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Farm Operational Capabilities and Profitability Perception in Strawberry Cultivation: Evidence from India

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ABSTRACT
This study investigates how operational capacities of the farms impact the perception of profitability by farmers in India in the cultivation of strawberries, with a special focus on the perception of how economic analyses differ in the journey of establishing how the managerial and operational aspects are affected by new economic analyses in the traditional yield or income measure skills. The discussion is based on major aspects of operations such as labour needs, control over land use, efficiency in harvesting and processing, control of production and price, issues that are related to cultivation and availability of knowledge and skills training. Primary data was gathered using a questionnaire on strawberry growers, and the research study was taken in the descriptive and analytical research design. The reliability analysis, exploratory factor analysis and confirmatory factor analysis were utilised to test the measurement structure, after which structural equation modelling was done to test the proposed relationships. The findings show that the labour management, land management, harvesting and handling, production and pricing management, access to knowledge and skill development have a positive and statistically significant impact on the perception of profitability by the farmers. Conversely, the issues of strawberry production have a negative and statistically insignificant impact, indicating that measures to adapt to adverse production conditions, the presence of institutions, and access to knowledge can help to overcome production and market limitations. In general, the results show that the perception of profitability in the strawberry farming sector is largely defined by the operational control of the farmers, managerial effectiveness, and availability of facilitating factors rather than production performance per se. This study contributes to the high-value horticultural literature by taking a capability-based approach, providing practical information to farmers, extension agencies, and policymakers who seek to increase the economic sustainability of strawberry production in India
Keywords: Farm operational capabilities, High-value horticulture, India, Profitability perception, Strawberry cultivation

INTRODUCTION

In many emerging economies, agriculture remains a key source of economic development, providing employment, rural livelihoods, and income diversification. In this industry, high-value horticultural produce is being considered as a viable alternative to boost the profitability of the farm, especially for small and marginal farmers (Ahmad et al., 2018). Due to the short crop cycle, high consumer demand, and the presence of better returns compared to various other conventional field crops, strawberry cultivation has garnered considerable scholarly attention because this crop is characterised by high consumer demand (Sawant et al., 2023). Strawberry production in India is no longer necessarily restricted to the conventional hilly areas, but instead, through the development of crop control, cultivated farms, and implementation of industrial farming inputs, is now being extended into more subtropical and peri-urban based areas (Menzel, 2025; Modi, 2023). At the same time, there is no possibility of strawberry farming being easy. The crop is absorbing, which means that it requires a careful preparation of the land, spacing of the plants, mulching, nutrient regulation, irrigation planning, harvest, and post-harvest operations (Hegde and Sangamesh, 2023; Datta et al., 2025). The farm income will, therefore, not only be determined by the biological capacity of the crop but also by the effectiveness with which the farmers can assemble and undertake these interrelated operations within the limitations of their resources and environment

(Madhukar, 2018; Vijay, 2023). The empirical experience of developing countries has shown that differences in the income of farms are often due not only to the differences in the decisions made but also to the choice of crops. (Cruz et al., 2024; Ahmad et al., 2018).

Recent developments in agricultural activities even continue to view the importance of technology-enabled and sustainability-driven farm activities. Increased productivity and more consistent returns have been linked to strawberry cultivation using improved irrigation methods, organic fertilisers, water-saving technologies, and covered cultivation (Cassel et al., 2025; Dekhane et al., 2023; Sonkar and Tripathi, 2025). Similarly, the partial mechanisation, IoT-based monitoring, and precision input application can be used to decrease reliance on human labour and enhance the efficiency of operations (Jyoti et al., 2024; Bharad and Khanpara, 2024). However, the practice is potentially facing many smallholders because of financial limitations, insufficient technical foundation, and risk factor issues (Autio et al., 2021; Kalaitzoglou, 2019). In India, research into strawberry cultivation has been focused, and it primarily addresses the economic viability of this crop by a cost-benefit analysis, efficiency of inputs, and marketing profitability (Hasan, 2016; Madhukar, 2018; Vijay, 2023). Although such studies are useful, they are usually concerned with actual profits and not with the perceived profitability of farmers themselves. This difference matters greatly since the attitude of farmers can hugely affect their desire to invest, practice better habits, diversification, or further continue cultivation under uncertain circumstances (Park, 2021). Perceived profitability is determined not only by the income but also by the feeling of control over operations by the farmers, employee demands, risks, and the sustainability of returns over the long run. In addition, most of the available literature correlates the application of individual practices, e.g., spacing, mulching, fertilisation, or harvesting one at a time (Datta et al., 2025; Tripathi, 2024). Such a strategy neglects the manner in which these activities are interrelated as a component of a larger operating mechanism. Recent studies during the analysis of resource-use efficiency and environmental performance indicate that profitability is becoming more and more dependent on the ability of the farmers to integrate operational efficiency with sustainable activity (Ozturk et al., 2025; Marcellini, 2020). However, empirical studies that consider farm operations as a combination of the capabilities that involve labour management, coordination of inputs, adoption of technology, and after-harvest management as one are limited.

The structural changes in the Indian strawberry industry are attributed to the growing urbanization pressures, strengthening value-chain connections, as well as implementing sophisticated production technologies, such as shielded horticulture and vertical cultivation (Dhiman, 2025; Sawant et al., 2023). These changes raise the importance of management abilities and work preparedness of farmers. With the shift in the strawberry growing process to a more commercially and technology-centred paradigm, it is critical to understand how farmers currently view the profitability of operations to establish effective extension services, policy interventions and investment support mechanisms. In that regard it is highly necessary to go past the traditional cost-analysis models and examine how the perception of profitability among farmers can be influenced by the operational capacity of the farms themselves. Of special relevance to this is the developing region, where farmers are struggling to cope with capital limitations, climatic fluctuations, labour supply, and market access, as they are likewise persuaded to adopt practices that are more sustainable and technologically oriented (Autio et al., 2021; Cassel et al., 2025). The current research attempts to cover this gap by testing the nature of the relationship between the farm operation capabilities and the perception of profitability among Indian strawberry growers. Through the conceptualisation of farm workings as a coordinated system of capabilities that do not serve as separate activities, the piece of research can contribute to the academic debate regarding high-value horticultural production and can make a difference in the actions of farmers, the number of proliferating agencies, and policymakers who aim to strengthen the economic viability of strawberry farming.

2. Relevant Literature and Hypotheses

In modernising economies, farming production systems are increasingly recognising the value of high-value horticultural produce as effective tools for enhancing farm revenues, creating jobs, and diversifying livelihoods (Ahmad et al., 2018; Rabha and Sarma, 2021). Among these products, strawberry (Fragaria × ananassa) production has attracted academic interest due to its strong economic value, a short production cycle, and the potential to deliver high-quality economic returns compared with many standard field crops (Sawant et al., 2023). In India, the expanding area of strawberry cultivation in subtropical and peri-urban GAPs has been supported by the adoption of protected-culture methods, the use of new technologies in input areas, and improvements in market connections (Menzel, 2025; Modi, 2023; Dhiman, 2025). However, the financial potential of strawberry production is constrained by the industry's high management requirements; profitability depends not only on yield volume but also on the effectiveness of organisational and operational managerial practices applied by farmers under resource constraints, climatic variability, and market uncertainty (Madhukar, 2018; Vijay, 2023). These managerial qualities represent the agronomic functioning potential of strawberry systems. Specifically, they include human resource needs, land-management laws, harvesting and post-harvest productivity, production and pricing, inherent cultivation issues, and the availability of technical knowledge and skills training. Together, these factors determine farmers' experiences and evaluations of the economic results of strawberry farming. The dependent variable of interest is perceived profitability, defined as farmers' personal evaluation of the commercial viability, financial stability, and long-term sustainability of strawberry production. These perceptions are central because they determine whether to invest, adopt improved

practices, and continue cultivating even in uncertain situations (Park, 2021).

Labor Requirements and Profitability Perception

Strawberry farming inevitably requires a large amount of labor especially during the planting process, intercultural management, harvesting and handling of the harvest. Accurate scheduling of labor and planned deployments helps to ensure these activities are completed on time, reduces the problem of bottlenecks in production, and helps advance the total performance of the farm by containing labor expenses (Prakash & Sarkar, 2017). In contrast, the short supply of workers, increasing wage bills, and the use of seasonal laborers impose it as cost volatility and cause the stress of operations, which may destroy the faith of farmers in future performance (Madhukar, 2018). Empirical research in horticultural systems has shown that the farms that adopt more refined labor management strategies, such as the use of improved schedules, specialisation of the tasks, or mechanised solutions, achieve high-quality operational management and increased economic efficiency (Bachhal et al., 2018; Bharad and Khanpara, 2024). Regarding the perception, good labor management supports the faith of the farmers in their ability to regulate expenses and meet the demand of the market and hence influences their perception of profitability. Hence, it is hypothesised that –

H1: *Labor requirements have a significant relationship with profitability perception in strawberry cultivation.*

Land Management and Profitability Perception

The basis of the high-yield and sustainable strawberry farming is land management practices; the yardage prepared and the formation of beds, distance, mulching, irrigation planning, and management of soil health all directly affect the level of yield stability, pest occurrences, and resource-use efficiency (Hasan, 2016). Ineffective land management exposes the firm to more production risks and makes it hard to pursue stable production and returns annually given to farmers (Datta et al., 2025). According to studies on sustainable horticulture, proper management of the land leads to better environmental management, better control and predictability of production, which is important to high-value crops (Marcellini, 2020). When farmers develop better land management behaviors, the standing of strawberry growing is thus likely to be seen as economical and sustainable (Ozturk et al., 2025). Based on the above discussion, it is posited that-

H2: *Land management capabilities significantly influence profitability perception in strawberry cultivation.*

Harvesting, Handling, and Profitability Perception

Picking and processing are essential stages of the strawberry growing process because the fruit is very perishable. Losses incurred in harvesting, grading, storage and transportation can significantly reduce realised revenues and reduce the profitability of the farm (Hegde & Sangamesh, 2023; Rakhonde et al., 2025). In this respect, the effectiveness of these operations management predetermines a key role in the structure of both objective and perceived economic results. The real-world patterns are that those farmers who have been endowed with high-quality harvesting and handling skills, including picking in time, handling with care and basic post-harvest skills, are put in a better position to maintain the fruit quality and gain maximum returns in the market (Vijay, 2023; Cruz et al., 2024). Such efficiencies dampen wastage and fluctuation in the income levels, hence enhancing the confidence of farmers in the profitability of strawberry production.

H3: *Harvesting and handling capabilities significantly influence profitability perception in strawberry cultivation*

Production and Pricing Management and Profitability Perception

Management of production and price indicates the capability of farmers to strategies production, manage input costs, and react to output price changes. The volatility of input prices, yield outcomes, and market prices in the context of developing countries creates high economic uncertainty, and it can deter farmers in terms of their confidence regarding farming as an activity that brings profits (Ali et al., 2021; Khatun et al., 2020). Those farmers who have greater knowledge of production planning and pricing are more capable of controlling and addressing cost structures and market risks, which allows them to stabilise returns in the long-run (Rabha & Sarma, 2021). Consequently, the management of production and pricing acts as an interpreting mechanism where farmers are in a position to examine the success and sustainability of strawberry production.

H4: *Production and pricing management significantly influence profitability perception in strawberry cultivation.*

Challenges of Strawberry Cultivation and Profitability Perception

The agronomic and economic crises that are facing strawberry production include: weather inconsistency, high rate of parasites and pathogens, high input costs, work shortages and unpredictability in the market. Such disasters increase the production risk and could undermine the confidence of farmers in the long-term sustainability of strawberry farming (Mandal, 2019; Autio et al., 2021). Still, farmers with a strong adaptive and managerial capacity (including climate-resilient practice, prudent stewardship of inputs, and effective risk management) are in a better position to overcome such challenges (Dhaker et al., 2024; Sonkar and Tripathi, 2025). The extent of perception of these challenges as being manageable has a critical impact on the perceptions of profitability of the farmers.

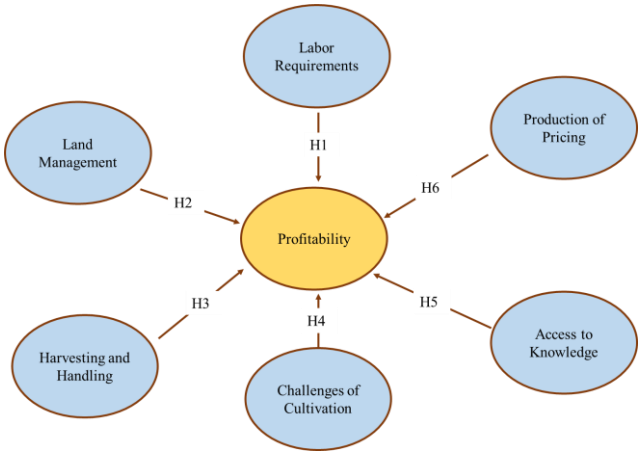
H5: *Challenges of strawberry cultivation are negatively related to profitability perception.*

Access to Knowledge and Skills Development and Profitability Perception

Knowledge and skills development accessibility is one of the supporting operational capabilities that stabilises all other farm management dimensions. The combination of structured training programmers, extensions, peer-learning, and exposure to finest practices helps to improve the technical competence of farmers and the quality of their decision-making (Kalaitzoglou, 2019; Jain et al., 2023). Further, access to knowledge will promote the embrace of modern inputs, technology, and environmentally friendly activities in the field of strawberry production (Jyoti et al., 2024; Cassel et al., 2025). The fact remains that empirical studies reveal that the confidence in farm operations and the more positive evaluation of profitability characterised farmers that gain more access to knowledge and opportunities to develop skills (Hasan et al., 2025; Sawant et al., 2023). Knowledge and skills development, therefore, forms one of the most influential enablers that determine the interpretation of economic performance by farmers and their perspective on the future of the same.

H6: *Access to knowledge and skills development positively influences profitability perception in strawberry cultivation.*

Based on the above discussion, the following conceptual framework was framed



Source*:* Authors Creation based on literature review

3. Methods

3.1 Sample, data collection, and questionnaire development

The past few decades have seen the emergence of strawberry farming as a viable high-value horticultural business in India, especially in relation to a shift of the traditional crop. Despite the rich and diverse academic literature exploring the economic aspect of strawberry production, the systematic analysis of the perceptions of growers regarding profitability as themed in the assembly of farm operational competencies is comparatively weak. The given research aims to fill this gap and examine the impact of various aspects of operations in the sense of its effects on profitability perceptions by Indian strawberry farmers. The research tool was worked out after a thorough examination of available literature in the related fields of farm management, high-value horticulture, operational efficiency, and profitability assessment (Madhukar, 2018; Vijay, 2023; Datta et al., 2025; Sawant et al., 2023). In this regard, a structured questionnaire was developed so as to embody important dimensions of operation on the following front: labour needs, land-management issues, harvesting and handling efficiency, production and pricing control, the challenges of strawberry farming, and knowledge and skills development. In parallel, an instrument complementing set was created to determine the perception of profitability of the farmers, i.e. their evaluation of the economic feasibility, the stability of the revenues, and the sustainability of strawberry production over the long run.

A pilot study was done on sixty strawberry growers to check the clarity, relevance, and consistency of the questionnaire items. The small adjustment of words and the deletion of wordy statements were prompted by the feedback received in the pilot survey. The questionnaire was subjected to additional critique by two experts in the subjects who have experience in agricultural economics and horticultural extension, and evaluated item content validity and situational appropriateness. Based on their suggestions, a few items were modified to make them more precise and eliminate overlap among constructs. The developed questionnaire consisted of questions that were rated on a five-point Likert scale between strong agreement and strong disagreement, with a section that included some basic demographic and farm-related data. Data were gathered with regards to strawberry growers in Bhiwani district, Haryana by using a field-based survey method. Before the data collection process, the respondents received the goals of the study, were assured confidentiality, and told that their participation was voluntary. Four hundred and twenty questionnaires were distributed during the data collection period; three hundred and nine of them were valid and used for quantitative analysis after filtering out the incomplete and inconsistent ones. This was followed by analysis of the collected data with reliability analysis, exploratory factor analysis, confirmatory factor analysis and structural equation modelling that aimed to establish the relationships between farm operational capabilities and profitability perception.

Figure 1. Primary data collection & the Strawberry production at the fruiting stage under the mulching system in Bhiwani district, Haryana.

Source: Author's Field Survey (2024 -25)

4. Results

4.1. Reliability Analysis

Cronbach's Alpha was initially used to assess the reliability of the constructs and the results were summarised in Table 5. The alpha coefficients of all six constructs, such as Labor Requirements, Land Management, Harvesting and Handling, Profitability Perception, Challenges of Strawberry Cultivation, and the Access to Knowledge and Skills Development, had met or surpassed the typical icon of.70. Specifically, there was the highest internal consistency of The Profitability Perception scale (.857), access to Knowledge and Skills Development (.718), Land Management (.712), and Harvesting and Handling (.710). Other two constructs, Labor Requirements (= 0.705) and problem of Strawberry cultivation (= 0.702) also reflected acceptable reliability hence support that the items in each scale are coherent and can be analyzed further. These results suggest that the items used to measure the latent constructs are strong in capturing the constructs of interest among the sample of the strawberry growers. (refer the table 5).

Table 5: Reliability Statistics (Cronbach's Alpha)

Construct	Variable Type	No. of Items	Cronbach's α
Labor Requirements	Independent variables	7	.705
Land Management		8	.712
Harvesting and Handling		5	.710
Production and Pricing		5	.734
Challenges of Strawberry Cultivation		8	.702
Access to Knowledge & Skills Development		6	.718
Profitability Perception	Dependent Variable	7	.857

Notes: All Cronbach's alpha values are ≥ .70, indicating acceptable internal consistency.

Source: Primary Data

4.2. Exploratory Factor Analysis for Farm Operational Activities

The variables of farm operational activity based on the literature previous data underwent Exploratory Factor Analysis (EFA) in order to explain the latent factor relationship. According to EFA, the sampling adequacy was acceptable, since Kaiser Meyer-Olkin (KMO) measure was 0.782. The Test of Sphericity has a value lower than 0.001 (p), which was statistically significant (p = 0.001) thus confirming that correlation was adequate to undergo the factor analytic procedures. The six factors that had a factor load greater than one was collected in the analysis that explained overall 65.39 per cent of the total variance. These were considered Labor, Land, Harvesting, Production and Pricing, Challenges and Knowledge. The rotated components matrix revealed that all the variables loaded onto their respective factors clearly, and factor loadings exceeded the acceptable level and there were no apparent cross-loadings. The clearly defined factor structure, therefore, signifies a satisfactory data quality and justifies the suitability of the outer dimensions extracted to further analyses into the investigation of interrelations between the farm operational activities. Detailed factor loadings and variance statistics are presented in Table 6.

Table 6: Exploratory Factor Analysis Results for Farm Operational Activities

Sampling Adequacy and Sphericity

Measure	Value
Kaiser–Meyer–Olkin (KMO)	0.782
Bartlett's Test of Sphericity (χ^2)	4234.218
Degrees of Freedom (df)	276
Significance (p-value)	0.000

Total Variance Explained

Factor	Eigenvalue	% of Variance	Cumulative %
1	6.412	22.53	22.53
2	3.841	13.51	36.04
3	2.971	10.44	46.48
4	2.685	9.43	55.91
5	1.512	5.24	61.15
6	1.207	4.24	65.39

Rotated Component Matrix

Variable	Labour	Land	Harvesting	Production & Pricing	Challenges	Knowledge
Labor1	0.762					

Labor2	0.739					
Labor3	0.701					
Labor4	0.712					
Labor5	0.688					
Labor6	0.655					
Labor7	0.672					
Land1		0.791				
Land2		0.765				
Land3		0.723				
Land4		0.702				
Land5		0.688				
Land6		0.671				
Land7		0.654				
Land8		0.683				
Harvest1			0.833			
Harvest2			0.819			
Harvest3			0.772			
Harvest4			0.698			
Harvest5			0.681			
Prod & Pricing 1				0.842		
Prod & Pricing 2				0.779		
Prod & Pricing 3				0.734		
Prod & Pricing 4				0.709		
Prod & Pricing 5				0.682		
Challenges1					0.765	
Challenges2					0.731	
Challenges3					0.702	
Challenges4					0.689	
Challenges5					0.673	
Knowledge1						0.728
Knowledge2						0.702
Knowledge3						0.681

Notes: Extraction Method: **Principal Component Analysis (PCA)**; Rotation Method: **Varimax with Kaiser Normalization**; Rotation converged in **6 iterations**; Factor loadings ≥ **0.65** are retained; **Total variance explained = 65.39%**

Source: Primary Data

4.3. Measurement Model

The instance of a Confirmatory Factor Analysis (CFA) was performed to test the measurement model regarding the farm operating activities, as well as the measurement

of Goodness-of-Fit and Construct validity. The model fit indices showed that the proposed measurement model has a reasonable fit to the observed data. The model co-produced a CMIN/DF of 2.12, which is within the suggested value of 2.12, and this means that it provides a satisfactory parsimonious fit. Other fit measures provided additional evidence of model adequacy, with GPI (0.928), NFI (0.915), and CFI (0.942) all having a greater level of adequacy compared to acceptable cut-offs, and RMSEA (0.054) indicating a tolerable error in approximation. The test of chi-square was statistically significant (p = 0.000), which frequently happens with big samples and which does not affect the overall fit of the model.

Average Variance Extracted (AVE) and Construct Reliability (CR) were the methods used to test convergent validity. Every construct exhibited good CR between 0.74 to 0.89, which is an indicator of high internal consistency. AVE values were nearly equal or higher than the suggested value of 0.50, which justifies the presence of adequate convergent validity of the constructs. The discriminant validity was also formed because the AVE values of each construction were much higher in comparison with the inter-construct ones, which proved the fact that the constructs were empirically distinct. All in all, the results of CFA prove the strength and validity of the measurement model of farm operational activities (see Table 7).

Table 7: Model Fit Indices

Fit Measure	Value	Construct of farm operational activities	Indicators	AVE	CR
CMIN/DF	2.12	Labor Requirements	7	0.50	0.87
GFI	0.928	Land Management	8	0.50	0.89
NFI	0.915	Harvesting and Handling	5	0.58	0.87
CFI	0.942	Production and Pricing	5	0.56	0.86
RMSEA	0.054	Challenges of Strawberry Cultivation	5	0.50	0.83
p-value	0.000	Access to Knowledge & Skills Development	3	0.49	0.74

Construct	AVE	Labor Req.	Land Mgmt.	Harvesting and Handling	Production and Pricing	Challenges of Strawberry Cultivation	Access to Knowledge & Skills Development
Labor Requirements	**0.50**	**1**					
Land Management	**0.50**	**0.36**	**1**				
Harvesting and Handling	**0.58**	**0.31**	**0.34**	**1**			
Production and Pricing	**0.56**	**0.28**	**0.29**	**0.27**	**1**		
Challenges of Strawberry Cultivation	**0.50**	**0.33**	**0.32**	**0.30**	**0.31**	**1**	
Access to Knowledge & Skills Development	**0.49**	**0.30**	**0.35**	**0.28**	**0.29**	**0.34**	**1**

Source: Primary Data

4.4. Structural Equation Modeling

The instance of a Confirmatory Factor Analysis (CFA) was performed to test the measurement model regarding the farm operating activities, as well as the measurement of Good-of-Fit and Construct validity. The model fit indices showed that the proposed measurement model has a reasonable fit to the observed data. The model co-produced a CMIN/DF of 2.12 that is within the suggested

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Land management gave the second impact on the predictor with statistically significant effect on the perception of profitability ($b = 0.274$, $p = 0.001$). Farmers who underlined the fact that there should be frequent soil testing, application of organic manures and mulching, had a greater likelihood of believing that these measures should contribute to the financial sustainability of their activities. The excellent performance of drip irrigation and the benefits of raised beds in the production of strawberries were also noted by the respondents. These agronomic treatments help in the maintenance of soil health and water-efficiency hence translating to superior yields and diminishing production risks. Therefore, farmers who embraced these methods had better profitability prospects, hence creating a direct correlation between sustainable farming of the land and the production of revenue.

The same case was observed in harvesting, and handling as they had a positive, statistically significant relationship with profitability perception (b 0.193, p 0.001). The likelihood of farmers who favored manual harvesting along with their recognition of the fact that manual harvesting would continue to maintain product quality to attribute their practices with an increased profitability was higher. Besides, the people who agreed on the fact that appropriate packaging would help to reduce spoilage and damage during transportation had a better understanding of the preservation of post-harvest value. Whereas some individuals in the survey have noted that mechanical harvesting saves time and labor, quality assurance in hand harvesting had a stronger economic impact, which was implemented at the expense of manual harvesting. This observation supports the statement that careful post-harvests measures are not just operationally crucial but also profitable to the budgets.

Access to Knowledge and Skills development construct had a positive impact on the perceived profitability of 0.248 with $p = 0.001$ (significant). The farmers who stated that they got satisfied with the training programmers organized by the government agencies and could receive the information in the agricultural universities and research institutes were more inclined to state that the availability of such knowledge increased their income opportunities. Peers who emphasized the success of online learning materials, peer networks and accessibility of information in their native languages also had greater confidence in their profitability. Such results confirm the importance of education and the dissemination of information in enhancing operational decision-making and financial performance.

Production and Pricing were able to produce a path coefficient of 0.205 with a significant figure ($p = 0.001$). Respondents who were satisfied with the average yield per acre, whose perception was that the selling price is high enough as to cover the production cost, and those respondents who said that labour cost and price variation influence the level of profitability were more inclined to perceive their operations as being economically sustainable. These mental images imply that those growers who can effectively manage production inputs and determine their pricing plans depending on the market situation are in a position to overcome the cost-related issues and, therefore, receive stable profits.

The exploratory analysis provided a statistically significant positive correlation between Market Access and Distribution and Profitability Perception ($b = 0.178$, $p < 0.001$). Those respondents who said that they could easily get markets at competitive prices and those who said that they were fairly compensated by grocery stores or supermarkets were more inclined to attach these as factors related to increased profitability. Other indicators mentioned were access to affordable transport and the belief that the markets of organic strawberries have better profits. These results point to the significance of logistics and organised marketing groups in consolidating returns and developing a vision of success among farmers. Another relationship that was similar and has a positive and significant effect was between Government Support and Profitability Perception ($b = 0.187$, $p < 0.001$).

Farmers who were aware of “government schemes and financial grants” and who reported that “government support positively impacted their farming” demonstrated higher profitability perception. Even though a portion of the subjects felt that support inputs were insufficient and that they needed to be increased, there was a general feeling of the fact that institutional support, whether in the form of financial support, technical support or policy orientation, played an important role in ensuring that the economics of strawberry production were viable. Conversely, the issues surrounding strawberry cultivation had an adverse though non-significant association with Profitability Perception ($b = -0.141$, $p = 0.052$).

It was frequently reported that the high cost of runners, lack of storage facilities in the village, unstable prices of the market, and the problem of timely payment is a challenge. These barriers, however, did not significantly reduce the perception of profitability, perhaps due to the eventual development by farmers of coping strategies or due to the fact that other factors, including government support and technical expertise or market access,

countered these barriers. The findings are then suggestive that across as many operational barriers are present, its direct influence on perceived income is small unless combined with an ineffective support system or limited resources. All in all, the structural equation modelling findings confirm that the most prominent influence on the perception of positive profitability by the farmers of strawberries is the labor dynamics, sustainable land use, efficient harvesting, conscious decision-making, and institutional and market support. All of the key directions in the model are aligned with particular questionnaire items, which supports the idea of the instrument's validity and proves that profitability is a complex phenomenon that cannot be described by a single operational factor, but instead, it is based on several enablers of the success of a company. These results are a holistic approach towards informing policy interventions, training programmers and infrastructural investments that will promote the financial viability of the fruit growers in the semi-arid agrarian areas.

Table 8: Model Fit Indices and Structural Equation Modelling Results

Category	Indicator	Indices
Model Fit Indices	CMIN/DF	2.93
	GFI	0.901
	NFI	0.919
	CFI	0.938
	RMSEA	0.034
	p-value	< 0.001

Cause and Effect Relationship Measures	**β**	***p*-value**	**Decision on hypotheses**
H1: Labor Requirements → Profitability Perception	0.310	***	Supported
H2: Land Management → Profitability Perception	0.274	***	Supported
H3: Harvesting and Handling → Profitability Perception	0.193	***	Supported
H4: Challenges of Cultivation → Profitability Perception	-0.148	***	Supported
H5: Access to Knowledge → Profitability Perception	0.094	0.218	Not Supported
H6: Production & Pricing → Profitability Perception	0.012	0.287	Not Supported

Note: *** indicates significance at p < 0.001
Source: Primary Data

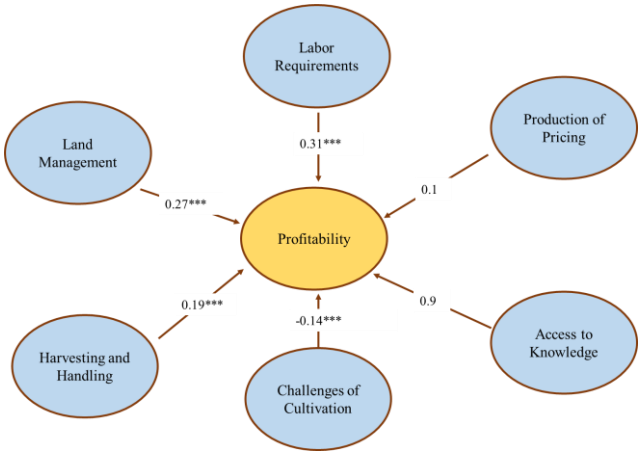

Figure 2: Structural Equation Model showing causal relationships

Note: The dotted Arrows Represents Insignificant results

5. Discussion and Implications

The objective of this study was to examine how the impact of the ability of farms to operate on the profitability perceptions of the strawberry growers in India. This study stresses the subjective economic assessment of farmers (not yield or accounting-based measures of profit), especially in the context of decision-making in a situation full of uncertainty, as opposed to traditional studies that largely rely on profit measures. These empirical findings indicate that perceptions of profitability in strawberry farming are influenced by a number of interconnected operational and support-related variables and not just one dimension.

Among all constructs examined, that were investigated, labor requirements turned out to be the most powerful indicator of profitability perception. Raising strawberries is very laborious, especially during planting, intercultural activities, harvesting, and handling post-harvest. The increased access to sufficient labor, adequate wage systems, and sound workforce management, augmented with better perceptions by farmers, made strawberry farming an economically rewarding venture. The discovery corresponds to the previous research that indicates labor management as one of the major contributors to cost effectiveness and operational stability of horticultural crops (Prakash and Sarkar, 2017; Madhukar, 2018; Bachhal et al., 2018). The finding indicates that a decrease in labour-related uncertainty results in a situation where farmers become more optimistic about the possibility to maintain income rates.

Profitability perception was also significantly and positively related to the land management practices. When farmers embraced soil tests, the raising of beds, soil mulching and the drip irrigation practices, these farmers were more hopeful of the financial success of their farm. Such practices are known to enhance soil health, water-use efficiency, and consistency in yields, thus lowering production risk. Other past research on strawberry farming has also found that the land and soil management increases productivity, as well as economic sustainability (Hasan, 2016; Datta et al., 2025; Ozturk et al., 2025). The current results reveal that the farmers retain these benefits both in the context of production and in the general evaluation of farm sustainability.

The harvesting and handling capabilities were found to have a significant impact on the perception of profitability. Because of the perishable nature of strawberry, they may become spoiled during harvesting, grading, packaging and transportation, significantly decreasing the amount of income realised. Farmers who focused on attentive manual harvesting, proper packaging, and maintenance of quality were more inclined to correlate their methods with increasing profitability. This finding could be compared to the body of study on the post-harvest efficiency as an essential economic outcome of fresh fruit systems (Hegde and Sangamesh, 2023; Cruz et al., 2024; Vijay, 2023). The results support the idea that the profitability of strawberry production not only ends with field-level production but is tightly connected with after-harvest management.

The positive and significant relationship between production and pricing management and profitability perception was also observed. Farmers who could match the level of production relative to the input costs and market prices were more confident of the economic viability of the strawberry farming industry. The usual threats faced in horticultural markets- usually in developing economies are volatility of prices and changes in input costs. In line with previous research (Khatun et al., 2020; Rabha and Sarma, 2021), the findings imply that effective production planning and pricing awareness result in the farmer to cope with economic uncertainty and stabilise their income expectation.

Access to points of knowledge and skills development tools has become a major facilitating factor influencing the perceptions of profitability of farmers. There was more confidence among the farmers who reported having access to training programs, extension services, agricultural universities, and digital learning platforms in their operational choices and income perspectives. This access promotes technical competence and informed decision making toward inputs, technology acquisition and risk management. This observation confirms the previous studies that highlight the usefulness of extension systems and learning systems in enhancing farm performance and economy in the cultivation of strawberries (Kalaitzoglou, 2019; Jain et al., 2023; Jyoti et al., 2024). On the other hand, issues inherent in the strawberry production showed a negative but statistically non-significant correlation to profitability perception. Even though farmers did admit that they faced certain limitations, including expensive inputs, weather unpredictability, lack of labour and unpredictable markets, these did not pose a major threat in their overall judgement of profitability. This implies that the growers can have established adaptive measures or can have had institutional support systems that reduce the negative impact of these constraints. The same has been found in such studies in which production risks were mitigated by access to knowledge, market linkages, and government support (Autio et al., 2021; Sonkar and Tripathi, 2025). Combined, the results show profitability perception of farmers is influenced by their perception of operations control, management ability, and availability of enabling resources. Perception of profitability, consequently, turns out to be a multidimensional construct that is affected by the activities within the farm as well as the external support systems.

5.1. Theoretical Implications

This study contributes to the literature on high-value horticulture and farm management by advancing a capability-based perspective on farm profitability. Previous research on strawberry cultivation has largely relied on cost-benefit analysis or examined individual practices in isolation (Hasan, 2016; Tripathi, 2024). In contrast, the present study conceptualises farm operations as a set of interconnected capabilities that jointly shape farmers' economic evaluations. By focusing on profitability perception rather than realised profit alone, the study aligns with behavioural approaches in agricultural economics, which recognise that farmers' decisions are influenced by subjective assessments of risk, stability, and long-term viability (Park, 2021). The results suggest that operational capabilities function not only as technical resources but also as cognitive frameworks through which farmers interpret their economic outcomes. This perspective extends existing models of farm performance and provides a more nuanced understanding of decision-making in high-value crop systems.

5.2. Practical and Policy Implications

The results have a number of workable implications to farmers, extension agency and policymakers. To start with, labor management has a powerful impact, which reveals the need to introduce the intervention measures aimed at improving labor availability, skills formation, and cost-easing. Promotion of selective mechanisation, imparting skilled labour and practicing equitable wages should all assist in enhancing operational efficiency and enhance confidence of farmers with regard to profitability. Second, the focus on land management supports the importance of promoting agronomic sustainability through the provision of goal-oriented extension services and policy support. Promotion of drip irrigation, mulching, soil analysis and protective cultivation can all be used simultaneously to increase output, reduce risk, and boost economic opportunities of the farmers. Third, post-harvest infrastructure, such as a packaging plant, a cold store and an efficient transportation system, should also be invested in to minimise loss and value maximisation should also be enabled. Enhancing harvesting and handling potential can significantly adjust

the noted and real profitability of strawberry production. Fourth, the enhancement of access to knowledge and skills development should be kept as one of the policy priorities. Close connections between farmers, research institutions and the extension agencies would bolster technology adoption and quality of decision making that would add strength to the rest of the work capabilities. Lastly, the production risks can be offset by having a good support mechanism, and this is shown by the insignificant influence of cultivation challenges. Combining financial and technical support with the ability to enter the market will prove more efficient than individual intervention when it comes to the preservation of strawberry farming in the new horticultural areas.

6. Conclusion, Limitations, and Future Directions

The findings of this study have established that the notion of profitability among the strawberry farmers in India is determined by the profound combination of various capabilities of operations of farms, as opposed to the determined production outcomes. The rational analysis of the problem of labour needs and labour demands, land management, productivity and efficiency of harvesting and handling, production, price management, availability of knowledge and skills development, and cultivation-related issues were crucial areas to organise a totality of operation capability structure. The results show that labour management, land management, harvesting and handling, production and pricing management, and access to knowledge play significant roles in determining the perceptions of profitability by the farmers. These findings indicate that the profitability of high-value horticultural products like strawberry does not only depend on yield or market-price but rather relates closely to the managerial control of the farmers, their efficiency of operation and availability of the enabling resources.

The outcome of the measurement model further indicates that most of the operational variables had a significant role with their respective latent constructs, which validates the strength of the proposed framework. The structural model indicated that profitability perception had important causal relationships with most of the operational capabilities, and difficulties in growing strawberries had a negative, though statistically insignificant, influence. This implies that despite farmers being conscious of the production and market limitations, their levels of confidence in the economy are more determined by the ability to manage activities and capitalise on institutional and knowledge-based assistance. The paper hence supports the argument that boosting farm-level capacity is key in improving the perceived and actual economic sustainability in growing strawberry.

Like all empirical research, this study is subject to certain limitations. First, it was based on a descriptive and analytical research design, which was gathered in a limited area of strawberry production, which might not be a complete representation of the diversity of production environment, market structure and institutional environment dominating the entire India. This means that care should be exercised in generalising the research to other areas or horticultural systems with different agroclimatic and socio-economic factors. Secondly, the research mostly depends on self-reported perceptual data, although these data are vital when explaining the behavioural reactions of farmers, they might be influenced by personal expectations, the recent experience or recall bias. Thirdly, the use of a single-period dataset limits the ability to trace the changes in time on the operational practice and profitability perception that may manifest due to the learning effect, the variability in climatic conditions, or the market forces.

Future research can build on the present findings in several meaningful ways. Longitudinal or panel data designs would allow the studies to gain a better insight into the way the operational capabilities and the perceptions of profitability of farms can change over time. To increase the generalizability of the framework, as well as provide regional comparisons, it would be beneficial to expand the geographical area to several states or agro-climatic areas. Future research might also combine objective financial pointers (yields, costs and net returns) and perceptual measures to give a more holistic view of farm performance. Besides, the linkage of moderating and mediating variables like farm size, access to credit, risk attitude, technology adoption, and market linkage intensity might provide additional information on how the operational capabilities affect profitability perception. Lastly, the qualitative methods, such as interviews and case studies, can be used to augment the quantitative results by providing the contextual reality and the adaptation strategies of the legislation growers that cannot easily be observed using the data of the surveys alone. On the whole, the paper gives a systematic background to further research and policy intervention on the security of the economic viability of high-value horticultural farming in the environment of developing countries

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