

Economic Findings and Suggestions for Pomegranate Cultivation in Chitradurga District, Karnataka

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Abstract:

Pomegranate (*Punica granatum* L.) cultivation has emerged as a highly lucrative venture for farmers in the arid and semi-arid regions of Karnataka due to its high export potential and drought-tolerant nature. In this context, the researcher has made an effort to analyze the economic aspects of pomegranate cultivation in Karnataka's Chitradurga District. This study systematically evaluates the establishment and operational costs, economic returns, and overall financial viability of pomegranate orchards in the region. Primary data were collected from selected pomegranate growers using a structured questionnaire, which helped in analyzing key economic indicators such as Net Present Value (NPV), Benefit-Cost Ratio (BCR), and Internal Rate of Return (IRR). The findings reveal that despite the high initial capital investment and challenges like bacterial blight and water scarcity, pomegranate cultivation yields substantial net returns, making it an economically viable and profitable enterprise for local farmers. The study concludes with policy recommendations aimed at improving credit access, providing subsidized inputs, and developing robust marketing infrastructure to support the growth and sustainability of pomegranate production in the district, ultimately benefiting local economies.

Keywords: Pomegranate Cultivation, Economic Analysis, Chitradurga District, Financial Viability, Cost and Returns.

1.1 Introduction

India, where 65% of the population relies on agriculture, generates substantial income from this sector, particularly through fruit production. Historically, the Mughals contributed to this by establishing extensive mango orchards. Agriculture continues to be crucial for the economy, with horticulture emerging as a lucrative industry. India ranks tenth in the world for fruit consumption, showcasing significant potential for pomegranates. In 1965, Karnataka set up the first horticultural promotion department, and currently, India cultivates over 1.32 lakh acres of pomegranates, especially in Maharashtra, where production surpasses one lakh MT, valued at approximately \$400. Pomegranates, which originated in Iran around 2000 B.C., are cultivated in various countries and rank 18th globally in fruit production based on yield. Karnataka has become one of the leading states in horticulture, with a total area of 18 lakh hectares dedicated to horticultural crops, of which 17.67 percent is allocated to fruits. During the 2013-14 period,

the area dedicated to pomegranate cultivation in Karnataka was 6911 hectares, with the primary districts for pomegranate farming being Chitradurga (6911), Bijapur (2478), Bagalkot (2293), Koppal (1917), and Bellary (1846). In Chitradurga, the area for pomegranate cultivation accounts for 10.79 percent of the total cultivated area in the state. Karnataka is the second-largest producer of pomegranates, contributing 19.2% of the nation's total production. Furthermore, the state is cultivating pomegranates over an area of 18,400 acres, yielding a total of 1,98,600 MT, with a production rate of 10.75 t/ha. The key districts for pomegranate production include Chitradurga, Bijapur, Tumkur, Dharwad, and Bagalkot. In this context, the researcher aims to conduct an economic analysis of pomegranate cultivation in the Chitradurga District of Karnataka. **With this context, the researcher has made an effort to reckon the economic analysis of pomegranate cultivation in Karnataka's Chitradurga District.**

1.2 Statement of the problem

Pomegranate farmers face significant challenges, especially since 2010-11, due to pests and diseases leading to a decline in cultivation. Limited studies exist on how pomegranate farming impacts farmers' economic conditions and asset formation. This study aims to analyze the contribution of pomegranate cultivation to asset formation and energy usage in the Chitradurga district, addressing existing research gaps. Further details are provided in the second chapter of this thesis.

1.3 Significance of the study

Pomegranate is highly sought after for both domestic consumption and export in both national and international markets. As a result, there is a strong emphasis on increasing its production and productivity. India holds the top position globally in terms of pomegranate cultivation, with an area of 1.25 lakh hectares and a production of 8.21 lakh tonnes. Among the states in India, Maharashtra leads with an area of 0.99 lakh hectares and a production of 5.56 lakh tonnes, followed by Karnataka, Andhra Pradesh, and Gujarat. However, the productivity of pomegranate in India is relatively low at 6.57 tonnes per hectare compared to countries like Spain (18.5 tonnes per hectare) and the USA (18.3 tonnes per hectare) where pomegranate cultivation is significant. All six taluks in the Chitradurga district of Karnataka are situated in the Central Dry Zone (Zone IV). The district experiences an average normal rainfall of 534.8mm spread over 32 rainy days. The rainfall in the district is meager and unevenly distributed, and the soils are shallow and of poor quality. The majority of the rainfall occurs during the southwest monsoon season, which lasts from June to October. The net sown area in the district is 3.98 lakh hectares, out of which 22.1% (0.86 lakh hectares) is irrigated, and the remaining 77.9% is dependent on rainwater. The canal network provides limited irrigation facilities to farmers in the Hiriyur taluk. Agriculture in the district heavily relies on timely and sufficient rainfall. This study also helpful to explore and address the constraints of pomegranate growers in Chitradurga district. This research led a significant contribution in the field of agricultural economics. This has been significantly beneficial to Government agencies, Agricultural boards, horticulture departments, farmers, stakeholders and interested academicians and research scholars to perceive the further focus on pomegranate cultivation.

1.4 Objectives of the study

The main aim of the research is to carry out an Economic Analysis of pomegranate cultivation in

Chitradurga district of Karnataka”. The Specific objectives of the study are stated below:

- a) To study the socio-economic profile of Pomegranate growers in Chitradurga district.
- b) To analyze the cost and returns in Pomegranate Cultivation.
- c) To study the impact of Pomegranate production on the income level of farmers.
- d) To evaluate the impact of Pomegranate production on asset formation at the farm level.
- e) To ascertain the factors influencing and constraints in Pomegranate cultivation in the study area.
- f) To analyze the energy use pattern in Pomegranate cultivation in the study area.

1.5 Hypothesis of the study

The hypothesis is generally regarded as the principle instrument in research. The main objective behind the formulation of the hypothesis is to empirically verify their validity. Inference will be drawn based on the empirical verification. The following hypothesis have been formulated for the empirical verification.

- a) There is significant increase in income of farmers after pomegranate farming.
- b) There is significant increase in assets position of farmers after pomegranate farming.
- c) There is a significant difference in the rankings of the Factors which impact on farmer's income in the study area.
- d) Listed constraints are not significantly affecting pomegranate farmers in the study area.
- e) There is a significant difference among constraints faced by the pomegranate farmers in the study area.

1.6 Scope of the study

The researcher has found, there are three types of scope has been observed for the study with the help laborious literature review, one is subject gap, as far as concerned very little studies carried on economic analysis of pomegranate cultivation. From Literature review it is found that till now major study on pomegranate was related with pomegranate cultivation and its medicinal values. Another one is geographical scope, as there are almost studies carried out in and around the Karnataka state and found many in out of Karnataka, but very less study had on an economic analysis of pomegranate cultivation by covering all the taluks of Chitradurga district. further one is time bound scope has observed, as far as studies completed are older one and not so relevant for the present context as present days, there are many hurdles and decreases taken place in pomegranate cultivation due to climate change and global warming. Therefore, present study is necessitated to explore an economic analysis of pomegranate cultivation in Chitradurga district of Karnataka.

Despite the several advantages of the study, this research has the following limitations. They are as follows;

- a) The present study has limited to the opinion of select pomegranate growers of the Chitradurga district and the views of the other farmers are excluded from the study.
- b) This research is confined only to “An Economic Analysis of Pomegranate Cultivation in Chitradurga district of Karnataka”.
- c) In this study, only selected areas of Taluks in Chitradurga district and other regions of Karnataka were not included in the study.
- d) In this study, the researcher has utilized both primary and secondary data. Primary

data has collected from only 495 sample pomegranate growers in the study area.

e) The current findings are valid for pomegranate growers in the study area and cannot be applied to other regions, states and countries.

f) The survey requires participants to have personal bias to provide accurate and reliable information.

1.7 Research Methodology

Research Methodology is like a toolkit of methods, steps, and approaches that researchers use to solve a research problem. It's a guide that helps them know how to go about their study and what steps to follow. It's like having a roadmap for their research. This study attempts to understanding present socio-economic conditions of pomegranate growers and analyze the impact of pomegranate production on asset formation at the farm level and farmers' income. And also, researcher tries to ascertain the constraints in the pomegranate cultivation. To achieve the objectives of the study, the researcher has collected the primary as well as secondary data and employed the descriptive and inferential statistics. Other information about Research methodology, research design and details of research procedures of the study are discussed in detail and presented in the following sections. The research design refers to the strategies and procedures used by a researcher in doing research. The researchers' design allows them to apply appropriate methodologies for the study and successfully set up their investigations in the future; for this study, the researchers used the descriptive and analytical research design. In this study, the sample size required was determined using the Cochran formula, which calculates the optimal sample size based on the desired confidence interval and precision. The Cochran formula is as follows:

$$n = \frac{Z^2 pq}{e^2}$$

In the given scenario, the sample size is denoted by n, where Z represents the standard value for a specific confidence level (assuming a 95% confidence level), p is the estimated population, q is 1 minus p, and e signifies the proportion of the sampling margin of error. In this instance, the confidence interval (CI) ranges from 0.04 to 0.05, indicating a sampling error allowance of 4% to 5%. Consequently, the formula for calculating the sample size for this study is as follows:

$$Z = 1.96 \text{ (Z table value)}, p = 0.5, q = 1 - p = 1 - 0.5 = 0.5, e = 0.05$$

Hence, $n = \frac{(1.96)^2 (0.5) (0.5)}{(0.05)^2} = 384$ (if margin of error CI is 5 %)

$$n = \frac{(1.96)^2 (0.5) (0.5)}{(0.04)^2} = 600 \text{ (if margin of error CI is 4 %)}$$

Utilizing the given formula, a 5% standard error yields a sample size of 384 while a 4% margin error yields 600. Thus, an ideal sample size for the study is between 384 and 600.

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Pomegranate manufacturers of Chitradurga district are the population for this have a look at. Multistage random sampling technique has been used for the selection pattern farmers. in the first stage all the six taluks of Chitradurga district have been selected. For each taluks list of villages in which pomegranate farmers are available has been organized with the help of taluka horticulture officers. From each taluk 6 villages were randomly selected. Therefore,

totally 36 villages have been randomly selected for the entire district. From each village selected for the survey list of farmers growing pomegranate have been prepared. From each list 14 farmers have been randomly selected. Thus, totally 504 pomegranate farmers were planned to select. But in 3 village adequate number of pomegranate farmers were not available. In one village there was shortage of one farmer and in another two village there was shortage of 4 farmers each. Though it was planned to select 504 famers but actually 495 farmers were selected through the multistage random sampling procedure.

1.8 Statistical Techniques used

The collected data underwent computation, analysis, and interpretation utilizing elementary statistical methodologies aligned with the study's objectives. The dataset encompasses both quantitative and qualitative components, warranting the application of both parametric and non-parametric tests for comprehensive analysis. Statistical tools, including tables and charts, were instrumental in the processing and analysis of the collected data. Descriptive statistics involved statistical measures such as mean and standard deviation. Hypothesis testing was conducted using one-sample t-test, independent sample t-test, ANOVA Post-hoc test, and Chi-Square test to validate hypotheses set for this study. The data analysis has done with the help of SPSS version 26 and Microsoft Excel.

1.9 Findings

1.91. Demographic characteristics

Gender: The majority of pomegranate growers in Chitradurga district are male accounting for 97.8% of the total sample farmers. The female representation is significantly lower (2.2%).

Marital Status: A significant majority of pomegranate growers are married, accounting for 93.7% of the total. This indicates that family units play a prominent role in pomegranate cultivation.

Age Distribution: The age distribution of pomegranate growers shows a diverse range, with the largest group falling within the age range of 41-50 (37.6%). This suggests that middle-aged individuals are actively engaged in pomegranate farming. Additionally, the age group above 51 years (33.5%) also represents a substantial portion of the growers.

Educational Qualifications: The majority of pomegranate growers have completed primary education (34.9%) or are illiterate (27.9%). This indicates that a significant proportion of growers may have limited formal education. However, it is worth noting that smaller percentages hold secondary (19.2%), graduation (9.5%), and post-graduation (8.5%) qualifications.

Caste Diversity: Pomegranate growers in Chitradurga district belong to diverse castes. The largest proportion represents the Scheduled Tribe (38.6%) category, followed by Other Backward Classes (31.5%) and Scheduled Castes (20.4%). This highlights the diverse social backgrounds of the growers.

Family Structure: The majority of pomegranate growers have nuclear families (73.5%), while joint families account for 26.5%. This suggests that pomegranate cultivation is undertaken by both individual households and extended family units.

Family Size: Family sizes among pomegranate growers vary, with the most common range being 4-7 members (38.2%). However, a significant proportion of families have 1-3 members (31.9%), indicating smaller family units engaged in pomegranate farming.

Religious Affiliation: Hindu growers comprise the majority (92.1%) of the pomegranate growers in the district. Muslims represent a smaller percentage (7.7%), while Christians account for a negligible portion (0.2%).

1.9.2 Economic Statuses of Pomegranate Farmers:

- Majority of pomegranate farmers fall into income categories between 2, 00,000 to 5,00,000 annually. A significant portion of farmers (65.7%) reported to have debt. All the sample farmers own bore wells (100%). Majority of the farmers reported to have bikes (96.2%). Gold ownership is prevalent among farmers (71.7%). Significant proportion of farmers found to have RCC roofed homes (58.6%).

1.9.3 Cost and Returns of Pomegranate Cultivation in the Study Area

- **Profitability Over Time:** The data demonstrates that, as the duration of pomegranate cultivation increases (from 5 to 15 years), both gross returns and net returns found to be increasing. Longer-term cultivation proves to be financially rewarding, with the 15-year scenario showing the highest net returns. The cost of production per tonne of pomegranates decreases as the yield increases, indicating economies of scale and efficiency with larger yields.

- The changing price dynamics significantly impact the net returns from pomegranate cultivation. Higher prices lead to more favorable profitability, with the 15-year scenario showing the highest net returns. Increased prices improve the overall profitability of pomegranate farming, making it even more enticing for farmers and investors. This highlights the influence of market fluctuations on financial outcomes.

- The majority of respondent farmers (31.3%) have pomegranate orchards ranging from 2 to 3 acres in size. 29.3% of respondents have orchards below 2 acres. 21.2% have orchards ranging from 3 to 4 acres. 18.2% of respondents have orchards above 4 acres in size.

- **Establishment Cost of Pomegranate Orchards (Rs. /Acre):** Labor cost represents the largest portion of establishment costs, accounting for 21.43% of the total. This highlights the significant reliance on labor-intensive activities during the establishment of pomegranate orchards. Material costs, including expenses like fencing and drip materials, constitute the majority of the remaining costs, representing 59.80% of the total. This underscores the importance of materials and equipment in pomegranate orchard establishment. Interest costs, both on working capital and fixed capital, are a significant component, making up 8.12% of the total establishment costs. This indicates the financial considerations involved in orchard establishment.

- **Annual Maintenance Costs of Pomegranate Orchards (Rs. /Acre):** Labor costs dominate the variable costs of maintaining pomegranate orchards, representing 21.85% of the total maintenance cost. This reflects the ongoing labor-intensive nature of orchard maintenance. Material costs, such as plant protection chemicals and irrigation charges, contribute substantially to variable costs, making up 31.36% of the total. These inputs are crucial for maintaining orchard health and productivity. Fixed costs, including land revenue and depreciation, form a significant part of the total cost (33.43%). These costs remain

relatively stable over time, contributing to the overall cost of maintaining the orchard.

- Sample farmers who have been growing pomegranate for more than 15 years found have earned the average net income of Rs. 5,46,242 per acre (at constant price) in year which is found to be considerably more compared the farmers who have been growing this crop for the period of less than 5 years (Rs.99,765 per acre).

- **Opinion of farmers on sources of finance**

- About 15 percent of the respondents ($9.7 + 4.85 = 14.55$) express their concerns about the non-availability of agricultural loans in their area. This indicates a considerable gap in access to crucial financial resources for agricultural activities.

- Approximately a quarter of farmers (23.23%) find it easier to obtain loans from private banks, indicating that private banks offer convenience. However, there are concerns about high-interest rates (37.58%) and limited repayment durations (46.26%), suggesting that improved financial terms are necessary to make private bank loans more farmer-friendly.

- A smaller portion of farmers (5.25%) perceives that loans from public banks are relatively easy to access. However, there are significant concerns about the lengthy and complicated loan application procedures (49.9%) and high-interest rates (3.64%). This indicates that simplifying processes and improving terms can enhance the accessibility of loans from public banks.

- Money lenders are considered relatively easy sources of loans by a substantial number of farmers (43.23%). However, high-interest rates (47.88%) and limited repayment durations (18.99%) are significant drawbacks associated with borrowing from money lenders.

- Farmers hold mixed opinions about government subsidies, with some considering them sufficient (27.47%) and others expressing concerns about the complexity of subsidy procedures (27.47%), excessive documentation requirements (27.47%), and delayed disbursement (27.47%). This shows that while subsidies exist, they may need better administration and communication to benefit the agricultural community effectively.

- The survey also sought to understand farmers' satisfaction with their overall financial situation. The results show a mixed response, with 27.47 % of respondents expressing strong satisfaction 24.04 express their satisfaction. Nearly 1/2 of the respondents are not satisfied with overall financial situation ($33.74 + 12.32 = 46.06$).

1.9.4 Impact of Pomegranate Production on Incomes of the Farmers

- Across all three experience levels (less than 5 years, 5 to 10 years, and above 10 years of pomegranate farming), there is a consistent and statistically significant increase in family income of the farmers After they started growing pomegranate. This suggests that pomegranate farming has generally led to improved financial outcomes for the surveyed individuals.

- The percentage increase in higher income brackets is more pronounced for those engaged in pomegranate farming for longer durations. This indicates that as individuals gain experience in pomegranate farming, their ability to earn higher incomes becomes more significant.

- There is a statistically significant increase in income levels "After pomegranate" compared to "Before pomegranate" for individuals engaged in pomegranate farming for less than 5 years.

The same kind of significant increase in income level of the sample farmers who are growing pomegranate for the duration between 5 to 10 years as well as the sample farmers who are growing pomegranate for more than 10 was revealed by the results of the paired t test.

1.9.5 Factors Affecting the Income of Pomegranate Farmers

Nearly half of the respondents (46.9%) agree that access to credit is a significant factor affecting their income. This indicates the importance of financial resources for pomegranate farmers to invest in their farms and improve their income.

Government policies and programs are also perceived as influential, with 46.5% of respondents agreeing. This suggests that supportive governmental initiatives can positively impact the income of pomegranate farmers.

Secure land ownership and tenure are seen as important by 43.6% of respondents. This highlights the potential role of land security in ensuring income stability and growth.

Market access is recognized as a crucial factor, with a substantial majority (75.6%) of respondents agreeing. Efficient marketing and distribution channels are vital for enhancing income levels.

A significant portion (71.5%) of respondent's values education and training. This underscores the importance of knowledge and skill development in improving farming practices and income.

Technology adoption is acknowledged as a factor affecting income by 43.0% of respondents. Embracing modern agricultural technologies can lead to increased productivity and income. Thus, Access to credit, government policies and programs, and market access are considered crucial factors affecting the income of pomegranate farmers, with a significant percentage of respondents agreeing on their importance. Land ownership and tenure, education and training, and technology adoption are also perceived as important factors influencing income, with substantial agreement among respondents.

1.9.6 Impact of Pomegranate Production Asset Formation

- There was a significant increase in tractor ownership after engaging in pomegranate farming, highlighting its importance in soil preparation and overall farm management.
- The presence of bore wells showed a strong association with pomegranate farming, indicating their critical role in providing irrigation water for pomegranate orchards.
- All farmers who adopted pomegranate farming acquired sprayers, underlining their essential role in pest control and orchard management.
- Fencing around the land increased significantly, emphasizing the need to protect pomegranate orchards from external threats.
- Bullock cart ownership also saw a notable negative change, possibly due to the increasing farmers preference towards tractors instead of bullock carts.
- The shift to pomegranate farming resulted in a significant increase in the ownership of assets such as bikes, air coolers, televisions, and gold among rural households. It indicates an improvement in economic well-being and a better quality of life for families engaged in pomegranate farming.
- Pomegranate farming had a positive impact on housing conditions, leading to a notable increase in the ownership of RCC roofed homes, and larger houses. The transition to better housing types indicates improved living standards and infrastructure for rural

households involved in pomegranate farming.

- The most influential factors, according to the Friedman mean rank test, include easy access to markets, access to education and training programs, government policies and subsidies, and modern agricultural technologies.
- These findings highlight the multifaceted nature of asset formation among pomegranate farmers and emphasize the importance of financial support, education, market opportunities, and technological advancements in enhancing their economic well-being.
- The Chi-Square test result indicates that there is a significant difference among the factors influencing assets formation of pomegranate farmers in the study area.

1.9.7 Factors Influencing Pomegranate Cultivation and Constraints

- Availability of suitable land is one of the most influencing variables in encouraging the farmers to choose the pomegranate crop for which
- 60.8 percent of the farmers strongly agreed and another 19.4 percent of the farmers agreed. Similarly, higher price for the pomegranate has also greater influence in selecting the crop for which 76.6 percent of the farmers strongly agreed.
- Proximity to markets had the highest percentage of respondents who Strongly Agreed (58.6%) with its importance besides significant proportion of farmers who simply agreed with this variable (18.2%). In general, respondents were more likely to agree or strongly agree that soil quality and water availability were important factors for influencing agricultural production.
- Extension services are considered the most important information and support factor for influencing agricultural production. 87.1 percent of the sample farmers are of the opinion that the extension services encouraged the farmers to cultivate the pomegranate.
- It is well established fact that pomegranate crop is more susceptible to pest and diseases which is one of the discouraging factors to grow this crop. Probably it may be the reason that majority of the farmers (80% (60.4 + 20.6)) agreed that they have opted to grow pomegranate due to availability of Integrated Pest Management technology to control the pest and disease in this crop.
- Majority of the farmers (77.6% (49.3 + 28.3)) reported that pomegranate crop don't have any tedious cultural practices which discourage the farmers to grow this crop
- Pomegranate crop needs more financial fund for its establishment. Only the farmers who have adequate fund or access to financial facility could think of growing the pomegranate crop. Therefore, easy accessibility micro credit has greater influence on the decision to grow the pomegranate crop which has been endorsed by 89.5 percent of the farmers.
- Among the seven motivational factors, High price in the market has secured highest mean value (4.5) with the overall rank of 3 out of the 28 variables chosen for this purpose. Availability of the suitable land is another important variable which greater influence on the decision to grow the pomegranate crop. The mean value of this variable was
- 4.2 with the overall rank 6.
- Extension services and Farmers association are the two important variables under the information and support factors which have greater influence on the farmers decision to cultivate the pomegranate crop. Extension services with its mean value of 4.5 stood at the

second rank.

- Drought or water scarcity is the most significant difficulty related to climate or weather patterns faced by pomegranate farmers in the Chitradurga district, with 63.4% of respondents strongly agreeing that they have experienced this difficulty. Excessive rainfall or flooding and freezing temperature are not a major constraint in growing pomegranate in Chitradurga as the rainfall is relatively low and temperature is relatively moderate in this district.
- The Scale insects is the most problematic pest, with 69.3 % (38.8 Strongly agreed & 30.5 agreed) of respondents identifying it as a major problem. The pomegranate butterfly is another major constraint in pomegranate cultivation for which 51.9 % farmers strongly agreed and another 15.2% agreed for this.
- The study observed the fact that drought or water scarcity is one of the major constraints in pomegranate cultivation. With its highest likert scale mean value of 4.3, stood at 1 rank. The other variables relating to climate or weather conditions like excessive rainfall freezing temperature and extreme heat waves are not a major concern in the study area as they are all stood at last ranks.
- Pomegranate butterfly and scale insects with respective mean values of 3.8 and 3.7 stood at 4th and 5th rank respectively. Next to these two diseases, mealy bug and pomegranate fruit borer is also one of the major concerns.
- Lack of market access is the most significant challenge related to marketing of pomegranate. With its mean likert scale value of 4.1 stood at second rank. Difficulty in meeting the quality standards is another major marketing issue. With its likert scale mean value of 3.9 stood at second rank. Limited market demand and low market price are also appearing to be the serious concern to the farmers.
- Chi-square result highlighted that the significant differences among constraints faced by pomegranate farmers. The statistical results confirmed the existence of substantial variations, underlining the diverse and multifaceted challenges experienced by pomegranate farmers in the study area.

1.9.8 Energy Usage Pattern in Pomegranate farming

- The most common irrigation pump capacity used by respondent farmers is "Up to 5HP," with 32.9% of farmers using pumps in this category. 32.1% of farmers use pumps whose capacity is more than 5HP but less than 10 HP. Another 20.6% use pumps capacity of which is 10 to 14.9 HP. 14.4% of farmers use pumps with a capacity 15 HP or more than that.
- The majority of respondents (36.6%) use their irrigation pumps for more than 6 hours per day during the peak season. 34.1% of respondents use their pumps for 6 hours per day. 17.2% use their pumps for 4 hours per day. 12.1% use their pumps for 2 hours per day.
- Majority 33.5% of respondents required power capacities of 200 kW per week. 31.9 respondents required power capacities 100 kW for pomegranate farming per week.
- The most common measure taken to reduce electricity consumption is "Using drip irrigation instead of flood irrigation," with 30.7% of respondents adopting this practice. 21.6% of respondents use variable frequency drives on pumps to optimize energy use. 17.8% have installed LED lighting in the orchard. 29.9% of respondents have not taken any

measures to reduce electricity consumption.

- Majority 40.0% of respondents reported never experiencing damage or equipment failures due to power surges or electrical issues. 30.3% occasionally experience such issues. 29.7% experience damage to their electric equipment's due to frequent power surges. A significant proportion of respondents are somewhat dissatisfied (29.1%) or very dissatisfied (30.9%) with the reliability of electricity supply for their orchard. Regarding the cost of electricity, 30.9% are somewhat dissatisfied, and 30.7% are very dissatisfied. About 27.9% experience electricity outages or disruptions during peak irrigation.
- Season. Only 10.7% are very satisfied with the efficiency of their orchard's electricity usage. 29.9% would be willing to invest in new technologies or practices to reduce electricity consumption.

1.10 Policy Implication:

Researcher through his empirical investigation using descriptive as well as inferential statistics listed several findings. The preceding section has listed several such findings. Based on these finding researchers listed some suggestions. There are some suggestions which are directed to the farmers for the better utilization of their resources to increase their profitability as well as for the sustainability of their income. The study has also listed some policy intervention by the government for facilitating the improvement in the pomegranate profitability as well as for the sustainable income security to the farmers.

1.11 Suggestions to Farmers

- Given the price sensitivity of pomegranate, farmers should adopt sound financial planning. This includes setting aside a portion of profits during high-price years to sustain operations during low-price years. Develop sound financial planning strategies to manage debt effectively and allocate resources efficiently. Seek financial advice and counseling if needed.
- While private banks are considered more accessible, concerns about high-interest rates exist. Farmers should explore the possibility of securing loans from public banks or agricultural cooperatives, which may offer more favorable terms.
- Farmers should collaborate with local agricultural cooperatives or associations to gain better access to markets. Networking and participation in farmer groups can help in negotiating favorable terms with buyers. Farmers should consider adopting modern agricultural technologies and practices to enhance productivity.
- Develop risk mitigation strategies, such as crop insurance, to protect against market price fluctuations. This can provide financial security during periods of low pomegranate prices.
- Farmers with orchards below 2 acres should consider implementing efficient irrigation methods like drip irrigation to optimize water use and minimize waste. For those with larger orchards (4 acres and above), segment their irrigation system to target specific areas for watering, ensuring more precise and efficient water distribution.
- Ensure that the capacity of farmer's irrigation pumps aligns with the size of their orchard. This will help prevent overuse of electricity and water resources. Consider investing in variable frequency drives (VFDs) for their pumps to optimize energy usage, regardless of

your pump's capacity.

- Farmers can further reduce electricity consumption by replacing traditional lighting in the orchard with energy-efficient LED lighting, especially if working during dark hours. Assess the cost-effectiveness of different measures to reduce electricity consumption. This could include incentives for adopting more energy-efficient equipment or practices. If willing and financially feasible, explore new technologies and practices to reduce electricity consumption. These investments may pay off in the long run through energy savings.
- Farmers need to be proactive in taking advantage of government programs and schemes aimed at supporting farmers. Stay informed about available opportunities for financial assistance, training, and subsidies.
- Staying updated with technological advancements observed to be improve crop management and overall income. Sustainable farming.

practices, such as water conservation and soil management proved not only contribute to the productivity but also helps in profitability and environmental sustainability. Therefore, farmers need to give priority for investing in sustainable and modern farming practices that can enhance crop yields and reduce production costs over the long term. Pomegranate farmers should also Consider intercropping with other compatible crops or engaging in agro-processing activities that can generate additional revenue.

Farmers should seek out extension services and other sources of information and support to improve their farming practices and stay up-to-date on new technologies and techniques. Embracing modern agricultural technologies can lead to increased productivity and efficiency. Farmers should explore opportunities to integrate technology into their farming practices. While market access is essential, farmers can further enhance their asset formation by exploring diverse markets, including processing and export opportunities, to maximize income from pomegranate farming. Given the influence of climate patterns, farmers should consider climate-resilient farming practices and invest in measures to protect their assets from adverse weather conditions.

- Farmers need to take appropriate measures to improve soil quality by using organic farming techniques and applying fertilizers based on soil test results. This will help to improve yields and the quality of the pomegranates. Since Department of agriculture is being implementing the programmes like Boochethana which encourage the farmers to adopt the Integrated nutrient management. Farmers need to utilize the benefit of such programme. Integrated Nutrient Management not only promote the productivity but also take care of soil health and sustainable crop yield.

1.11.1 Suggestions to Government

- The government could invest in research and development of integrated pest management practices specifically for the pomegranate and promote the use of biological control agents. Farmers could also be educated on the importance of regular pest and disease monitoring and management, as well as the safe and effective use of pesticides.
- The government could work with farmers and other stakeholders to develop policies and regulations that balance environmental sustainability with the needs of the agricultural sector. This could include providing incentives for sustainable practices and alternative livelihoods, as well as offering training and education on compliance with regulations.

Farmers could also be encouraged to participate in policy-making processes and advocate for their interests.

- The government can improve extension services by training and providing more resources to extension officers. This can be done by establishing training programs, workshops, and other educational initiatives to help extension officers provide better support and advice to farmers.
- Enhance agricultural training and extension services for all farmers, with a particular focus on modern and sustainable farming practices. This can help improve crop yields and overall farm profitability.
- The government could work with financial institutions to provide better access to credit for pomegranate farmers. This could include offering subsidies or loan guarantees, as well as providing education and training to farmers on how to access financing.
- Identify and provide targeted financial support to farmers in the "Low" and "Moderate" economic status categories. This support could come in the form of subsidies, low-interest loans, or grants to help them invest in their farming operations and improve their economic status.
- Efforts should be made to streamline loan application procedures for both private and public banks. Simplifying documentation requirements and reducing bureaucracy can encourage more farmers to seek loans.
- Since easy access to markets and fair pricing are crucial, the government should work on improving market infrastructure, creating market linkages, and ensuring that farmers receive fair prices for their pomegranate produce. This can be achieved through market reforms and interventions.
- The government could facilitate the development of market linkages and value chains, and provide support for market information and pricing systems. Farmers could also be encouraged to form producer groups or cooperatives to improve their bargaining power and negotiate better prices.
- Government agencies can provide training, subsidies, or incentives to encourage farmers to adopt efficient irrigation methods, such as drip irrigation, regardless of orchard size.
- Government needs to launch energy efficiency programs aimed at agricultural sectors, offering financial incentives or subsidies for the adoption of energy-efficient irrigation pumps and lighting systems. Further it has to Invest in research and development initiatives focused on developing and promoting energy-efficient technologies specifically tailored to agriculture, such as energy-efficient pump systems.
- Enhance rural electrification infrastructure to ensure a reliable supply of electricity, especially during peak irrigation seasons, reducing power disruptions and equipment damage. Government need provide financial support and subsidies to encourage the farmers to invest in energy-saving technologies and equipment.
- Conduct awareness campaigns and educational programs to inform farmers about the benefits of energy efficiency and sustainable practices in agriculture.
- The government should promote pomegranate farming as a high-potential crop and work to develop domestic and international markets for pomegranates to improve the economic potential for farmers.

1.11.1 a. Energy Usage Pattern in Pomegranate farming

- The most common irrigation pump capacity used by respondent farmers is "Up to 5HP," with 32.9% of farmers using pumps in this category. 32.1% of farmers use pumps whose capacity is more than 5HP but less than 10 HP. Another 20.6% use pumps capacity of which is 10 to 14.9 HP. 14.4% of farmers use pumps with a capacity 15 HP or more than that.
- The majority of respondents (36.6%) use their irrigation pumps for more than 6 hours per day during the peak season. 34.1% of respondents use their pumps for 6 hours per day. 17.2% use their pumps for 4 hours per day. 12.1% use their pumps for 2 hours per day.
- Majority 33.5% of respondents required power capacities of 200 kW per week. 31.9 respondents required power capacities 100 kW for pomegranate farming per week.
- The most common measure taken to reduce electricity consumption is "Using drip irrigation instead of flood irrigation," with 30.7% of respondents adopting this practice. 21.6% of respondents use variable frequency drives on pumps to optimize energy use. 17.8% have installed LED lighting in the orchard. 29.9% of respondents have not taken any measures to reduce electricity consumption.
- Majority 40.0% of respondents reported never experiencing damage or equipment failures due to power surges or electrical issues. 30.3% occasionally experience such issues. 29.7% experience damage to their electric equipment's due to frequent power surges.
- A significant proportion of respondents are somewhat dissatisfied (29.1%) or very dissatisfied (30.9%) with the reliability of electricity supply for their orchard. Regarding the cost of electricity, 30.9% are somewhat dissatisfied, and 30.7% are very dissatisfied. About 27.9% experience electricity outages or disruptions during peak irrigation season. Only 10.7% are very satisfied with the efficiency of their orchard's electricity usage. 29.9% would be willing to invest in new technologies or practices to reduce electricity consumption.

1.11.1b. Policy Implications: Researcher through his empirical investigation using descriptive as well as inferential statistics listed several findings. The preceding section has listed several such findings. Based on these finding researchers listed some suggestions. There are some suggestions which are directed to the farmers for the better utilization of their resources to increase their profitability as well as for the sustainability of their income. The study has also listed some policy intervention by the government for facilitating the improvement in the pomegranate profitability as well as for the sustainable income security to the farmers.

1.11.1c. Suggestions to Farmers

- Given the price sensitivity of pomegranate, farmers should adopt sound financial planning. This includes setting aside a portion of profits during high-price years to sustain operations during low-price years. Develop sound financial planning strategies to manage debt effectively and allocate resources efficiently. Seek financial advice and counseling if needed.
- While private banks are considered more accessible, concerns about high-interest rates exist. Farmers should explore the possibility of securing loans from public banks or agricultural cooperatives, which may offer more favorable terms.

Farmers should collaborate with local agricultural cooperatives or associations to gain better access to markets. Networking and participation in farmer groups can help in negotiating favorable terms with buyers. Farmers should consider adopting modern agricultural technologies and practices to enhance productivity.

- Develop risk mitigation strategies, such as crop insurance, to protect against market price fluctuations. This can provide financial security during periods of low pomegranate prices.
 - Farmers with orchards below 2 acres should consider implementing efficient irrigation methods like drip irrigation to optimize water use and minimize waste. For those with larger orchards (4 acres and above), segment their irrigation system to target specific areas for watering, ensuring more precise and efficient water distribution.
 - Ensure that the capacity of farmer's irrigation pumps aligns with the size of their orchard. This will help prevent overuse of electricity and water resources. Consider investing in variable frequency drives (VFDs) for their pumps to optimize energy usage, regardless of your pump's capacity.
 - Farmers can further reduce electricity consumption by replacing traditional lighting in the orchard with energy-efficient LED lighting, especially if working during dark hours. Assess the cost-effectiveness of different measures to reduce electricity consumption. This could include incentives for adopting more energy-efficient equipment or practices. If willing and financially feasible, explore new technologies and practices to reduce electricity consumption. These investments may pay off in the long run through energy savings.
- Farmers need to be proactive in taking advantage of government programs and schemes aimed at supporting farmers. Stay informed about available opportunities for financial assistance, training, and subsidies. Staying updated with technological advancements observed to improve crop management and overall income. Sustainable farming practices, such as water conservation and soil management proved not only contribute to the productivity but also helps in profitability and environmental sustainability. Therefore, farmers need to give priority for investing in sustainable and modern farming practices that can enhance crop yields and reduce production costs over the long term. Pomegranate farmers should also Consider intercropping with other compatible crops or engaging in agro-processing activities that can generate additional revenue.
- Farmers should seek out extension services and other sources of information and support to improve their farming practices and stay up-to-date on new technologies and techniques.
 - Embracing modern agricultural technologies can lead to increased productivity and efficiency. Farmers should explore opportunities to integrate technology into their farming practices. While market access is essential, farmers can further enhance their asset formation by exploring diverse markets, including processing and export opportunities, to maximize income from pomegranate farming. Given the influence of climate patterns, farmers should consider climate-resilient farming practices and invest in measures to protect their assets from adverse weather conditions.
 - Farmers need to take appropriate measures to improve soil quality by using organic farming techniques and applying fertilizers based on soil test results. This will help to

improve yields and the quality of the pomegranates. Since Department of agriculture is being implementing the programmes like Boochethana which encourage the farmers to adopt the Integrated nutrient management. Farmers need to utilize the benefit of such programme. Integrated Nutrient Management not only promote the productivity but also take care of soil health and sustainable crop yield.

1.11.2 Suggestions to Government

- The government could invest in research and development of integrated pest management practices specifically for the pomegranate and promote the use of biological control agents. Farmers could also be educated on the importance of regular pest and disease monitoring and management, as well as the safe and effective use of pesticides.
- The government could work with farmers and other stakeholders to develop policies and regulations that balance environmental sustainability with the needs of the agricultural sector. This could include providing incentives for sustainable practices and alternative livelihoods, as well as offering training and education on compliance with regulations. Farmers could also be encouraged to participate in policy-making processes and advocate for their interests.
- The government can improve extension services by training and providing more resources to extension officers. This can be done by establishing training programs, workshops, and other educational initiatives to help extension officers provide better support and advice to farmers.
- Enhance agricultural training and extension services for all farmers, with a particular focus on modern and sustainable farming practices. This can help improve crop yields and overall farm profitability.
- The government could work with financial institutions to provide better access to credit for pomegranate farmers. This could include offering subsidies or loan guarantees, as well as providing education and training to farmers on how to access financing.
- Identify and provide targeted financial support to farmers in the "Low" and "Moderate" economic status categories. This support could come in the form of subsidies, low-interest loans, or grants to help them invest in their farming operations and improve their economic status.
- Efforts should be made to streamline loan application procedures for both private and public banks. Simplifying documentation requirements and reducing bureaucracy can encourage more farmers to seek loans.
- Since easy access to markets and fair pricing are crucial, the government should work on improving market infrastructure, creating market linkages, and ensuring that farmers receive fair prices for their pomegranate produce. This can be achieved through market reforms and interventions.
- The government could facilitate the development of market linkages and value chains, and provide support for market information and pricing systems. Farmers could also be encouraged to form producer groups or cooperatives to improve their bargaining power and negotiate better prices.
- Government agencies can provide training, subsidies, or incentives to encourage farmers to adopt efficient irrigation methods, such as drip irrigation, regardless of orchard size.

- Government needs to launch energy efficiency programs aimed at agricultural sectors, offering financial incentives or subsidies for the adoption of energy-efficient irrigation pumps and lighting systems. Further it has to Invest in research and development initiatives focused on developing and promoting energy-efficient technologies specifically tailored to agriculture, such as energy-efficient pump systems.
- Enhance rural electrification infrastructure to ensure a reliable supply of electricity, especially during peak irrigation seasons, reducing power disruptions and equipment damage. Government need provide financial support and subsidies to encourage the farmers to invest in energy-saving technologies and equipment.
- Conduct awareness campaigns and educational programs to inform farmers about the benefits of energy efficiency and sustainable practices in agriculture.
- The government should promote pomegranate farming as a high-potential crop and work to develop domestic and international markets for pomegranates to improve the economic potential for farmers.
- The government should encourage the adoption of new technologies and practices that can help to improve yields and reduce input costs for farmers.

1.12 Conclusion

Pomegranates are in high demand due to their health benefits, unique taste and versatility in culinary applications. Pomegranates are a relatively high-value crop, with prices often fetching more than other fruits. Pomegranates are relatively easy to grow, require less water than other crops, and are generally resistant to pests and diseases. This makes them a more sustainable crop option for farmers, who can save on water usage and pesticide costs, while also reducing the environmental impact of their farming practices. Pomegranate cultivation and processing can create employment opportunities for local communities, which can help to boost economic development and reduce poverty in rural areas. Pomegranates are a highly exportable crop, with growing demand in international markets. Despite of many advantages from pomegranate most of the farmers struggling to choose and grow pomegranates, still in Chitradurga district pomegranate farmers economical positions are not reformed hence this study was the essential to be carried out.

This study is an attempt to understand and analyse economic status of pomegranate farmers in Chitradurga district situated in Karnataka state, India. The study also throws light on the variable which influence the farmers in Chitradurga district to choose pomegranate as their crop such as motivational factors, Location Advantage Factors, Information and support Factors, Crop Advantage Factors and Financial Advantage factors.

- It has been shown that pomegranate farming related expenditures how significantly impacts on farmers' income and which are the pomegranate related factors helps formation of assets in the study area.

It has been shown in the study analyzed the pomegranate growing farmers has also improved price realization for farmers with increased demand for their produce and better access to markets. Although, pomegranate growing farmers comes up with many constraints in production such as biggest challenges when it comes to growing pomegranates, difficulties related to climate or weather patterns, Pests or diseases, Challenges related to marketing or

selling your pomegranate crops and Regulatory or policy constraints. There is also the issue of lack of adequate support from the Government with respect to technological and agricultural research support, timely and adequate supply of seeds, inputs, subsidies, fiscal and monetary support and incentives etc. Critical issues with respect to the post-harvest period and marketing related concerns have also been highlighted in the study. Constructive inferences, insights and appropriate suggestions have been offered purely in the light of study's scope and findings.

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