CHAPTER 7
CONCLUSION

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CHAPTER - 7

CONCLUSION

The global food system is a complex web of production, processing, storage and transportation that moves agricultural products from field-to-fork, or from capture-to-consumption, through a traditionally resource-inefficient series of activities. Scientists, policy makers and producers of food agree that these global agri-food supply chains are unsustainable and that new incentives for increasing resource efficiency in the sector are crucial to meeting the challenges before us. A resource based approach that facilitates scientific and optimal utilization of production potential of natural and human resources are the primary consideration. The Boserupian view on agricultural intensification was discussed in the background of thickly populated coastal agro-eco systems. The trickle down mechanism of intensive agriculture was also taken for discussion in the context of backward rural economies. An attempt has been made to review the past studies which were relevant to farm economics especially the economics of rice based cropping systems in item of methodology and subject matter. Studies on different types of integrated farming practices evolved around the world were also appraised. In the discussion, the ‘win-win’ model of sustainable crop production aroused as a viable proposition. The potentials of the integrated farming technology for transforming existing traditional farming systems into more sustainable system has been highlighted in the study.

The present study was intended to fill the research gap in systematic identification of the trends in the agricultural sector of coastal Kerala especially with regard to the rice based farming practices in the coastal tract. The complementary nature of the crops raised in the integrated
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systems was systematically analyzed through an exploratory research. Through a frontier production function analysis, resource use efficiency was checked and technical efficiency of the sample farms was analyzed. It’s a fact that even though scientific experiments were proved to be in favour of the integrated approach, there was dearth of policies in popularizing such farming practices. Hence the present study has given special attention to identify the constraints confronted by the farming communities involved in integrated farming in the coastal agro-ecosystem of the state.

7.1 Findings

The crisis situation in the cultivation of major crops especially the decelerating trend in area under cultivation and the economic dimensions have clarified through the Compound Annual Growth Rate analysis. From the trend analysis, it was found that the coastal districts as such provided a significantly high negative growth in area, production and productivity for the food crops, paddy and tapioca but no significant difference was observable for the non-food crops. The findings suggest that to revive the agricultural economy of coastal Kerala, it is high time to implement a food crop oriented strategy with rice as the central crop. The most significant Indian policies and institutional support that would apply to the sustainable development of coastal agro-eco systems were explored to find out appropriate alternatives their better management.

The primary level investigation under the study was carried out using a multi stage stratified random sampling procedure with equal sample representation in the selected coastal ecosystems of Pokkali and Kuttanad. The pooled results on the general profile of the samples revealed the absence of a young generation as agricultural work force in the study region. Another noteworthy finding was with regard to the occupational
status of farmers which revealed that only 15 per cent of the sample respondents in the Pokkali system and 36 per cent in the Kuttanad tract were following this age old activity as their main occupation. When the farming experience was analyzed it was seen that the respondent farmers have got more than quarter-a-century experience in their farming activities.

The average farm size for the study area was found to be 0.56 ha for the Pokkali ecosystem and 0.714ha for the Kuttanad system setting them aside under the title of marginal farmers. The field survey revealed that more than one-third of the respondents were having animal husbandry as their supplementary enterprise. The system gives immense scope for following the sustainable farming practices like organic farming and eco farming in the coastal paddy fields.

The farming practice in Pokkali fields under study is unique and no significant difference was found between sample locations in chi-square test. Nearly two-third of the respondent farmers used traditional Pokkali seeds for paddy cultivation against the high yielding variety seeds. Against the trend found in Pokkali fields, the Kuttanad farmers were seen to be more scientific in selecting paddy seeds. The coverage of High Yielding Variety was almost hundred cent in Kuttanad tract. When tested using chi-square statistic, no significant difference was seen across selected locations with regard to the farming practices in the study area.

With regard to the cost of cultivation, input expended for the cultivation of paddy comprised labour, machine, materials and other items. For monocropping of Pokkali rice, Rs.22466 per hectare was incurred as the operational expenses accounting to 89.7 per cent of the total cost of Rs.25034 per hectare. With labour cost accounting to more than two-third, rice monocropping in Pokkali has been proved to be a highly labour intensive activity and this means that any labour shortage will definitely
give rise to a heavy reduction in area under cultivation of this crop. The low usage of fertilizers revealed the system of Pokkali rice production as cost-effective and eco-friendly organic culture. The result of the input-wise cost incurred across sample locations for paddy cultivation under the sequential farming practice portrayed two things; firstly, the cost reduction from the monocropping system was common for both the locations and secondly, the cost difference across regions had narrowed down. The comparative analysis of the input-wise cost for paddy cultivation under monocropping and rotational farming in the Pokkali tract illustrated the cost advantages of the crop grown under the integrated system with the cost reduction to the tune of 4.8 per cent of the total cost incurred in monocropping. Comparative cost advantages for paddy cultivation in the rotational farming system indicate that the mutualism experimented in this region is a good model for incorporation in similar ecosystems. Against the low input agricultural activity, the aquaculture practice in Pokkali area was highly capital intensive with an average cost of Rs. 135245 per hectare. A huge spending within a short span of time makes prawn farming a risky venture.

In the Pokkali ecosystem, the average yield attained by the respondent farmers for rice was much lower when compared with the state average of 2733kg per hectare. The productivity reported by respondent farmers for rice under monocropping and sequential farming practice were 1979 kg/ha and 2090 kg/ha respectively. The sequential farming practice was seen earning an additional output of 110 (5.29%) per hectare. Though minimal, the result proved the relative superiority of sequential practice over the rice monocropping systems. The result of the normal test also showed statistical significance for these results. The yield gap analysis revealed that 16 per cent gap exists between the average farm yield and the
potential yield realized among farmers following rice monocrop in the study area. The results obtained in the case of respondents practicing sequential farming was 15 per cent. The shortfall in desirable yield was occurred basically because of the unscientific method of paddy cultivation with heavy dependency on low productive local variety seeds. Socio-economic issues like inactivism due to little expectations from the farming community, lack of mechanization in harvesting were also accountable for the low yielding Pokkali.

In the case of prawn farming in Pokkali system, yield gap recorded was 37.6 per cent. Major constraints identified in realizing the potential yield were the unscientific management of the system in selection of seed, feed supplementing and eradication of predator fishes. The low survival of prawn seeds and the frequent outbreak of diseases were also accountable to a great extent in reducing the prawn yield in Pokkali. As revealed by the respondent farmers, the integrated paddy was found complimenting prawn culture in two ways; firstly, the bi-product recycling enabled by the paddy cultivation with the rice plants taking away the huge bio-mass settled down during prawn farming reduced the risk of disease outbreak in subsequent prawn culture. Secondly, with the juvenile prawns fed by the plankton growth in the left over straw, the survival rate of prawn seeds came up and thereby productivity enhancement occurred in the rice-prawn sequential system.

Under the Pokkali tract, paddy cultivation was found to be less remunerative for both monocropping and sequential farming practices. The net returns and Benefit-Cost ratio revealed the economic superiority of rice-prawn rotational farming practiced in the Pokkali tract. The results revealed that the farmers under rice mono culture incurred a net loss of Rs. 3791 per hectare for their farming activity. When the respondent farmers
practicing rice-prawn sequential farming incurred a net loss of Rs.1426 for their paddy cultivation they were able to compensate their losses through the net return of Rs.65555 per hectare they earned through prawn farming. The B-C ratio of rice monocropping in Pokkali was found to be 0.85 against 0.94 for rice component in the sequential system and the prawn component of 1.48. For the rice-prawn farmers the net return from the two enterprises together was Rs.64128 per hectare with a B-C ratio of 1.40. The region-wise result revealed that in both the locations, the respondent farmers following rice-prawn rotational practice have improved their economic position against their counterparts in the monocropping system.

The results showed that the agricultural operations in Kuttanad paddy fields were highly labour-intensive even when many critical operations like harvesting had been mechanized. At the aggregate level, the total cost for rice production under rice monocropping amounted to Rs.39148 per hectare of which cost on hired labour alone constituted 45 per cent. When compared to the sequential farming, majority of the farmers under rice monocropping spent huge money on fertilizers and chemicals. Remarkable reduction in input cost was evident for rice production under sequential farming practice. The cost saving was to the tune of Rs.7721 per hectare or 19 per cent. Major cost reduction was seen in three components namely labour, machine power and fertilizers. Cost on plant protection chemicals was fully saved and cost for removing weed plants was reduced significantly. The trend is promising in the sustainable perspective because a reduction in the use of these materials will certainly give more balance to the Kuttanad wet land ecosystem. Input-wise cost of cultivation for fish indicated that human labour was the most important input component of the total cost of Rs. 25224/ha incurred at the aggregate level.
The average yield attained by the respondent farmers in the Kuttanad tract for rice under monocropping and sequential farming practice were promising and it stood far above the state average. Productivity per hectare for rice under rice-fish sequential system was found to be improved by 263 kg or 6.9 per cent over rice monocropping. The result of the normal test carried out provided statistical significance for these results. Since the area under rice has been dwindling day by day, the available solution for meeting the growing domestic requirements is productivity improvement programmes and the rice-fish sequential system practiced in the rice bowl of Kerala has shown such yield enhancements. The yield gap analysis revealed a gap of 11 per cent and 8 per cent respectively under rice monocropping and sequential farming. Yield gap was reduced under sequential farming due to the higher technical efficiency of the integrated system. In the case of fish culture under rice-fish sequential system, an average yield of 579 per hectare was observed with a yield gap of 18 per cent which suggests for further interventions for productivity improvements in fish under sequential system in Kuttanad.

Contrary to the results of Pokkali tract, the sample respondents in Kuttanad across all the regions and all the systems were able to fetch remunerative return for paddy cultivation. At the aggregate level, net return per hectare for rice monocropping, rice under sequential system and fish under sequential farming were amounted to Rs.5405, Rs.16312 and 16540 respectively. The phenomenal hike in the net return for the sequential farming reflects its significance in the rice based agro-eco system of Kuttanad. The Benefit-Cost ratio showed that when the rice monocropping activity produced a B-C ratio of 1.14, for the rice-fish farmers it was 1.6. For the sample farmers in sequential farming, it was found that their net profit got many-fold increase through the change over to the new system.
The findings of the study strengthen the literature on comparative advantage of rice based multi enterprises in generating additional employment opportunities. As per the findings of the study, the rice-prawn rotational practice followed in the Pokkali tract and the rice-fish sequential farming practiced in the Kuttanad tract were found to be solutions to the ever increasing seasonal unemployment in the rural economy of coastal Kerala. The study revealed that the rice-prawn rotational farming system in the Pokkali tract generated additional employment opportunities to the tune of 175 man days per hectare (264%) against the monocropping practice.

The employment generation potential of rice-fish rotational farming system practiced in the Kuttanad tract was evident from the result of the field survey. In places where single crop of rice was carried out earlier, an additional employment generation to the tune of 60 man days per hectare was generated through fish integration. The results of the study showed that the incremental employment generation in sequential farming system over rice monocropping was 38 man days per hectare. The integrated system now followed in Kuttanad has enough potential to use much more labour days if farming is undertaken on an extensive scale. Therefore the new system is undoubtedly advantageous in mitigating the seasonal unemployment problem among the agricultural labourers.

The major constraints for rice under monocropping and in the sequential system were identified and ranked by the respondents based on the severity as perceived by them. Labour shortage for farm operation under water logged conditions was found to be the most important constraint for paddy cultivation in the Pokkali tract and followed by this came the issue of non-availability of suitable agro-machineries. The low price fetched due to the absence of a proper marketing mechanism for the organic rice was identified as the third most important problem. The other
constraints raised were non-availability of high yielding variety seeds and salinity intrusion due to the illegal activity of perennial prawn culture in the area. Among the constraints identified by the respondents for prawn farming, the highest rank was given for non-availability of quality seeds and followed by this came the crucial issue of disease attacking the prawns before attaining the marketable size. Other issues put forwarded were non-availability of credit, water quality, lack of institutional support and high input cost.

In the case of paddy cultivation in Kuttanad, non-availability of labour during the peak agricultural operations was considered as the major constraint. Marketing at unaffordable price was the second important problem felt by the rice farmers and followed this other issues like high input price, weed infestation in rice monocropping, pest and disease outbreak. Due to improper management of the salt water barrier in Thanneermukkom, salinity intrusion was also identified as a major constraint by respondent farmers. Inadequacy of fish fingerlings and its untimely supply were the most important constraints as felt by respondent fish farmers in Kuttanad. Direct marketing without any buffer stock operations was found to be second great problem. Lack of coordination among the farmers in the polder was the third ranked constraint as revealed by the respondent farmers. Since farming operations under fish segment was carried out jointly by the polder group society, individual initiative was absent and hence theft was frequent in the study region.

The statistically significant components under resource use efficiency test carried out for Pokkali rice in sequential farming were man power and farming experience of the sample respondents. The result obtained for components like seed, machine power and fertilizers revealed over use of these factors. The only input which provided statistically
significant result under rice monocropping in Pokkali system was lime and fertilizers. The coefficient obtained indicated the negative elasticity of fertilizer on rice productivity. The result once again demonstrated the evil effect of chemical fertilizers on the productivity deterioration in Pokkali farms. The lower mean efficiency value found out in technical efficiency analysis for paddy among the sample respondents in Pokkali tract indicated that there was scope for improvement in the yield of paddy in the Pokkali area through resource reorganization.

The resource efficiency of inputs used for paddy cultivation in Kuttanad revealed that human labour was found statistically significant in rice-fish systems whereas machine power was significant in rice monocropping system. Though statistically non-significant, the negative coefficients for seed in sequential system indicated their over usage in crop production. Over use of labour force, plant protection chemicals and sub optimal size of paddy fields were evident from the resource productivity analysis of rice monocropping in Kuttanad.

The economic superiority of farmers participating in the integrated farming paradigm increased competitiveness and the participatory approach for collective farming. In contrast to the intensive rice monocropping practices that brought about degradation of the coastal wetland ecosystem, the rice based integrated farming system not only reduced the use of agrochemicals, but also paved the way for an organic culture before the farming community. Reliance on integrated management through recycling of bio-products have been the focus of this approach and the system therefore been resource conserving and socially supportive.

7.2 Contributions of the Study

A modest attempt is made to study the rice based cropping system in coastal Kerala. The crisis situation in the cultivation of food crops in the
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state is clarified in this study through the trend analysis. The coastal agroeco system of the state has its speciality which is portrayed in the study. **The attempt to measure the competitiveness of rice based cropping system is the significance of the work.** The findings of the study signify the superiority of rice based cropping system in generating additional employment opportunities. The study gives attention to a comprehensive assessment of the resource use and technical efficiency of the paddy fields of coastal Kerala. The study also identifies the deficiencies in proper utilization of resources.

### 7.3 Policy Implications and Suggestions

The need of the hour is to optimize and popularize suitable models of rice based cropping systems in the coastal ecosystem of the state. Appropriate policy measures are to be adopted to insulate the rice farmers of coastal Kerala. The following policy options are suggested in this regard.

1) In the low lying coastal paddy belts of the state, integrated rice-prawn/fish rotational farming system may be popularized and encouraged by lending all institutional support and patronage.

2) More funds may be allocated for Research and Development to evolve economically viable and technically feasible cropping systems with rice as the central crop.

3) Farming operations especially land preparation and harvesting may be incorporated under the schedule of activities of the Mahatma Gandhi National Rural Employment Guarantee Programme.

4) Farm mechanization may be encouraged wherever possible in the context of acute labour shortage during peak season. Agro machinery suitable for Pokkali region should be developed in a time bound manner.
5) Soil and water conservation measures to be intensified by strengthening the outer bunds of paddy fields so that profitable crop rotation can be taken up systematically. A mechanism as envisaged in the Kuttanad package is desirable for the coastal paddy fields of the state.

6) Organic farming may be popularized through frontline demonstrations and production incentives. Certification and branding of organic products from coastal wet lands is suggested.

7) In order to fetch a reasonable price for the fish harvested in Kuttanad system, the post harvest technology may be formulated so as to ensure long shelf storage to the fish.

8) There are cases to raise other perennial crops like the continuous prawn farming in the Pokkali fields. Conversions are also going on for non-agricultural purposes in the coastal agro-eco system of the state. The legal parameters should be redefined by the government.

7.4 Conclusion

The study established the need for an integrated approach to farming to save rice in wetland ecologies and highlighted that water is the strength and integration of an aquaculture enterprise is an opportunity available to farmers depending on the coastal low lying paddy fields of Kerala. There is further scope for a detailed multidisciplinary analysis of rice based cropping system in Kerala.