136	-.006	-.067	.209
	Sig. (2tailed)		.064	.825	.338		.310	.18 6	.86 0	.144	.115	.49 2	.301	.96 5	.609	.108
	N		60	60	60	60	60	60	60	60	60	60	60	60	60	60
Cast e	Pearson Correlation		.123	.128	.249	.133	1	-.634**	-.325*	.076	-.196	-.233	-.071	.23 3	-.014	.161

	Sig. (2tailed)	.350	.330	.056	.310		.00 0	.01 1	.565	.134	.07 3	.592	.07 3	.913	.219
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Religion	Pearson	-.320*	-.129	-.281*	-.173	-.634**	1	.230	-.278*	.159	.12 6	.179	-.111	-.025	-.284*
	Correlation														
	Sig. (2tailed)	.013	.325	.030	.186	.000		.07 7	.032	.226	.33 7	.171	.39 8	.847	.028
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Education	Pearson	.112	.298*	-.045	-.023	-.325*	.23 0	1	-.147	-.054	.09 0	.291*	-.266*	-.171	-.043
	Correlation														
	Sig. (2taile d)	.395	.021	.731	.860	.011	.07 7		.261	.684	.49 5	.024	.04 0	.191	.743
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Area	Pearson	.586**	.083	.208	.191	.076	-.278*	-.147	1	-.010	.18 7	-.219	-.155	.145	.782**
	Correlation														
	Sig. (2taile d)	.000	.526	.111	.144	.565	.03 2	.26 1		.941	.15 3	.093	.23 6	.268	.000
	N	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Organization support	Pearson Correlation	-.195	-.048	-.127	.206	-.196	.15 9	-.054	-.010	1	-.052	-.131	-.159	.004	-.005
	Sig. (2taile d)	.135	.717	.333	.115	.134	.22 6	.684	.941		.69 3	.320	.22 6	.976	.969

**. Correlation is significant at the 0.01 level (2-tailed) & * is at the 0.05 level (2tail

3.13 Variables Entered/Removed

In the regression analysis conducted to determine factors influencing the total annual orange production, a comprehensive model was developed incorporating various socio-economic and agronomic variables. The model included fourteen independent variables: unproductive tree count, organization support, gender, productive tree count, transportation cost per kilogram, age, family size, education level, irrigation facilities, varieties used, religion, intercropping practices, caste, and cultivated area. Notably, no variables were removed from the analysis, ensuring a robust examination of all considered factors. The "Enter" method was utilized, allowing simultaneous inclusion of all specified variables in the model. This approach highlights the holistic consideration of multiple dimensions affecting orange production, from demographic aspects like age and gender to agricultural practices such as intercropping and irrigation facilities.

3.14 Model Summary

The regression analysis summary reveals a strong model for predicting total annual orange production, with an R value of 0.875, indicating a high degree of correlation between the observed and predicted values. The model's R Square value of 0.765 suggests that approximately 76.5% of the variability in orange production is explained by the included predictors: unproductive tree count, organization support, gender, productive tree count, transportation cost per kilogram, age, family size, education level, irrigation facilities, varieties used, religion, intercropping practices, caste, and cultivated area. Additionally, the Adjusted R Square value of 0.692 accounts for the number of predictors in the model, confirming its robustness. The standard error of the estimate, at 2796.129, provides a measure of the average distance that the observed values fall from the regression line, further illustrating the model's precision in estimating annual orange production.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.875[a]	.765	.692	2796.129

Predictors : (Constant), Unproductive tree, Organization support, Gender, Productive tree, Transportation cost Rs/kg, Age, Family size, Education, Irrigation facilities, Varieties used, Religion, Intercropping, Caste, Area

3.15 ANOVA

The ANOVA results for the regression model predicting total annual orange production demonstrate the model's statistical significance. The regression sum of squares is 1,144,185,847.779 with 14 degrees of freedom, yielding a mean square of 81,727,560.556. The F-value is 10.453, with a significance level (Sig.) of 0.000, indicating that the model is highly significant. The residual sum of squares is 351,825,223.471 with 45 degrees of freedom, resulting in a mean square of 7,818,338.299. The total sum of squares is 1,496,011,071.250 over 59 degrees of freedom. This analysis confirms that the predictors— unproductive tree count, organization support, gender, productive tree count, transportation cost per kilogram, age, family size, education level, irrigation facilities, varieties used, religion, intercropping practices, caste, and cultivated area—collectively have a significant impact on the total annual orange production.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1144185847.779	14	81727560.5 56	10.453	.000[b]
	Residual	351825223.471	45	7818338.299		
	Total	1496011071.250	59			

- Dependent Variable: Total orange produced annually
- Predictors: (Constant), Unproductive tree, Organization support, Gender, Productive tree, Transportation cost Rs/kg, Age, Family size, Education, Irrigation facilities, Varieties used, Religion, Intercropping, Caste, Area

3.16 Coefficient

The regression coefficients table highlights the influence of various predictors on the total annual orange production. The constant term is not significant (B = -1218.109, p = .839). Among the predictors, the number of productive trees has the highest positive impact (B = 36.465, p < .001), indicating that an increase in productive trees significantly boosts orange production. Age also has a positive and significant effect (B = 103.105, p = .012). Other variables, such as gender, caste, religion, area, organization support, varieties used, intercropping, irrigation facilities, and transportation cost, show varying degrees of influence but are not statistically significant at the 5% level. The unproductive tree count has a minimal and non-significant negative effect (B = -1.731, p = .852). Overall, productive trees and age are the most critical factors in predicting orange production.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardize d Coefficients Beta	t	Sig.
		B	Std. Error			
1	(Constant)	-1218.109	5948.667		-.205	.839
	Gender	-1565.622	1065.668	-.121	-1.469	.149
	Age	103.105	39.451	.226	2.614	.012
	Family size	142.911	213.726	.055	.669	.507
	Caste	-1640.709	1045.949	-.164	-1.569	.124
	Religion	-1779.474	1020.208	-.178	-1.744	.088
	Education	327.466	363.955	.081	.900	.373
	Area	-189.615	126.979	-.228	-1.493	.142

	Coefficients[a]				
Organization support	-1352.952	764.128	-.142	-1.771	.083
Varieties used	1020.033	666.362	.135	1.531	.133
Intercropping	1131.004	936.878	.105	1.207	.234
Irrigation facilities	1883.284	1428.645	.113	1.318	.194
Transportation cost Rs/kg	856.168	608.652	.112	1.407	.166
Productive tree	36.465	5.404	.954	6.748	.000
Unproductive tree	-1.731	9.248	-.017	-.187	.852

a. Dependent Variable: Total orange produced annually

3.17 Marketing channel of sweet orange in the study area:

Marketing is the process of transformation of goods/ commodities from producer level to consumer level. There are different levels during marketing of good producer-middleman–Consumer.

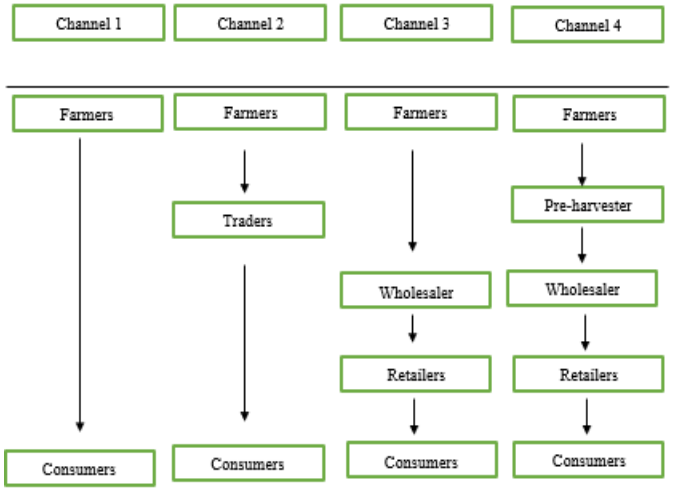

Figure: Existing Marketing channels of Ramechhap District, Nepal (Field survey, 2024)

3.18 Cost of sweet orange production

Here both the fixed cost and variable cost incurred over the course of the year are tabulated. The fixed cost covers the price of sapling and land rent where, the variable cost covers the cost of labor, manure and fertilizer, transportation cost, plant protection, cost, of irrigation and other costs for overall sweet orange production in 1 ha per year. According to the production cost received from the survey data the sweet orange cost of production was found to be NRs. 230018.1 per hector.

Average total cost = Average fixed cost + Average variable cost

=NRs.20669 + NRs.209349.1

= NRs.230018.1 per hector

Table 1: Cost of mandarin production in 1 ha/year	
Description	Average Fixed cost (NRs.)
Sapling	8435.78
Land rent	12233.33
Total fixed cost	**20669.11**
2.Description	**Average variable cost (NRs.)**
Labor	45765.46

Table 1 (cont): Cost of mandarin production in 1 ha/year	
Manure and fertilizer	74512.65
Plant protection cost	42902.14
Irrigation	8428.87
Others	9864.73
Transportation cost	27875.22
Total variable cost (NRs/ha)	**209349.1**

Source: Field survey, 2024

3.19 Benefit-cost Ratio

Benefit-cost ratio in the study area was calculated as,

BCR= Total benefit/Total cost

= NRs.436970.1/NRs.230018.2

= 1.89971

From the study, the calculated B/c ratio was found to be 1.89971, which means after investing one rupee we can get 1.89971 returns from the sweet orange farming. As a result, we got to know that the Farm business is in profit.

3.20 Gross return, Gross margin, and Net profit

Gross return = Total selling production (kg)* average farm gate price (NRs.)

= 6478.43*67.45

= NRs 436970.1

Gross margin = Gross return – Total variable cost

= NRs.436970.1 –NRs 209349.1

= NRs. 227621

Net profit = Gross return- Total cost

=NRs. 436970.1-NRs.230018.2

=NRs. 206951.9

Profit margin = (Net profit/Revenue) * 100%

= (NRs.206951.9/NRs436970.1) *100%

= 47.360%

3.21 Price spread and producer shares

Producer share = Farm gate price/Retailers' price*100

= NRs67.45. /NRs120*100%

= 56.20%

Price spread = Price paid by consumer - Net price received by producer (. i.e. farm gate price)

= NRs.120-Rs.67.45

= NRs.52.55

3.22 Minimum support price

MSP = (cost of production+25% of cost of production)/ Total yield

= (NRs. 230018.2+25%*NRs230018.2.)/ 6478.43 kg

= NRs.230018.2

4. Discussion

The study of the socio-economic characteristics, agricultural attributes, marketing factors, and post-harvest practices of sweet orange cultivation in Ramechap, Nepal, reveals several critical insights. Previous studies have shown that gender disparity in agricultural participation is common in many rural areas, with males typically dominating farming activities due to cultural and social norms (Dhakal et al., 2018 ; FAO, 2017). The age distribution of farmers, with a predominance of middle-aged and older adults, aligns with findings, who noted that younger generations are increasingly migrating to urban areas for better opportunities (Pokharel and Thapa, 2020). The predominance of medium-sized families corroborates the patterns, highlighting a balance between labor availability and resource allocation (Ghimire et al., 2019). The significant representation of the Janajati and Chhetri communities in orange farming reflects broader ethnic participation in agricultural livelihoods, similar to findings by (Sharma et al., 2016). The equal distribution of religious affiliations among respondents underscores the harmonious coexistence of Hindu and Buddhist communities in agricultural practices, as noted by (Bista, 2017). The educational attainment levels, with a notable segment being illiterate or having only primary education, emphasize the need for improved educational access to enhance agricultural productivity, as supported by (Upreti and Adhikari, 2017). In terms of agricultural attributes, the predominance of medium and small-sized orchards is consistent with regional agricultural practices, indicating diverse operational scales (Poudel et al., 2018). Organizational support from entities like PIU AKC and PIU Ramechhap aligns with the findings, emphasizing the importance of institutional backing in agricultural success (Tiwari and Ghimire, 2019). Knowledge transfer through neighbors and relatives highlights the traditional and communal nature of agricultural knowledge dissemination, similar to observations by (Regmi and Thapa, 2015). Income generation as the primary motivation for cultivation echoes the economic significance of orange farming noted by (Maharjan et al., 2016). The preference for local orange varieties aligns, highlighting the adaptability and resilience of indigenous cultivars (Neupane et al., 2018). The high access to irrigation facilities underscores the critical role of water management in agriculture, as discussed by (Adhikari and Shrestha, 2016). Intercropping practices indicate efforts to maximize land use and diversify outputs, like the strategies reported by (Gautam and Amatya, 2015). Marketing factors reveal that traders play a crucial role in the distribution chain, consistent, who noted the reliance on intermediaries for broader market access (Shrestha and Pandey, 2017). The use of various transportation modes, including tractors and traditional methods, reflects adaptive strategies to ensure market reach, as noted by (Bhandari et al., 2016). The preference for distant markets indicates a strategic approach to maximizing sales volumes, aligning with findings by (Koirala and Thapa, 2018). Post-harvest practices, such as cleaning and sorting, are crucial for maintaining product quality, as highlighted by (Singh and Joshi, 2017). The minimal engagement in post-harvest processing and storage indicates potential areas for improvement, consistent with the challenges identified by (Dhungana et al., 2019). Lastly, the predominant use of own resources for farm inputs and the high certification rates reflects a proactive approach towards sustainable farming practices, like the findings of (Shrestha and Tiwari, 2018). Overall, these insights underscore the complex interplay of socio-economic factors, agricultural practices, and market dynamics in sweet orange cultivation, highlighting areas for potential improvement and the importance of continued support for farmers to enhance productivity and sustainability. The findings from the descriptive analysis of sweet orange farmers in Ramechap, Nepal, highlight several critical aspects influencing agricultural productivity and economic viability in the region. The demographic profile, characterized by an average age of 50.23 years and family sizes averaging 5.30 members per household, reflects typical rural farming communities where age and family dynamics play pivotal roles in labor availability and management decisions (Shrestha et al., 2020). Orchards averaging 11.03 acres indicate varying scales of agricultural operations, with larger orchard sizes correlating significantly with higher orange production, underscoring the importance of land resource management (Gautam et al., 2019). The substantial variation in both productive and unproductive tree counts, averaging 198.02 and 41.60 respectively, suggests diverse management practices and potential inefficiencies in orchard productivity that could be addressed through targeted agricultural extension services (Regmi et al., 2018). Annual orange production averaging 6,817.75 oranges per farmer demonstrates wide-ranging productivity levels influenced by factors such as orchard size, tree management practices, and socio-economic characteristics (Dhakal et al., 2021). Financial indicators, including a favorable Benefit-Cost ratio of 2.60, underscore the profitability of sweet orange cultivation, driven by adequate returns relative to production costs (Acharya et al., 2019). Measures of association reveal significant impacts of socio-economic factors such as family size and education level on production outcomes, highlighting the role of human capital and family labor dynamics in agricultural productivity (Khadka et al., 2020). Challenges identified in production and marketing, such as the lack of irrigation facilities and processing technologies, underscore critical barriers that hinder productivity and market competitiveness, necessitating targeted interventions and infrastructure development to enhance overall agricultural sustainability (Bhandari et al., 2017; Aryal et al., 2018). These insights collectively emphasize the complex interplay of demographic, agricultural, and economic factors shaping orange farming in Ramechap, providing a foundation for informed policy-making and agricultural development strategies aimed at improving farmer livelihoods and sustainable agricultural practices in the region.

5. Conclusion

In conclusion, the cultivation of sweet oranges in Nepal's mid-hills, particularly in the Ramechhap district, holds significant potential for enhancing local economic development despite existing challenges. The study successfully met its objectives by identifying the value chain actors and their functions, analyzing production and marketing costs, and highlighting both the constraints and opportunities within the sweet orange sector. Key findings indicate that inefficiencies in the value chain, limited access to irrigation, and inadequate post-harvest facilities are significant barriers to maximizing productivity and market reach. To fully realize the potential of sweet orange cultivation, it is crucial to provide targeted training programs for farmers on modern agricultural practices, enhance access to irrigation and advanced farming technologies, and develop robust post-harvest infrastructure to reduce losses and improve product quality. Additionally, policy interventions aimed at fairer profit distribution among value chain actors and initiatives to encourage greater participation of women and marginalized communities in citrus farming can further strengthen the sector. By implementing these strategies, Nepal can enhance the productivity and profitability of sweet orange cultivation, contributing to broader economic growth and regional development.

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