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A critical analysis of factors influencing the managerial efficiency of shrimp farmers at Nagapattinam District, Tamil Nadu

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Abstract
Shrimp farming plays a crucial role in global aquaculture exports, offering a sustainable alternative to reduce pressure on natural fish stocks. Ensuring stable and enhanced shrimp production in India necessitates better management practices and advanced technologies**,** with Nagapattinam District, Tamil Nadu playing a crucial role in its production. This study critically examines the factors influencing the managerial efficiency of shrimp farmers in the district. A total of 150 shrimp farmers were randomly selected from three major blocks in the district. Data were collected through structured interviews and analysed statistically. Results revealed that 71.33% of the farmers showed medium-level efficiency, with an overall managerial efficiency of 72.67% and a gap of 27.33%. Key functional domains influencing efficiency included timely adoption, resource mobilization, evaluation competence, and planning ability, which showed higher efficiency levels. However, gaps were noted in rational decision-making, marketing, and coordination activities. Variables such as education, income, experience, farm size, training, and risk orientation positively influenced efficiency, whereas farm ownership had a negative effect. The study emphasizes the need for targeted training programs aimed at enhancing decision-making skills, market intelligence, and interpersonal coordination to bridge the efficiency gap and promote the long-term sustainability of shrimp aquaculture.

Keywords: Aquaculture, budgeting, factors, managerial efficiency, shrimp

1. Introduction
Shrimp is an important farmed aquatic species that play a vital role in the nutritional needs of humans because of its high protein, minerals, vitamins and balanced amino acids, etc., (Salehi, 2010; Tazike, 2010) [1, 2]. In fisheries sectors, shrimp farming is irreplaceable in terms of market value and contribution to the global economy. Worldwide shrimp production growth was predicted around 5.6%, with the greatest demand from China and US. India is the second-largest contributor of farmed seafood (6.3%) in the world after China and ranks sixth among the largest shrimp producers in the world. India exported 17, 81, 602 metric tonnes of seafood during 2023-24, marking a 2.67% increase in quantity compared to 17, 35, 286 tonnes in 2022-23. However, the export value declined, with total earnings of ₹60,523.89 crore (US$ 7,381.89 million), representing a 5.39% drop in rupee terms and an 8.80% decline in dollar terms from the previous year. The unit value of exports also fell from US$ 4.66/kg to US$ 4.14/kg, a decrease of 11.17%, indicating downward pressure on international prices despite the increase in volume. The most dominant species *Penaeus vannamei* production reached up to 94% of the total shrimp production of the country during 2023-24. Shrimp farming creates direct employment to 0.3 million people of India (Patil *et al*. 2019) [3]. The primary cause for such growth is the adoption of best management practices and efficient management of the enterprise. Among the other factors of shrimp production, management factors are more crucial. Recent advances in shrimp production practices, technology demonstration and the scientific method have a great potential for improving shrimp production. Therefore, raising managerial efficiency is very important to shrimp producers. This will open up new vistas and make it possible for shrimp farmers to achieve a substantial gain in income. Hence, raising

managerial efficiency is considered to have prior importance and also a basic problem. This problem needs to be carefully tackled for the long-run solution of underdeveloped shrimp farmers. With knowledge pertained with this background the present study was framed with the following objectives; to ascertain the managerial efficiency of shrimp farmers and to identify the relationship between socio-economic profile and managerial efficiency of shrimp farmers.

2. Materials and Methods

The present study was conducted in Nagapattinam district, Tamil Nadu, India, which has the second-longest coastline in the state, stretching approximately 188 km. The fisheries sector serves as an economic backbone of the district and plays a vital role in marine exports. Additionally, the district's backwater resources offer favourable conditions for shrimp farming. Shrimp is one of the major export-oriented commodities in the region. Considering these factors, three blocks (Nagapattinam, Keelvelur and Vedaranyam) were purposively selected for the study, with respondents distributed village-wise. A total of 150 shrimp farmers actively engaged in shrimp farming were randomly selected as respondents.

2.1 Data collection and analysing

The primary data was collected using a pre-tested and well-structured questionnaire interview schedule applied to the respondents. The shrimp farmers were interviewed regarding production cycle with the following input-output data: ability in planning, ability in make rational decisions, timely adoption, ability to mobilize resource, ability to coordinate activities, efficient use of resource, ability in rational marketing, competence in evaluation, budgeting skill as well as the socio-economic profile of the respondents. A managerial efficiency scale was developed following the method proposed by Nagaraja (1989) [4], with slight modifications to suit the present study context. The data were analysed using appropriate statistical tools such as frequency distribution, percentage analysis, mean, standard deviation, and multiple regression. A managerial efficiency index was calculated for each shrimp farmer, as well as for each individual managerial efficiency component, to assess the strengths and gaps across functional areas. Based on the mean and standard deviation, respondents were classified into low, medium, and high-efficiency categories.

3. Results and Discussion

3.1 Level of managerial efficiency of shrimp farmers

Managerial efficiency refers to the extent to which an individual adopts and utilizes effective management factors within an enterprise to achieve higher levels of performance. The results of the managerial efficiency analysis of shrimp farmers in the present study are presented in Table 1.

Table 1: Distribution of the respondents according to their level of managerial efficiency of shrimp farmers

SL. No.	Level of Managerial efficiency		Number	Percent
1	Low	(<80.19)	24	16.00
2	Medium (80.19 to 93.13)		107	71.33
3	High	(>93.13)	19	12.67
	Total		150	100
Mean=86.66		Standard Deviation (SD) =6.47		

The results presented in Table 1 indicate that a majority (71.33%) of the shrimp farmers showed a medium level of managerial efficiency, followed by 16.00% with low efficiency and only 12.67% with high managerial efficiency. The mean managerial efficiency index was recorded as 86.66±6.47, indicating a moderate overall performance in managing shrimp farming activities. This suggests that the majority of farmers are moderately effective in managing their shrimp farming operations. One possible reason for this outcome could be the limited access to formal training programs, which restricts farmers from enhancing their skills in key areas such as planning, marketing, and decision-making. Although many have practical experience, a lack of structured exposure to modern farm management techniques and insufficient extension support may contribute to this moderate performance. Additionally, socio-economic factors like education level, income, and risk orientation, while positively influencing efficiency may not be strong enough among all respondents to push them into the high-efficiency category. For instance, similar patterns have been observed in livestock farming, where most farmers reported moderate levels of managerial effectiveness in broiler and dairy units (Topper *et al*., 2004; Sowjanya & Halakatti, 2015; Patel, 2016) [5-7]. Likewise, Kalsariya (2016) [8] found that the majority of coconut farmers also fell into the low to medium efficiency category, suggesting that this trend may be common across various agricultural enterprises in India.

Table 2: Extent of overall managerial efficiency and managerial efficiency gap among shrimp farmers in farm management practices, N=150

Components of managerial efficiency	Maximum of obtainable mean score	Total of obtainable mean score	Extent of managerial efficiency, (%)	Managerial efficiency gap, (%)
1. Ability in planning	07	5.09	72.71	27.29
2. Ability to make rational decision	18	9.74	54.11	45.89
3. Timely adoption	34	30.47	89.62	10.38
4. Ability to mobilize resource	24	21.31	88.79	11.21
5. Ability to coordinate activities	07	3.83	54.71	45.29
6. Efficient use of resource	05	3.79	75.8	24.2
7. Ability in rational marketing	07	2.89	41.29	58.71
8. Competence in evaluation	06	4.50	75.00	25.00
9. Budgeting skill	12	7.04	58.67	41.33
Overall	122	88.66	72.67	27.33

The component-wise analysis of managerial efficiency among shrimp farmers revealed significant variation across different functional areas (Table 1 and Figure 1). The highest efficiency levels were recorded in timely adoption (89.62%) and resource mobilization (88.79%), indicating that most farmers are prompt in adopting new farming practices and capable of organizing essential inputs effectively. These results suggest a high level of practical engagement and adaptability among the respondents, which is often driven by experience, peer influence, and immediate operational demands. Moderate efficiency was observed in efficient use of resources (75.80%), evaluation competence (75.00%) and planning ability (72.71%). These components reflect a reasonable level of awareness and skill in routine farm management. However, the relatively lower scores in planning indicate a possible lack of formal training in systematic farm design and forward-looking strategies.

The lower efficiency was found in rational decision-making (54.11%), coordination of activities (54.71%), and budgeting skills (58.67%), suggesting a deficiency in structured thinking, financial literacy, and multi-tasking abilities. In that, rational marketing scored the lowest efficiency at 41.29%, highlighting a significant gap in market orientation, pricing knowledge, and marketing strategies. This could be attributed to limited exposure to formal market systems, lack of training in value chain management, and inadequate access to real-time market information and production cycle.

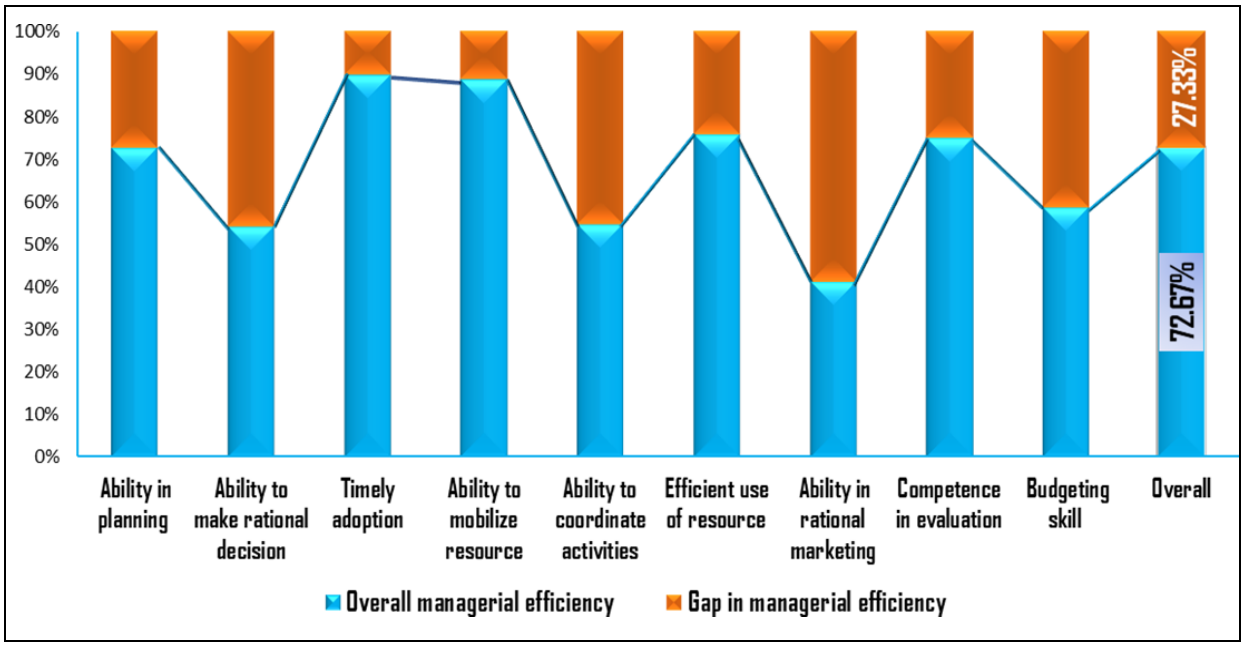

Fig 1: Extent of overall managerial efficiency and managerial efficiency gap among shrimp farmers in farm management practices

The overall managerial efficiency was found to be 72.67%, with a managerial efficiency gap of 27.33%, indicating a moderate level of effectiveness in managing shrimp farms. These findings are consistent with previous studies in other agricultural sectors, where a majority of respondents exhibited medium levels of managerial efficiency. Similar studies were reported in dairy and broiler farming (Topper *et al*., 2004; Sowjanya & Halakatti, 2015; Patel, 2016) [5-7], as well as in coconut cultivation, where Kalsariya (2016) [8] found that 76% of the farmers fell into low or medium efficiency categories.

3.2 Factors influencing the managerial efficiency of shrimp farmers

Table 3 presents the result of the relationship between socio-economic profile and managerial efficiency of shrimp farmers in the study area. The multiple regression analysis is used to determine whether independent variable factors contribute to the dependent variable of managerial efficiency. The F-ratio (5.59) was significant at 5% suggesting a good fit of the model. The R2 estimate (0.435) indicated that 18 independent variables could explain 43.5% of the variation in the dependent variable (managerial efficiency).

The results in Table 3 indicate that 14 variables had a positive (p<0.01, p<0.05) impact on managerial efficiency of shrimp farmers including age, occupational status, annual income, experience of shrimp farmers, farm size, participation in training programme, social participation, innovativeness, mass media exposure, scientific orientation, risk orientation and educational status, level of aspiration and credit orientation, while only one variable (farm ownership) had a negative impact. Although three independent variables namely contact with extension agency, self-confidence and economic motivation related to shrimp farming had no significant impact on the managerial efficiency of shrimp farmers.

The results showed that the age of shrimp farmers was positively significant at a 1% level to managerial efficiency, which was consistent with the statement made by (Tammaroopa *et al*., 2016) [9] indicating that the age of the farmers positively influences the white shrimp production. Similarly, other reports are supporting that the older farmers are more capable than the younger farmers in better management practices leading to increased production (Alauddin and Hamid, 1996; Begum *et al*., 2015; Dey *et al*., 2000; Alam *et al*., 2011 and Rhaman *et al*. 2011) [10-14]. The influence of age may be due to the fact that experience gained through learning-by-doing positively contributes to the managerial efficiency of the older shrimp farmers.

As for the farm size is considered, the results showed that the size of the farms has positively correlated with managerial efficiency at a significance level of 1%. These results are in accordance with the findings of Tammaroopa *et al*. (2016) [9] where the farm size had a positive significant relationship with technologies used for increased shrimp production. The

reason behind these findings may be due to the efficient utilization of resources, manpower, machinery and farming equipment for the management of year around shrimp culture activity in such increased cultivation area. This was further confirmed in previous findings (Rahman. 2005; Begum *et al*., 2015) [15, 11] where increased farm size has led to increased production.

Further in our study, the educated farmers are better at managing the shrimp farms as the educational status was positively significant with managerial efficiency. Similar results were observed by Begum *et al*. (2015) [11] where a greater number of respondents involved in shrimp farming were educated. It can be speculated that educated farmers are better at following proper farm management practices and are capable to gather and adopt more information regarding new technologies. These findings were supported by Abdulai and Eberlin. (2001) [16] where the increased formal education would augment more productivity as they have knowledge of utilization of purchased or available resources, financial management and participating in training programs related to better management practices.

In our study, we also found that the variable farm ownership has a significant negative impact on managerial efficiency. That is the farmers having leased farms gave more attention to farm management than the farmers who are the landowners of their farms. A similar negative relationship between farm ownership and management was observed in a previous report (Swathi Lekshmi *et al*., 2005) [17]. The farmers having their farms leased could spend them financial investment in adopting new management practices like increased feed, disease management, water and soil quality management.

Table 3: Relationship between socio economic profile and managerial efficiency of shrimp farmer's, N=150

Variable code	Independent variables	Correlation coefficient ('r') value	Regression (B)
X1	Age	0.325**	0.040
X2	Education status	0.171*	1.330
X3	Occupational status	0.229**	0.626
X4	Annual income	0.318**	-1.243
X5	Experience of shrimp farmers	0.429**	1.662
X6	Farm size	0.365**	-0.452
X7	Farm Ownership	-0.273**	-1.160
X8	Participation in training programme	0.404**	0.603

NS = Non significance, ** = significance at 0.01 level * = significance at 0.05 level

4. Conclusion

From this study, it can be concluded that shrimp farmers showed a moderate level of managerial efficiency, with an overall efficiency of 72.67% and an efficiency gap of 27.33%. This gap indicates a pressing need to address managerial inefficiencies in shrimp farming practices. To bridge this gap, the study recommends the implementation of regular training and capacity-building programmes aimed at enhancing technical knowledge, farming skills, and awareness of relevant government schemes. In addition, the government should prioritize shrimp price stabilization, the establishment of accessible disease diagnostic centers, and affordable water quality testing laboratories to support farmers. Improving managerial efficiency is essential for the sustainable development of the sector. Therefore, extension agencies must play a proactive role in educating farmers on the efficient and sustainable use of resources to ensure better farm management and long-term productivity.

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Conflict of interest

It is declared that there is no conflict of interest by the authors.

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