GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD

FOURTEENTH FIVE-YEAR PLAN
(2022-2027)

WORKING GROUP ON

A PLAN TO EXPAND AND MODERNIZE SUPPLY CHAINS IN AGRICULTURE IN KERALA

REPORT

AGRICULTURE DIVISION
March 2022

FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to this Plan. The members of the Working Groups represented a wide spectrum of society and include scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialised knowledge in different sectors, best practices in the field, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalised after several rounds of discussions and consultations held between September to December 2021.

This document is the Report of the Working Group on "A plan to expand and modernize supply chains in agriculture in Kerala." The Co-Chairpersons of Working Group were Dr.Poornima Varma and Dr.A.Prema. Dr.R.Ramakumar, Member of the State Planning Board co-ordinated the activities of the Working Group. Sri.S.S.Nagesh, Chief, Agriculture Division was the Convenor of the Working Group and Smt.G. C. Roshni, Agronomist, Agriculture Division was Co-Convenor. The terms of reference of the Working Group and its members are in Appendix 1 of the Report.

Member Secretary

PREFACE

As part of formulation of the 14th Five Year Plan, the Kerala State Planning Board had constituted working groups of experts in all the major sectors. In Agriculture and Allied Sectors, 6 working groups were constituted viz. Agriculture and Cooperation, Animal Husbandry and Dairy, Inland and Marine Fisheries, Forest and Environment, Water Resources and Regional Packages. To discuss and frame policies in each of these sectors, the working groups were further divided into 28 Expert Sub-Groups (ESG) with specific mandates.

Each Expert Subgroup held at least three meetings beside one focused group meeting before finalising the report. We, the Co-Chairs, place our deep appreciation and gratitude to all the esteemed members of the ESG for their valuable contributions in preparing the report. We are extremely grateful to Dr. V. K. Ramachandran, the Honourable Vice-Chairperson, Kerala State Planning Board, Dr. R. Ramakumar, Member, Kerala State Planning Board, Sri. S. S. Nagesh, Chief, Agriculture Division, for their consistent guidance and suggestions in preparing the report.The support provided by Dr. C. Anil Kumar, Assistant Director and Smt. Shahida. M. N, Research Assistant in bringing out this report is appreciated. The drafting team put in commendable work in bringing together all the views and opinions of the members. We sincerely hope the recommendations in the report can lead to important changes in the public policy on agricultural development in the State.

Dr.Poornima Varma
Expert co-chairperson

Dr.A.Prema
Official co-chairperson

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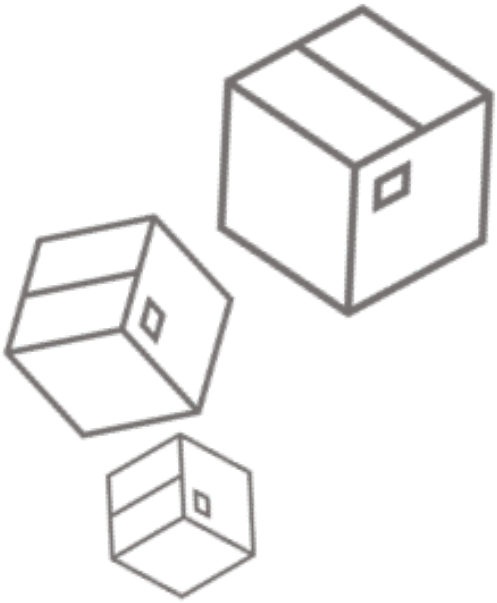


A PLAN TO EXPAND AND MODERNIZE SUPPLY CHAINS IN AGRICULTURE IN KERALA

HIGHLIGHTS

- Contribution of agriculture to the economy and drawbacks of current supply chain systems are identified.
- Supply chains for agricultural products and inputs are explained in detail.
- Demerits of existing supply chains are enumerated.
- Future strategies proposed include region- and crop-specific aggregation strategies, managing market gluts and price fluctuations, creation of a directorate of marketing and price intelligence, and improving the existing system with innovations in the value chain.
- ICT-based and Digital interventions are also proposed.

EXECUTIVE SUMMARY

The contribution of agriculture to State Domestic Product (SDP) was seen declining over the years from 13.3 percent in 2011-12 to 7.1 percent in 2019-20. However, the absolute value of sectoral contribution to SDP increased by 1.5 times. The share of agriculture in the category of agricultural and allied sectors declined from 60 percent in 2011-12 to 53.2 percent in 2019-20.

Agro-food Supply Chain Integration (ASCI) - One of the crucial issues that agricultural production in Kerala is facing is the small and fragmented production with an increase in the share of marginal farmers. Therefore, supply chain in Kerala is largely fragmented and riddled with the presence of numerous intermediaries like distributors and re-sellers who appropriate high margins.

With existing supply chains, farmers experience price risk, information asymmetry about demand, distribution inefficiency, and receive late payments. Retailers face problems like higher costs, low quality and unhygienic produce, high price volatility, and the everyday hassle of going to the market. The traditional supply chain is unorganized and has a high rate of food wastage.

The features of supply chains for each commodity are explained in detail in the report, along with the existing public and private organizations. The functioning of these institution in the supply chain management system is handicapped due to various issues such as lack of organized market information and market intelligence system, predominance of intermediaries with fragmented farmers, lack of standardization and grading, perishability, lack of storage and warehousing facilities, lack of exclusive logistic management system for agri-produce, effective financial support system, dearth of standardization and non-availability of standardized planting materials/seeds and inadequate base price assurance system. The supply chain features of agricultural inputs are also explained, including the availability of seeds, fertilizer, etc.

Future strategies proposed include Region- and crop-specific aggregation strategies, managing market gluts and price fluctuations, creation of a directorate of marketing and price intelligence, improving the existing system with innovations in the value chain.

Digital interventions have also been proposed, including a website and mobile application to share farm resources, use of blockchain technologies, tuber crops online marketing system app, and horticulture-crops online marketing system. Also, the promotion of smart production and smart farming by incorporating ICT into machinery and equipment must also be considered.

The immediate next steps are

- Critical analysis of the suitability and scalability of various transactional ICT systems existing with different organizations. Extension of Agricultural Information Management System portal (AIMS) with sufficient APIs for integration with other transactional and analytics systems.

- Sector specific, highly scalable, transactional systems with pluggable workflows
- All transactional systems built should be interoperable with API integrations.
- Sector-specific Data Marts for actionable intelligence needs to be built.
- A globally branded, Government owned digital marketplace
- Mobiles for weather alerts and sharing information on agriculture

1. INTRODUCTION

Agriculture has always been an important sector in the development trajectory of Kerala. By supplying food, providing raw material for industry, and generating livelihood it has imparted resilience to the rural economy. The State visualises a critical role of agriculture for its sojourn ahead, by leveraging transformative ability of agriculture in generating rural income through production, marketing, processing, farm tourism, and other diversified activities. Ensuring supply of inputs and services for agriculture and creating value for outputs by establishing efficient supply chain is critical in achieving this transformation. There are agencies, both under public and private sector, involved in the supply chain. However, the supply chain of agriculture inputs, products, and services are enmeshed with several inefficiencies. Creation of value for agriculture produce forms the basis for further leveraging the sector's potential. The value chain requirements for agricultural commodities has seen a sea change with emerging demand for diversified agricultural products including processed and value added products, food safety and traceability, and environmental sustainability in agricultural production. Export of agricultural produce has emerged an important income source. The need to ensure food quality and safety, particularly with regards to chemical and microbial contamination, has gained paramount importance. Various bilateral and multilateral agreements on agriculture that India has entered into has generated opportunities, but at the same time has posed several challenges too. This is mainly to remain competitive in the face of thriving agriculture in other parts of the globe, mainly in South and East Asian countries. Creating a supply chain that harnesses economies of scale is critical to remaining competitive. In this context, the sub-group examines the issues in agricultural supply chains and proposes recommendations for improving it.

SECTORAL CONTRIBUTION OF AGRICULTURE

The contribution of agriculture to State Domestic Product (SDP) was seen declining over the years from 13.3 percent in 2011-12 to 7.1 percent in 2019-20. However, the absolute value of sectoral contribution to SDP increased by 1.5 times. The share of agriculture in the category of agricultural and allied sectors declined from 60 percent in 2011-12 to 53.2 percent in 2019-20. Decline in absolute value contributed by agriculture was also seen during the decade. The decline in the sectoral share is anticipated with the transformation of the economy towards secondary and tertiary sector. However, decrease in agricultural production (in value terms) could be a point of concern.

As per Economic Review (2020), the growth rate of value added in agriculture and allied sectors in Kerala was-2.38 percent and -6.62 percent in 2018-19 and 2019-20 respectively (at constant 2011-12 prices), while rest of the sectors had displayed negative growth rate. In 2018-19, fishing and forestry sector had shown positive growth rate of 6.55 percent and 0.54 percent respectively, and in 2019-20 all the sectors had shown negative growth rates (see Table 1).

Table 1 *Trend in Contribution of Agriculture to GSDP in Kerala, 2011-12 to 2019-20 at 2011-12 Prices*

Year	State Domestic Product (SDP) (Rs. Lakh)	Agriculture and Allied Activities (Rs. Lakh)	Percentage	Agriculture (Rs. Lakh)	Percentage
	(1)	(2)	Of (2) to (1)	(3)	Of (3) to (2)
2011-2012	36404789	4837594	13.3	2904593	60.0
2012-2013	38769346	4906807	12.7	2869263	58.5
2013-2014	40278133	4597159	11.4	2599876	56.6
2014-2015	41995555	4598265	10.9	2474420	53.8
2015-2016	45121002	4363785	9.7	2278769	52.2
2016-2017	48530154	4335472	8.9	2319185	53.5
2017-2018	51618976	4426954	8.6	2354343	53.2
2018-2019	54967293	4321442	7.9	2247791	52.0
2019-2020	56863552	4035211	7.1	2147193	53.2

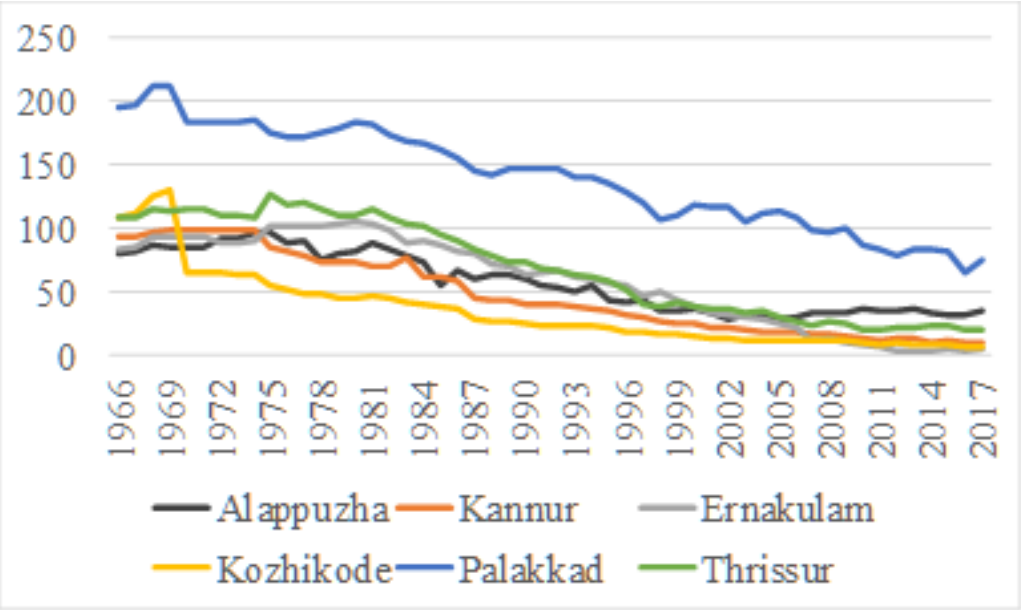
Source: EPWRF Time Series Database

AGRICULTURAL PRODUCTION SCENARIO

Rice is the major food grain cultivated in Kerala. The area under cultivation of rice was however declining over the last several decades. The total area under cultivation of paddy was 7.53 lakh ha in 1960-61 and 8.76 lakh ha in 1975-76. However, since then the cultivation experienced a decline to around 2.29 lakh ha in 2007-08. Though there was a marginal improvement in the subsequent year, in the year 2018-19 the area was only 2.06 lakh ha. During the same year, the production was around 5.78 lakh tonnes. Needless to say, the decline in area under cultivation got reflected in production as well. The area and production of paddy witnessed a negative compound annual growth of 1.8 percent and 0.4 percent respectively during the period 2009 to 2018-19 (EXIM Bank, 2020). Palakkad and Alappuzha are the major producers of rice and Figure1 given below shows that there has been a sharp decline in area under cultivation in all the major producing districts. The cultivation takes place in both dry and wet land. The dry land cultivation takes place mainly in Alappuzha district. Wetland cultivation is predominantly in Palakkad district (see Table 2).

Coconut cultivation has the largest share in the total area under crop cultivation in the State. The area under coconut cultivation was 6.93 lakh ha during 1975-76 and 7.2 lakh ha during 1985-86. The maximum area under cultivation took place in the year 2000-01 with 9.26 lakh ha. However, since then there has been a declining trend in the area under coconut. For example, the area under coconut declined to around 7.6 lakh ha in the year 2018-19. The major producer of coconut is Kozhikode with area under cultivation of around 1.15 lakh ha. This is around 15.21 percent of the total area under cultivation.

Figure1 *Trends in Area under Rice in Major Rice Growing Districts*



Source: ICRISAT

Malappuram and Kannur are the second and third major cultivators with area share of around 13.76 percent and 10.99 percent respectively.

Fresh fruits contribute around 33.88 percent of total area under food crops in Kerala. The major fresh fruits cultivated are jackfruits, mango, banana, pineapple and papaya. The area under fruits was 3.19 lakh ha in the year 2018-19. The major producing district is Palakkad with a contribution of around 12.3 percent. This is followed by Idukki and Malappuram with a share of 10.38 percent and 9.35 percent respectively.

Cashew is an important dry fruit cultivated in Kerala. However, the data of the last 15 years shows that there has been a decline in the area under cultivation of cashew (Department of Economics and Statistics, 2018-19). In the year 2018-19 the area under cashew was around 38.8 hundred ha, whereas it was 39.7 hundred ha in 2017-18. Kannur is the major producer of cashew in Kerala with a contribution of around 49.62 percent in the total area under cultivation.

Although, tapioca was the main staple food crop produced and consumed in Kerala, the area under tapioca was shifted eventually to rubber cultivation. In the year 2018-19, the total area under tapioca cultivation was around 61.9 hundred ha. Thiruvananthapuram followed by Kollam and Idukki are the major producers of Tapioca.

Table 2 *Area under Paddy Cultivation in Kerala in 2018-19*

Districts	Area under Dry Land				Area under Wetland
	Autumn	Winter	Summer	Total	
Thiruvananthapuram	70	0	0	70	1969
Kollam	156	4	0	160	1975
Pathanamthitta	30	0	1	31	3169
Alappuzha	35	3	3613	3651	38623
Kottayam	51	0	0	51	22172
Idukki	6	0	6	12	676
Ernakulam	35	7	0	42	5002
Thrissur	115	34	0	149	21982
Palakkad	97	81	0	178	76943
Malappuram	134	0	0	134	8206
Kozhikode	146	8	0	154	2175
Wayanad	0	0	0	0	7762
Kannur	186	4	0	190	5140
Kasaragod	47	6	3	56	2234
State	1108	147	3623	4878	198028

Source: Department of Economics and Statistics, Government of Kerala

Around 1.7 percent area under food crops belong to tubers. The major tubers produced are elephant foot yam, colocasia, yam, sweet potato, koorka, nanakizhangu, etc. The area under cultivation of tubers was around 16 hundred ha in the year 2018-19. Kollam is the major producer of tubers with 17.5 percent of area and followed by Pathanamthitta (16.12%) and Palakkad (11.48%) districts.

Pepper, ginger, turmeric, cardamom, arecanut, tamarind, cloves, nutmeg, and cinnamon are the major spices and condiments cultivated in the State. Idukki is the major producer of spices and condiments and in the year 2018-19 Idukki contributed around 31.5 percent of total production. The area under arecanut and pepper is around 37.05 percent and 32.03 percent of the total area under spices in Kerala. The total area under cultivation of spices & condiments during the year 2018-19 was 2.58 lakh ha. The area under pepper was around 82.8 thousand ha in 2018-19 out of which around 43 thousand ha was contributed by Idukki with a share of around 52 percent. Idukki is followed by Wayanad with an area under cultivation of around 9.9 hundred ha.

Ginger occupies around 1.27 percent of area under spices and condiments in the State with area under cultivation of 3.3 hundred ha. Wayanad is the major producer of ginger with a contribution of around 45 percent during 2018-19. The area under cultivation of

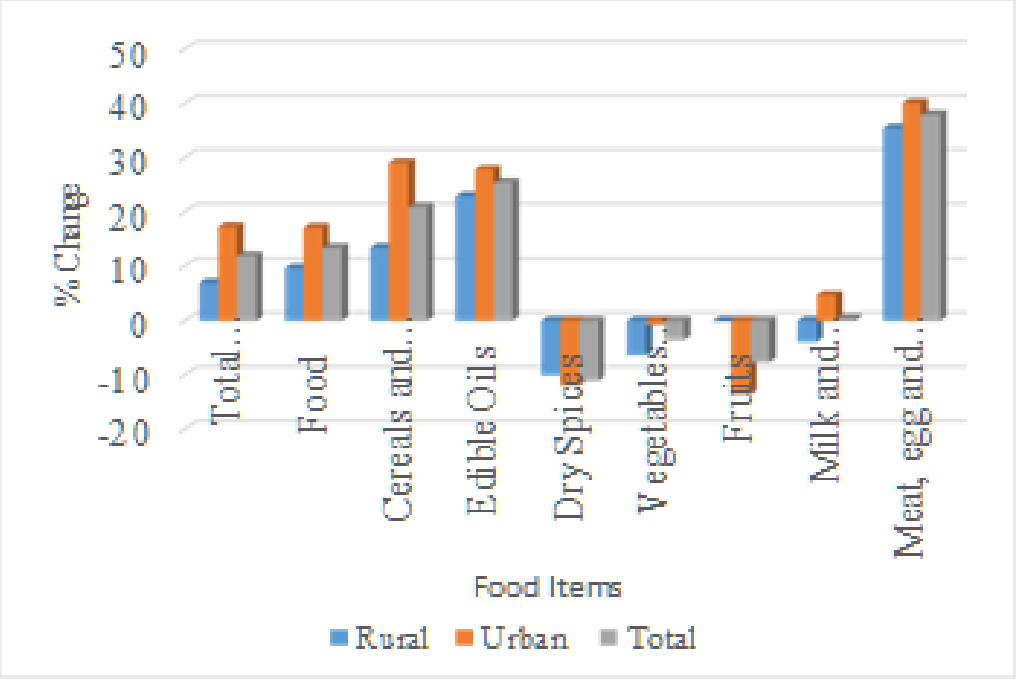
turmeric is the highest in Palakkad with around 474.86 ha in 2018-19. Around 15.05 percent of total area under spices and condiments is under cardamom and the production takes place in seven districts. The major contributor of cardamom is Idukki and followed by Wayanad. Arecanut cultivation takes place on 95.7 hundred ha of land. Though area under turmeric experienced a decline and cardamom was static, the area under arecanut showed an improvement.

The major vegetables cultivated in the State are drumstick, amaranthus, bitter gourd, snake gourd, ladies finger, brinjal, green chillies, bottle gourd, little gourd (koval), ash gourd, pumpkin, cucumber, and payar. The total area under cultivation of vegetables during 2018-19 was 41,809.11 ha with a share of around 4.42 % area of under food crops. The data shows that the area under vegetables has decreased by 9.82 percent as compared to the previous year. Palakkad (13.52 percent area), Idukki (12.12 percent area), and Malappuram (11.90 percent area) are the major producers of tapioca.

DEMAND FOR AGRICULTURAL PRODUCE IN KERALA

Food security is of top most concern with the increase in population over the years. Consumer Pyramids Household Survey (CPHS) by CMIE regularly estimates the consumption statistics of households in Kerala. Drawing from the data on CPHS, an average household in Kerala spent Rs. 6322 on their food expenses during the period 2018-19. This works out to 40.57 % of the total monthly consumption expenditure, of which 70.07% is spent

Figure 2. *Percentage change in share of various food items in total house hold expenditure between 2014-2019.*



Source: CPHS, CMIE 2018-19

on agricultural products and 29.93% on dairy and fish products for the year 2018-19 (see Table 3 and Figure 2).

Though consumption figures are available, data regarding domestic market absorption need to be estimated. This would also throw light on how much agricultural supplies are taking its route to Kerala from other States. Projecting on the basis of consumption estimate, domestic food demand in Kerala could be estimated to value of Rs.41746 crores of which 45% could be serviced by the production in the State (see Table 4). Imports of agricultural products are not reflected in the estimates due to the lack of detailed inter-State movement of products data. However, the available data from Directorate General of Commerce, Intelligence and Statistics (DGCIS) shows that the inward movement of rice, wheat, maize and millets, other grains and spices was around 601023 tonnes, 405402 tonnes, 31643 tonnes, 2376 tonnes and 256 tonnes respectively in the year 2019-20 (see Table 5).

Table 3: *Average Food Consumption Expenditure of Kerala Households in 2014 and 2019 in Rupees /month*

Items	2014						2019					
	Total	% share	Rural	% share	Urban	% share	Total	% share	Rural	% share	Urban	% share
Total	28612		14753		13859		32019		15768		16252	42
Food	11725	41	5850	40	5875	42	13292	42	6410	41	6882	13
Cereals & Pulses	3290	11	1714	12	1576	11	3977	12	1943	12	2034	2
Edible Oils	528	2	263	2	265	2	662	2	324	2	338	2
Dry Spices	553	2	258	2	295	2	492	2	232	1	260	2
Vegetables & wet Spices	1763	6	871	6	893	6	1700	5	815	5	885	5
Fruits	442	2	192	1	249	2	407	1	192	1	215	1
Milk & Milk Pdcts	1029	4	511	3	518	4	407	3	491	3	542	3
Meat, Egg & Fish	2030	7	980	7	1050	8	1033	9	1327	8	1471	9

Source: Calculated from CPHS, CMIE 2018-19

AGRICULTURAL EXPORTS FROM KERALA

Plantations carry significant role in the agricultural sector of the State, mainly for its industrial applications and exports. Agricultural product exports from Kerala over the years is presented in Table 6. It was found that the export contribution of Kerala appears to be minuscule both in terms of quantity and value when compared to the country level exports.

Table 4 *Estimated Demand and Supply of Agricultural Produce (2018-19)*

Particulars	Amount
Number of households in Kerala (2011 census)#	7853754
Average food expenditure of household (agriculture products) monthly (Rs. Crore) (2018-19)*	4429.49
Yearly expenditure of household on food (demand for food) (Rs./annum) (Average 2018-19) Rs. Crore	41745.75
Agricultural SDP Rs. Crore (2018-19)	22477.91
Value of Agricultural Exports Rs. Crore (2018-19)	3681.07
Demand - supply gap (Value Terms) Rs. Crore	19267.84
% of demand serviced by internal production	45

Source: ***CMIE, CPHS Survey, #Census, 2011, EPWRF Time series data, APEDA**

Table 5 *Inward Movement of Agricultural Commodities to Kerala in tonnes, 2019-20*

Products	Inward
Rice not in the husk(inc. Rice Flour)	601023.3
Wheat	405402.9
Other Grain	2376
Oil Cakes	155505.3
Spices	256

Source: DGCIS

Analysis of the export basket reveals that output from cash crops has been predominant among the exported items from Kerala. Natural rubber accounted for the largest share (63.6 percent) in India's total exports during 2018-19 (EXIM Bank, 2020). Kerala accounted for the largest share in cashew exports (47.2 percent of India's total exports). Apart from this, Kerala has significant share in exports of products such as floor coverings (56.9 percent), vegetable oil (15.5 percent), spices (13.4 percent) and tea (13 percent) (EXIM Bank, 2020).

A comparison of exports in two different time periods (2010-11 and 2020-21) show that Kerala's exports is the highest in cashew and there is a sharp increase in the exports of cashew kernels from Kerala. The other major items exported are non-basmati rice and fresh vegetables. In the case of non-basmati rice exports there is a sharp increase in exports in terms of value from 1.6 million dollars in 2010-11 to 48.2 million dollars in 2020-21. The other items which experienced a sharp increase in the exports in terms of value are processed fruits, juices and nuts, and processed vegetables and other fresh fruits (see Figure3). The exports of fresh fruits, vegetables and vegetable seeds however experienced a sharp decline in exports. This indicates the increasing significance of processed fruits and vegetables in the export basket. The other reason for the decline in exports of fresh fruits and vegetables

could be the quality and products standard related concerns.

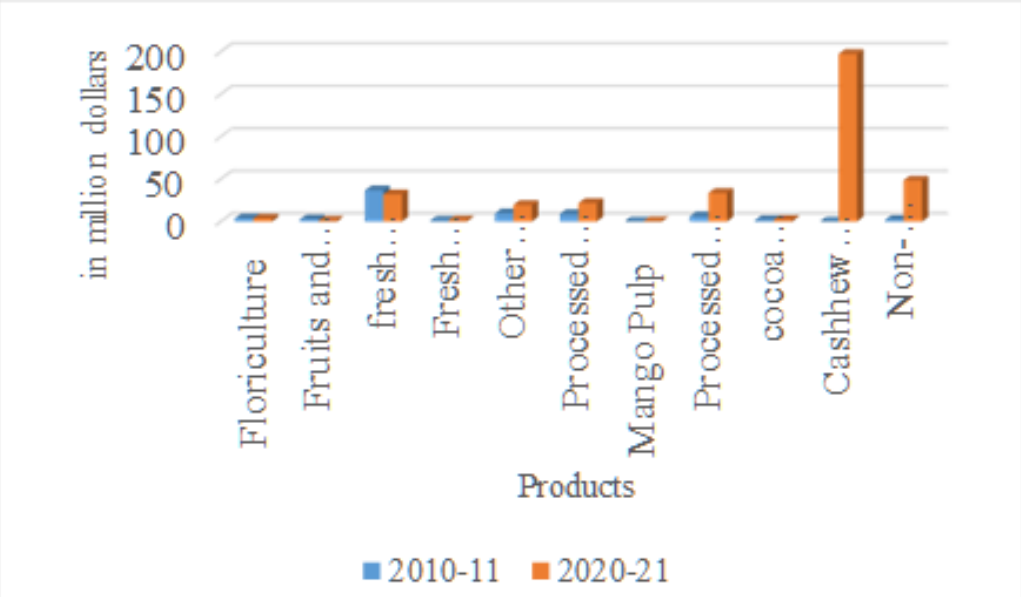
Table 6 *Trends in Agricultural Exports from Kerala (2011-12 to 2020-21) (in real terms/ base year)*

Year	Kerala (1)		India (2)		Percentage of total export	
	Qty (Tonnes)	Value (Rs. Cr)	Qty (Tonnes)	Value (Rs. Cr)	Qty	Value
2020-21	263313.06	3444.58	3,20,35,939.39	1,52,730.39	0.82	2.26
2019-20	2,48,588.01	3,638.12	1,82,69,249.90	1,19,390.70	1.36	3.05
2018-19	2,49,645.08	3,681.07	2,31,80,482.31	1,35,101.23	1.08	2.72
2017-18	2,75,383.97	4,407.40	2,24,04,037.27	1,25,852.71	1.23	3.50
2016-17	2,74,850.89	4,191.67	2,13,85,985.73	1,13,853.83	1.29	3.68
2015-16	2,45,907.79	1,659.54	2,04,74,814.39	1,07,482.86	1.20	1.54
2014-15	1,91,095.38	1,342.75	2,71,34,311.43	1,31,342.99	0.70	1.02
2013-14	1,78,648.00	1,391.52	3,00,01,796.52	1,36,922.58	0.60	1.02
2012-13	2,10,911.18	1,086.14	3,01,72,963.87	1,18,250.99	0.70	0.92
2011-12	1,97,982.38	784.28	1,96,64,571.17	82,940.16	1.01	0.95

Source: APEDA Statistics

Recent report by EXIM Bank analyses the products with high potential using Revealed Comparative Advantage (RCA) method. The study identifies few products as product champions if the RCA is greater than 0. As per their analysis, fruits and nuts, tea and spices,

Figure 3: *Kerala's Exports of Different Products in Million Dollars*



Source: APEDA

essential oils, rice, edible food preparations and coconut from Kerala appeared to be among the list of products that showed huge potential (see Table 7).

Table 7 *Products with High Export Potential from Kerala, Analyzed Through Revealed Comparative Advantage*

Product Champions	No of products under HS 6 digit	US$ million exports in 2018
Fruits and nuts	2	331.67
Essential oils	3	247.36
Tea and spices	5	197.95
Rice	1	42.52
Edible food preparations	2	30.75
Vegetables	1	28.49
Preparation from fruits and nuts	1	28.40
Cashews	1	14.62
Coconut and coconut products	2	29.95

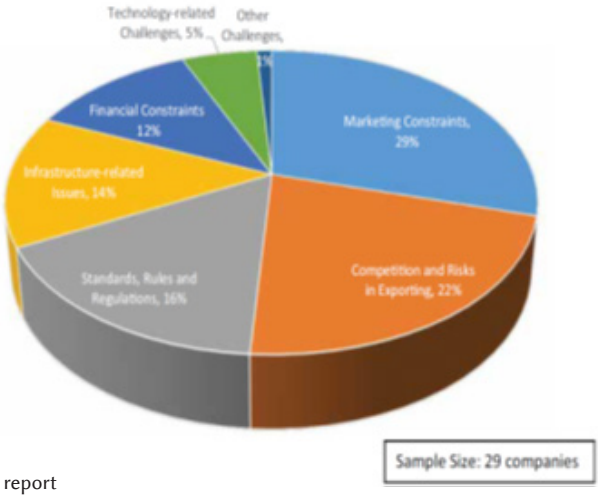
Source: EXIM Bank, 2020

Challenges Faced by Exporters

The below diagram (see Figure4) from EXIM Bank survey report shows that the major challenges that the exporters facing are:

1. High competition
2. Infrastructure related issues
3. Product standards-regulations, license, clearance, certification, training and awareness.
4. Technological constraints

Figure 4 : *Challenges faced by the Agri-Food Exporters from Kerala*



Source: EXIM Bank survey report

5. Financial constraints

ROLE OF SUPPLY CHAIN DEVELOPMENT IN KERALA'S AGRICULTURAL DEVELOPMENT

Agro-food Supply Chain Integration (ASCI) plays an important role in ensuring stable and sustainable development. An efficient supply chain works effectively in integrating upstream and downstream partners with both internal as well as external integration. It includes several stages of coordination such as production, marketing, distribution and so on. One of the major challenges that the ASCI encounters in a developing country context is to effectively integrate the small-scale farmers with fragmented and scattered production. Aggregation of agricultural products turns out to be the major issue. One of the crucial issues that agricultural production in Kerala is facing is the small and fragmented production with an increase in the share of marginal farmers. As a consequence, supply chain in Kerala is largely fragmented and riddled with the presence of numerous intermediaries like distributors and re-sellers who appropriate high margins. Therefore, an effective integration through aggregation becomes all the more challenging.

Inter-State supply chain suffers from multiple taxes. Lack of infrastructure like godowns, cold stores, cool chains and ripening chambers add to the situation. Furthermore, the link between producers, researchers and consumers are weak. Wastage of agricultural produce amounts to 30% of production each year, which is much more than the 18% reported at national average. This is largely due to poor post-harvest facilities and cold chain infrastructure. Another significant problem is the lack of trained professionals to manage the supply chain (Kalidas et al, 2017).

The role of supply chain management is thus crucial for agriculture development and for taking the production dynamics to the next level. Development of infrastructure, especially at the post-harvest stage is essential so that the produce can be optimally utilized with opportunity for value addition and be profitable to farmers. Improved marketing infrastructure enables farmers to sell directly to a larger base of consumers and increase value realization for farmers and thus improve their overall income. Better logistics can help lower post-harvest losses as well as number of intermediaries in the value chain thereby making farmers more independent. Access to modern packaging and cold stores empower farmers by helping them to decide on time of sale and realising better price. All these can ultimately benefit the end consumer also in that larger share of produce reach the market with better quality and price.

In this context, better market integration turns out to be essential for better price realization for farmers. However, realizing better integration is fraught with several institutional issues as the farm size is small and fragmented. As per the agricultural census data, the share of marginal farmers in Kerala increased from 53.29 percent in 1995-96 to 61.37 percent in 2015-16. Another interesting observation is the area under marginal farms declined from 912449 ha in 1995-96 to 856074 in 2015-16 (see Table 8). Although the share of small farmers declined from 20.41 percent in 1995-96 to 17.37 percent in 2015-16, the area of land belonged to small farmers declined from 349541 ha to 242336. The reduction in area is observed for all farm size categories as a result of the total reduction in area under

Table 8 *Size of Landholdings (in ha)*

		1995-96	2015-16
1	MARGINAL	912449 [53.29]	856074 [61.37]
2	SMALL	349541 [20.41]	242336 [17.37]
3	SEMIMEDIUM	243961 [14.25]	141685 [10.16]
4	MEDIUM	103812 [6.06]	60007 [4.3]
5	LARGE	102460 [5.98]	94833 [6.8]
6	ALL CLASSES	1712223 [100]	1394936 [100]

Note: figures in parenthesis are the percentage share. Source: Agricultural Census

cultivation from 1712223 ha in 1995-96 to 1394936 ha in 2015-16, could be due to diversion to non-agricultural purposes.

EXISTING INSTITUTIONS OF SUPPLY CHAIN OF AGRICULTURAL OUTPUTS AND INPUTS IN KERALA

Agriculture has a multiplicity of supply chains, involving both public and private agencies. Some of the prominent players in the domestic supply chain is listed below.

- Private sector (both unorganised and modern sector): The private individuals in the form of shops and processing centres form the major agencies involved in the supply chain of agricultural commodities and inputs in Kerala. However, a statistic on the total quantity of agricultural outputs and the share in the total agricultural outputs transacted is not available.
- Horticorp: Horticorp undertakes procurement and distribution of agricultural products through its networks.
- VFPCK: Vegetable and Fruit Promotion Council, Kerala (VFPCK) has established a supply chain integrating producers through SKSs (Swasraya Karshaka Samithi) which initiates primary production and marketing through farmer markets (Swasraya karshaka vipani) at different locations.
- Kudumbashree: Kudumbashree has its crew of Joint Liability Group (JLG) to undertake primary production activities, which are marketed through Kudumbashree outlets or ecoshops. The produce is also transferred for making value added products, either by the same groups or by other Kudumbashree units. This is being marketed through Kudumbashree home shoppe and Kudumbashree bazar online.
- Co-operatives: The Co-operative societies in the State own supermarkets or stores through which agricultural products are being sold. Some Co-operatives also serve as service providers including farm labour and agro machinery. (For instance, the Green Army initiative of Peringadiyoor Service Co-operative Bank. One of the initiatives of the Co-operative department is of establishing the 'Co-op Mart', the chain store mooted through the co-operative network, in which branding is to be done under the umbrella brand of 'Co-op Mart'.

- Farmer Producers Organisations: Farmers are organised into Farmer Producer's Organisations organised as primary producers and value addition units.

Weakness of the Existing Supply Chains

- Farmers experience price risk, information asymmetry about demand, distribution inefficiency, and receive late payments.
- Retailers face problems like higher costs, low quality and unhygienic produce, high price volatility, and the everyday hassle of going to the market.
- The traditional supply chain is unorganized and has a high rate of food wastage.

In this context, the sub-committee was formed with the following terms of reference with a purpose of improving the supply chain.

TERMS OF REFERENCE (TOR)

- To suggest a design of a unified supply chain of farm inputs and outputs with specific references to aggregation/ procurement, storage and marketing.
- To suggest a framework where LSGIs, Co-operatives and FPCs can be effectively integrated into a unified supply chain.
- To suggest ways to ensure that the supply chain is integrated with the objectives of trade, value addition and processing- domestic and global- as well as agricultural finance institutions.
- Suggest ways in which the private agencies in procurement, trade and marketing are integrated with the supply chains.
- To ensure that the supply chains meet the requirements of niche sectors such as organic farming, certifications, and traceability.
- To suggest the major technological challenges and infrastructural investments required to equip the State's supply chain systems to meet the needs of the farming community as well as domestic and international trade.

DELIBERATIONS OF THE COMMITTEE

The subcommittee of the working group on Agriculture for the XIV Five Year Plan on "A plan to expand and modernize supply chains in agriculture in Kerala" met four times, and the drafting committee met three times to prepare the document. The first online meeting of the committee on 9-9-2021, was attended by the Vice Chairperson, Planning Board member for agriculture, Dr. R. Ramakumar and Mr. Nagesh SS, Chief (Agriculture) discussed the terms of reference of the committee. The committee again met online on 17-09-2021 and discussed in detail the issues under each task. Communications for collecting data and statistics were sent to different institutions and agencies. The members interacted with the stakeholders in the supply chain, including the Department of Agriculture, VFPCK, farmers, Co-operatives, Agricultural University, Horticorp, etc and gathered information. A hybrid mode meeting was convened on 28-09-2021 at Kerala Agricultural University, Thrissur on 28-09-2021 which came out with the broad outline and the focal themes for inclusion in the draft. A drafting committee was also constituted in the meeting. The drafting committee held three sittings (online) before finalising the report.

Scheme of the report

The report is divided into 6 sections including introduction and conclusion.

1. Introduction and terms of references, as shown above.
2. Existing output supply chain, in general and specific for selected commodities.
3. Inputs supply chains
4. Proposed model of integration
5. Digital interventions
6. Conclusion and key recommendations

CHAPER.2
EXISTING SUPPLY CHAINS OF MAJOR AGRICULTURAL COMMODITIES

The current section discusses the existing supply chain of selected agricultural commodities from different major groups and the role of public and private sector.

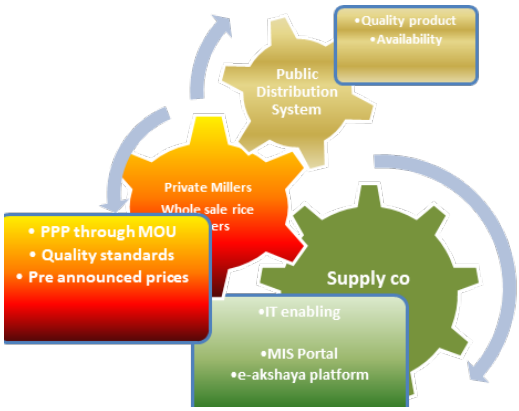
COMMODITY-WISE SUPPLY CHAIN ANALYSIS: SOME EXAMPLES AND WAY FORWARD

Paddy

Kerala has always been a deficit State in paddy production and even the less than 20 percent production could not be properly marketed for want of sufficient warehousing and processing facilities. Given the absence of effective procurement by the Government or its agencies, paddy farmers were at the mercy of private dealers, mainly a small group of modern rice-mill owners in Ernakulum district (Thomas, 2011). The implementation of the "Decentralised Paddy Procurement and Custom Milling Scheme for procurement of paddy through Kerala State Civil Supplies Corporation (Supply Co), by the State Government in 2005-06 was a landmark intervention in this regard. It was implemented with the objectives to ensure profitable price to paddy farmers, to ensure the availability of local rice to consumers through the fair price shops and to ensure a stable marketing system for paddy. The Supply Co procured paddy from the registered farmers at rates fixed by the Government through designated private rice mills which process the paddy into rice and issue the rice to the authorized ration wholesalers for selling through the ration shops. Management Information System based procurement and the Public Private Partnership (PPP) vehicle of instrumentality between the mill owners and the Government is an effective mechanism. The high light of the scheme is the partnership between the Kerala State Civil Supplies Corporation (SupplyCo), the largest retail chain of essential commodities and consumer goods for the public of Kerala and the private rice millers, based on a Memorandum of Understanding. Paddy from the farmers' fields is lifted directly by the mills selected by Supply Co at rates fixed by the Government and processed to rice which is then issued to the Authorized Ration Wholesalers for distributing to the people through the PDS as Custom Milled Rice (CMR). The State has ensured a higher price for the paddy which is procured under the above central scheme by giving additional subsidy. During 2021-22 the procurement price is Rs.28/kg (MSP Rs 19.4 and SIB 8.6).

The procurement figures for the current year stand at 75962.7 MT worth Rs. 212.69 crores involving 55 rice mills in the State. Procurement is made directly by Supplyco, and the farmer receive, a Paddy Receipt Sheet (PRS), the duplicate goes to the Paddy Payment Officer (PPO) of Supplyco, before the paddy is sent to the mill. The miller in turn enters the details of paddy that is processed online and this is reconciled with the PRS, before the payment is transferred electronically to the farmer. The processed rice is checked by Quality Assurance Officers before it is transported to Supplyco's outlets and the public distribution system. The system has registered over 50,000 farmers and over 60 rice mills that process 250000 metric tonnes in every crop season. The web portal has multiple sites for farmers, millers, marketing officers, payment office as well as public interfaces, where one can locate

Figure 5 *Semantic Diagram of Paddy Procurement Scheme*



farmers and mills in any panchayat or register to be part of the procurement process.

Coconut

Increased vulnerability among small coconut holders from declining and fluctuating profitability of coconut is an area of grave concern. On the other hand, when we analyse the aspects of coconut in a time perspective, our field level insights indicate that, of late, the number of farmers who are solely dependent on coconut farming for their livelihood are declining. Therefore, we need to examine how Kerala coconut farmers are actively diversifying their livelihood. It is also important that, while we look at the sector as a whole, along with farmer, the livelihood of other significant players like labourers, traders, processors, intermediaries are also put in the right perspective.

Not ignoring the fact that, the integration of international and regional coconut markets indeed in a big way influenced the demand and price movement in Kerala and represent an important challenge to the millers with respect to the cheaper raw materials from neighbouring States. In this context, there is a larger ongoing 'crisis narration' wherein we argue that the cheap import of palmoil is the major cause of price instability of the coconut in Kerala. Though it is partly true, we need to undertake a close scrutiny of this aspect. There have been umpteen pre-existing and proven advocacies to address such issues, like tariff restructuring, cluster formation, group synergy and value addition. On the contrary, most importantly we need to seriously address the issue of labour scarcity that demands novel policy interventions. Moreover, we need to address the issues largely felt at meso and micro level like disorientation from coconut farming, the regional patterns of coconut cultivation, the domestic consumption pattern of coconut and coconut products, the functioning of domestic coconut value chains etc. The way in which the labour market is socially structured may prove challenging for newly trained climbers, wherein, for them, it would be difficult to access the regular employment. The field level findings necessarily validate this argument.

We need to capitalize the regional differences in coconut cultivation across the State and

concentrate on regional production hubs, where the large-scale commercial integration is possible with adequate farmer participation.

Raw coconut procurement can be implemented effectively as an ad-hoc regulatory measure. But as of now only meagre share of farmer produce gets support due to inadequate procurement, delay in payment and transaction drudgery that all leads to distress sale of the produce. With respect to this we need to improve the infrastructural and storage facilities of Krishi Bhavans. Alternatively, we can think of establishing procurement hubs at panchayath levels using the vast network of established CPSs. We need to create a sort of accountability among the societies and also encourage them to proactively undertake the minimal processing.

Issues Related to Procurement and Marketing

The studies on marketing margins and costs are important as they reveal many facets of trade, price structure, and the efficiency of the system. The 'price spread' is associated with the movement of a commodity from the producer to consumer wherein the actual costs involved in the transaction at various nodes as well as the margins accrued to various actors at different nodes are accounted.

Price spread analysis of coconut marketing revealed that near about 70 percent of the farmers sell their produce through the village traders as raw coconut. Less marketable surplus due to small and marginal holding size is the major reason for the farmers for not undertaking copra or oil for sale.

In Kerala conditions, which are the same in many countries with predominantly small holder coconut gardens, the producer share in consumer rupee was found to be around 64 percent and the market chain consumes as much as 36 percent share in the total value chain. Higher price spread always indicates a lower share of the final price to the producer. In other words, it reflects the low marketing efficiency of the market channel. The price spread and marketing efficiency can be improved only through collective and constant efforts in terms of adoption of higher value addition technologies at individual or group level.

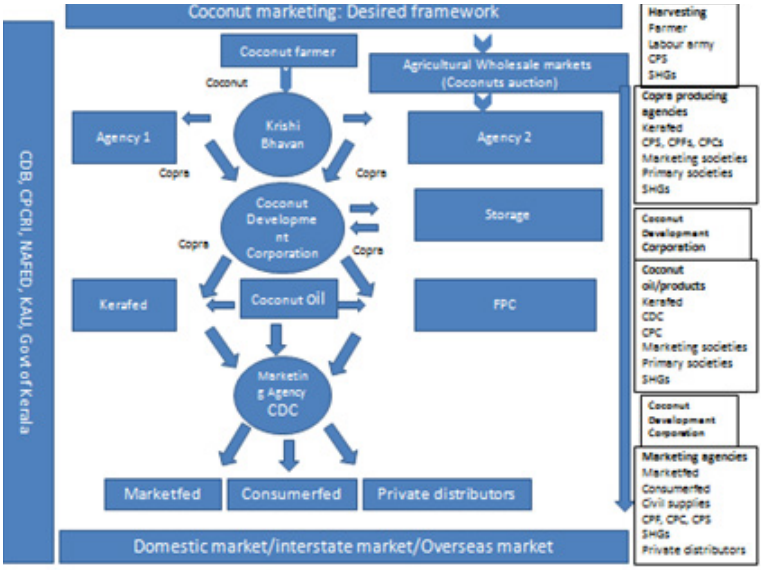
It is an experienced fact that the coconut prices are volatile and unpredictable, and there are close substitutes available to replace the coconut oil in the event of any supply shock or price crash. In this scenario, it is wise to redefine the present coconut farming methods more towards high density integrated farming, based on the agro-climatic specifications.

Table 9 *Agencies Involved in Coconut/Copra Procurement and Aggregation*

S.L. No	Agency	Role	Limitations
1	KERAFED	Instituted in 1987. Apex institution of 100 primary cooperative societies ; Procurement agency (MSP) under NAFED Largest coconut oil producer in Kerala	The Primary Co-operative Societies under KERAFED have very limited infrastructure facilities for processing. Mostly procure from other states; The Primary Co-operative Societies are not focused on coconut procurement. Not effectively utilizing the copra processing facilities
2	Coconut Development Corporation	Instituted under State Government in 1975. Produces coconut oil and VCO, and other value added products under brand name-Kerajam	Ineffective marketing (lack of funds); Though producing good quality products, fails to compete with the adulterated brands; Lacking effective institutional assistance
3	Marketfed	Procurement agency in affiliation with NAFED; Produces and markets coconut oil in collaboration with private mills	Mostly procures coconut oil from private agencies and markets with own brand name
4	Consumerfed	Aggregator established in 1965 ; Procures and markets coconut oil in collaboration with private mills	Mostly procures coconut oil from private agencies and markets with own brand name (Thriveni), wherein quality is not ensured. Cooperative agencies are sidelined
5	Civil supplies corporation	Procures and markets coconut oil in collaboration with private mills	Mostly procures coconut oil from private agencies and markets with own brand name (Sabari), wherein quality is not ensured.; Cooperative agencies are marginalized

6	CPS,CPF CPC	Farmer Producer Organizations under CDB (from 2011 onwards)	Functions at suboptimal level; Lack of professional management; Lack of institutional support; Ineffective implementation of marketing strategies
7	Primary Co-operative Societies	Procures coconut and copra, carry out processing and markets under their own brand	Basic infrastructural facilities are inadequate. Mostly procures from traders, thereby the coconut farmers are sidelined
8	Department of Agriculture	Direct procurement of raw coconut from farmer in 2013	Lack of storage infrastructure; Relies on other agencies for processing; Ineffective in ensuring the quality of coconut (copra content).
9	Agricultural Urban Wholesale Markets	Three big markets situated at Maradu, Vengeri, and Anayara; Three Satelite markets at Sultan Bathery, Muvattupuzha and Nedumangadu	The arrival of coconut for auction is meagre.
10	Self Help Groups (Kudumbashree)	Small scale copra dryers and mills; Regional marketing	Small time players; Low economies of scale

Figure 6 *Coconut marketing: Desired framework*



Source: Compiled by the committee based on Key Informant Survey

Kerala-specific sectoral challenges

Constraints such as high level of market fluctuation/price crash in coconut, changes in the demographic characteristics of coconut growers with a shift towards absentee landlordism, predominance of senile and unproductive palms, predominance of small and marginal holdings, over populated stands of both coconut and other trees in the homesteads, low level of adoption of crop management practices resulting in low productivity, depletion of natural resources in coconut gardens and soil related constraints, inadequate irrigation facilities, lack of availability of quality planting materials, lack of skilled labour and high wage rate, crop loss due to incidence of various pests and diseases, low level of product diversification etc. had adversely affected coconut farming in the State, and as such coconut has become a neglected crop. The study on fertility of soils of Kerala has revealed that soil related constraints viz., very strong soil acidity, extensive deficiency of secondary nutrients (calcium and magnesium) and widespread deficiency of micro-nutrient boron are among the important factors for low productivity of coconut in the State. Hence, appropriate research, extension and policy interventions are to be formulated and implemented to enable coconut growers to alleviate these constraints and steer the sector towards achieving the goal of sustainability.

Arecanut

Though the arecanut is not an export-oriented crop, the internal demand has always remained at higher levels. Stagnating market prices and increasing cost of production, especially the skilled labour charges in the recent times have generated livelihood concerns of arecanut farmers in India. Surging imports, which is around 12 percent of the domestic production, certainly has a significant role in price stickiness. It is a researched fact that more than 75% of the domestic arecanut trade lies in the hands of private traders, wherein co-operatives have little bargaining position. This eventually results in frequent fluctuations in prices due to poor market intelligence, market hoarding and imperfect market formation. The price spread analysis of arecanut indicated only a meagre share of producer in the consumer price. These indiscriminate expansions of area under arecanut due to the remunerative price prevailed during the period of 1995 to 2000 have resulted in the surplus production of arecanut in the country. Though, alternative uses and medicinal values of arecanut have been reported, viable technologies are yet to be developed on an industrial scale for exploiting it economically. The methodologies for alternate uses are available but due to high cost of areca raw material, the commercialization has not taken place. Social cost of arecanut promotion is another issue to ponder. Arecanut sector in India is facing a crisis owing to the policy level conflicts of interests and is a matter of concern for the millions of small and marginal farmers who are solely dependent on arecanut farming for their livelihood. On one hand the possible huge social cost of growing arecanut with all the existing institutional support for the crop, and on the other hand the possible marginalization of millions of farming community in the event of threats of partial or complete ban on the cultivation and allied activities of the crop are major issues to contemplate.

Arecanut Marketing Channels

Study highlighted that the areca farmers were invariably indebted irrespective of the size of

holding, and the proportion of consumption loan was found to overweigh the crop loans. It was observed that farmers' having 2-4 acres of holding size were highly indebted. Farmers in this category is more vulnerable as most of them entirely dependent on areca farming for their livelihood.

It was noteworthy that 80 percent of the farmers, who disposed the produce immediately after harvest, were small cultivators. Of the remaining 20 percent, who disposed the produce when the prices in the market are favourable, were large farmers. It was observed that indebtedness and lack of proper infrastructure facilities for storage compel the small farmer to dispose the produce at the earliest. Four different marketing channels were observed in the study. Producer's share in consumer price ranged from 63.53 to 68.10 percent. The analysis of marketing efficiency highlighted co-operative marketing channel as the most efficient marketing channel with lowest composite index.

Major Challenges in Arecanut Marketing

- Complex supply chain
- Social cost of arecanut promotion
- Price volatility
- Indiscriminate expansion of area under arecanut resulting in over production
- Limited demand for the commodity
- Feasibility issues regarding alternate uses of arecanut

Cocoa

In India, cocoa is cultivated mainly in the States of Tamil Nadu, Andhra Pradesh, Kerala, and Karnataka. India produced 19,866 tonnes of cocoa from an area of 88,515 ha with a productivity of 580 kg/ha in the year 2020. Tamil Nadu has the highest area under cocoa (33%), followed by Andhra Pradesh (32%), and in the case of cocoa production, Andhra Pradesh has the major share (41%) followed by Kerala (38%). The contribution of cocoa to the national income amounts to Rs.2000 million. The cocoa industry in the country had expanded to a considerable extent in recent years. At present more than 15 industrial entrepreneurs and firms existing in the field demanding nearly 40,000 tonnes of cocoa beans of which the present domestic availability is only about 42%.

India imports large quantity of cocoa beans and powder to bridge the gap between supply and demand in the domestic market. Of late, the international cocoa prices are soaring high and the likely impact of the current price rally may be reflected in the Indian market in another three months as the importers usually book orders in advance.

Demand and Supply-Indian Scenario

Taking into consideration the present-day food consumption patterns and growth of confectionary industry in India at around 20%, the demand for cocoa is likely to increase in coming years. The import of cocoa and cocoa products to India has increased at a compound growth rate of 17% during the ten years' period (2009-19), which shows a surging domestic demand of cocoa and cocoa products as well as surplus processing capacity existing in the country. It is noteworthy that the import of cocoa in the year 2019 was 63,613 tonnes, while the export was meagre 25,700 tonnes accounting for a negative trade balance of

37,913 tonnes. The projected demand of cocoa in India by 2050 is 212 thousand tonnes against the estimated supply of 121 thousand tonnes. With the projected supply there would be a demand-supply gap of 90 thousand tonnes of cocoa beans in 2050. To achieve this target, the production should increase at an annual growth rate of 7.68%.

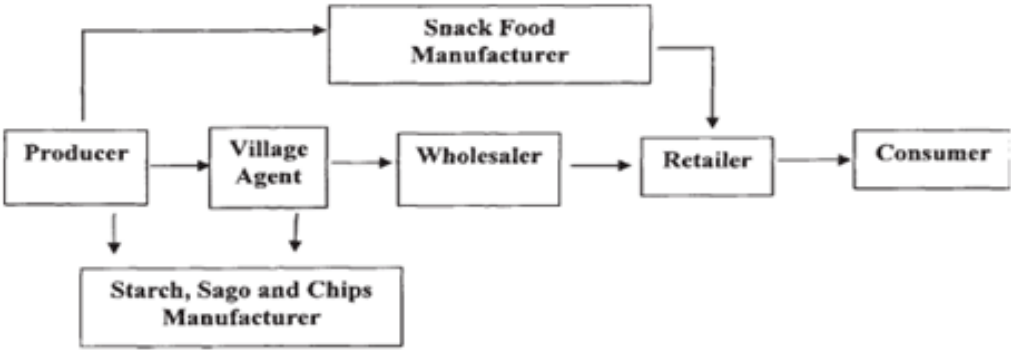
Strategic Intervention

We need to chalk out a logical and pragmatic strategy to achieve the desirable projected demand-supply equation. Growth in per capita consumption of cocoa in India is the motivating factor behind the projection of an optimistic supply-demand scenario. We have about 26 lakhs ha area available in India under coconut, arecanut and oil palm gardens for cultivation of cocoa plants (new area expansion) and around 35% of this land is under irrigation. Thereby, the total potential area for cocoa planting comes to around nine lakhs ha. Availability of such areas in the States of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh and Orissa will therefore offer ample scope for new area expansion of cocoa.

Tuber Crops

Marketing aspects of tuber crops had not yet received the attention that actually deserves in Kerala. Inefficient marketing system is noticed as the major production constraints of tuber crops in Kerala. Major existing supply chain channels of tuber crops in Kerala are Producers- Primary Wholesalers- Secondary Wholesalers-Retailers-Consumers. Taking the example of important tuber crop, Tapioca, out of the total production in Kerala, 40 % of tapioca produced is consumed as vegetable, parboiled and fried chips. Contract merchants or village agents collect the tubers from farmers and supply to wholesalers in vegetable markets like Nedumangadu in Thiruvananthapuram district of Kerala. Retailers purchase from wholesaler for further distributing to consumers. Some cottage industries are making fried chips in Kerala and are supplied to bakeries, super markets in the surrounding towns for retail sales. Another market chain involved in tapioca is the supply chain of value-added products of tapioca. Starch, sago and chip manufactures procure raw tubers from farmers either directly or through village agents. Manufacturers of fried chips and baked tubers procure raw tubers from farmers during production season. Wholesalers collect tubers from village agents for export to Gulf countries. Fried chips are sold through retail outlets in Kerala. Around 20 % of the cassava production in Kerala is supplied to sago and starch industries in Tamil Nadu. The supply chain identified for tapioca in Kerala is summarized in **Fig.7**

Fig.7 *Existing Supply Chain of Tapioca in Kerala*



The major drawback of this kind of supply chains is the inadequate percent share of producer's profit on consumer's price. The gap existing between the producers-the farmers, and consumers hold the maximum share of profit. Farmers' lack of proper knowledge about tuber markets pushes them to sell their commodity in a lower price to wholesaler or commission agents. The same phenomena happen in case of consumers also where; they are forced to buy tubers on a high price from retailers. In this scenario, producer's share in consumer's rupee remain lower compared to the other supply chains involving the direct marketing of commodities. These problems can be solved by the adoption of newer inputs in the existing supply chains of tuber crops.

Vegetables

The supply chain of vegetables and fruits assumes significance due to its perishable nature and short shelf life. The total area under fruits and vegetables in the year 2015 was 373.73 thousand ha and 46.75 thousand ha respectively. The area under fruits in 1966 was 265.66 thousand ha and in the case of vegetables it was around 283.84. Though there has been a marginal improvement in the area under fruits, the area under vegetables showed a sharp decline over the years. In Kerala, most of the vegetables are sourced from neighbouring States like Tamil Nadu and Karnataka. Due to lack of infrastructure like godowns and cold storage facilities, around 30 percent of produce is getting wasted annually (Kalidas et al., 2017). Around 20% is wasted due to post harvest losses because of poor harvesting and cold chain facilities.

Since majority of the vegetables is sourced from Tamil Nadu, the wholesalers of vegetables obtain the vegetables from markets such as Ottanchathiram and Kinathukadavu. Wholesalers procure the vegetables from these markets and sell it to retailers. Until recently, channel 2 was more prevalent in Kerala where the farmers will sell the vegetables to commission agents in Tamil Nadu market and then the intermediaries will procure it from these markets and sell it to unorganised retailers. From their it goes to local level retailers and then finally end consumers. Currently channel 1 is getting popular in Kerala as the organised retailers have intermediaries who purchase for these retailers and sell it to local retailers and consumers (Kalidas et al., 2017). In Palakkad district, the more prominent supply chain is channel 3.

Figure 8 *Vegetables Supply Chain in Kerala*

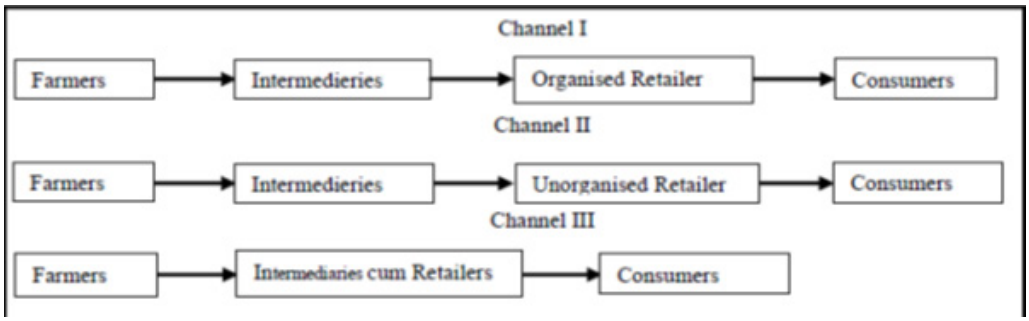


Table 10 *The Existing Fruits and Vegetable Markets Under ADFW Department in Kerala*

S.L. No.	Type of Market	Number of outlets
1	Cluster managed market	255
2	Block level Federated Organization BLFO	38
3	Ecoshops	487
4	Weekly Markets	945
5	VFPCK Swasraya Karshaka Sangham	288
6	Horticorp Own stall	100
7	Horticorp Franchises	212
8	Horticorp District Procurement Centre	16
9	Haritha Groups	34
10	HADA(Hill area development Authority) Markets	2
11	NIPHM weekly Markets	11
12	Agricultural Rural World Market	3
13	Agricultural Urban World Market	3
	Grand Total	2394

All these markets are managed in a decentralised manner having its executive committee of farmers and officers. Some are working on cluster-based business model and some are aggregating from farmers and selling based on demand. There are markets which are running on weekly which are having turn over around 4000 to 6000 per day. The strategy of VFPCK markets in managing farmers produce is by way of auctioning once or twice in a week.

Agriculture Wholesale markets are playing a great role in marketing the surplus vegetable production by acting as auction centres through which wholesalers, traders, and Government agencies like HORTICORP, VFPCK can source safe to eat and good quality fruits &

vegetables directly from farmer.

The price spread of different vegetable in different channels is given table 11. The price spread for onion varies from 16 to 7.8 between channel 1 and channel 3

Table 11 *Price Spread of Major Vegetables in Kerala in Different Channels*

S.L. No	Particulars	Channel 1			Channel 2			Channel 3		
		Onion (Rs.)	Potato (Rs.)	Tomato (Rs.)	Onion (Rs.)	Potato (Rs.)	Tomato (Rs.)	Onion (Rs.)	Potato (Rs.)	Tomato (Rs.)
	Farmer									
1	Price received by the farmer (Rs./ kg)	16.00	20.00	30.00	16.00	20.00	30.00	18.00	23.00	45.00
	Intermediaries									
2	Purchasing price of the commission agent	16.00	20.00	30.00	16.00	20.00	30.00	18.00	23.00	45.00
	Loading and unloadings charges	1.00	2.25	2.25	1.00	2.00	2.00	1.00	2.00	2.00
	Transportation cost	1.00	2.25	2.25	1.00	2.00	2.00	1.00	2.00	2.00
	Wholesalers margin	2.80	1.50	5.50	2.80	2.00	5.50	4.80	4.00	11.00
	Selling price of commission agent	20.80	26.00	40.00	20.80	26.00	39.50	25.80	30.00	60.00
	Marketing cost	2.00	6.00	4.50	2.00	4.00	4.00	3.00	3.00	4.00
3	**Organized retailer**									
	Purchasing price of organized retailer	20.80	26.00	40.00						
	Loading and unloading charges	1.00	1.50	1.50						
	Transporation cost	2.00	2.00	2.00						
	Margin	8.20	4.50	16.5						

	Selling price of the organized retailer	32.00	34.00	60.00						
	Marketing cost	3.00	3.50	3.50						
4	**Unorganized retailer**									
	Purchasing price of organized retailer				20.80	26.00	39.50			
	Loading and unloading				1.00	1.00	1.00			
	Transporation cost				2.00	2.00	2.50			
	Margin				6.20	3.00	15.00			
	Selling price of the unorganized retailer				30.00	32.00	58.00			
	Marketing coast				3.00	3.00	3.50			
5	**Consumers**									
	Purchasing price of the consumers (Rs./kg)	32.00	34.00	60.00	30.00	32.00	58.00	25.80	30.00	60.00
	Price spread	16.00	14.00	30.00	14	12	28.00	7.80	7.00	15.00

Source: Kalidas et al., 2017

EXISTING INSTITUTIONS IN SUPPLY CHAIN OF AGRICULTURAL OUTPUTS

Role of Private Sector

The supply chain of agricultural outputs and inputs are dominated by the private sector. In this process, the agricultural sector provides employment and income opportunity to lot of private players. Further, the private players carry a significant role in price determination. It is prudent for the State to leave to the market to determine the price of agricultural commodities so that it would send the market signals for the farmers as well as for the economy as a whole. This could serve as an important tool for farmers to have his decision on area allocation for crops, agricultural planning process and finance. However, the market is to be governed by rules and regulations that eliminate unhealthy practices. Also, the Government should have institutions sufficient enough to intervene in the market, should the market forces behave in an unacceptable manner hampering the interest of the farmers and consumers. The private sector players consist of several whole sale merchants who purchase products from the farmers at their farms, markets or in their shops both from domestic markets and from other States. It is passed on to the retailing network.

Public Sector

Kerala does not have APMC system. In Kerala, the marketing infrastructure from the public sector is provided by the Government and Local Self-Government (LSG) institutions, in addition to farmer producer organisations (FPOs) (Nair,2021; NIAM, 2011-12).

The Government of Kerala is promoting organized marketing of agricultural commodities in the State through a network of markets in rural as well as in urban areas established throughout the State. Kerala has six wholesale agricultural markets, three in urban areas (Anayara in Trivandrum, Maradu in Ernakulam, Vengeri in Kozhikode) and three in rural areas (Nedumangad in Trivandrum, Moovattupuzha in Ernakulam, and Sultan Bathery in Wayanad). These six markets are Government owned markets constituted under Department of Agriculture and are functioning as per market rules framed by Govt. of Kerala. These agricultural markets play an important role in marketing surplus vegetable production by acting as auction centres. In these markets, wholesalers, traders and Government agencies like HORTICORP can source fruits and vegetables produced locally. The initiatives are taking place to link these six wholesale markets to e NAM (electronic national agricultural market) at all India level.

In addition to the above wholesale markets, five district procurement cum marketing centres are functioning in Kaliyanchatha (Kollam), Kodenthuruthu (Alappuzha), Kurupppunthara (Kottayam), Thodupuzha (Idukki), and Pavaratti (Thrissur).

Table 12 *Wholesale Assembling Markets in Kerala*

District	No. of markets	Crops Traded
Alappuzha	5	Banana, copra, vegetables, beans, cucumber, fruits,yam
Ernakulam	35	Banana,coconut,tapioca,pepper,vegetables,arecanut,copra
Idukki	28	pepper, arecanut, cardomom,banana, vegetables, rubber
Kannur	8	pepper, copra, tapioca, cashew, arecanut
Kasargod	3	copra, pepper, ginger, cashew, arecanut
Kollam	13	bananana, pepper, cashew,ginger, vegetables
Kottayam	22	rubber, pepper, coconut,tapioca,banana,vegetables
Kozhikode	9	copra, coconut,arecunut, banana, vegetables
Palakkad	14	vegetables,coconut, tapioca,rice, bananana
Pathanamthitta	8	bananna, yam,pepper, ginger
Thiruvananthapuram	23	pepper, coconut,tapioca, ginger,vegetables
Thrissur	28	banana, vegetables,pineapple, coconut,arecanut, vegetables
Wayanad	5	pepper, ginger, turmeric, coffee

Source: Nair (2021)

The ability of the public sector to play constructive role in agricultural markets of Kerala

is visible time and again during the Onam and Vishu seasons, when the Government mechanisms step in to stabilise the market prices in the interest of both consumers and producers. The department is having its own mechanism to deal with the local farm produce in an efficient manner and having about 2400 market outlets with different mode of aggregation and marketing. These markets mainly deal with locally produced vegetables fruits and tubers. There are wholesale markets having an annual turn over to the tune of 12 crores. The other village level markets are placed at various level based on the number of farmers involved and local availability of vegetables and fruits.

In addition to this, there are commodity boards (Spices Board, Coconut Development Board, Rubber Board, Coffee Board, etc.) who operate in the market during certain times. NAFED also involves in procurement during certain occasions.

Base Price Assurance System

The first ever scheme of its kind in the country for fruits and vegetables introduced by the State Government in 2020-21, for 16 items of vegetables and fruits. The scheme intended to provide stable price to vegetable and fruit farmers during all seasons and thus assured income. The mechanism is co-ordinated by Agricultural development and farmers' welfare department along with local bodies and notified Primary Agricultural Co-operative Societies. Notified nodal markets will compare the local market prices, and generate data for declaration of base prices. District level price monitoring committees will monitor prices and make recommendations. For instance, when prices fall below base price, procurement from farmers is effected through ecoshops, Horticorp or Co-operatives, as the case may be, and the difference in amount will be credited to farmer's accounts. For produce procured by PACS, the gap fund to be made available by Local Self-Government to PACS. In order to improve the efficacy of the 'Base price; system, prescribing specific quality standards to the produce may be insisted. Specific productivity levels may be assigned for each crop and the benefit may be given the quantity that tallies with assigned productivity levels.

Limitations of Existing Marketing System

The functioning of these institution in the supply chain management system is handicapped due to various issues such as:

1. Lack of Organized Market Information and Market Intelligence System: Our market information is not interlinked or data from each market remain with them. The market intelligence does not work here and hence farmers do not get the price benefit and due to scattered nature of markets especially in the village level the economies of scale also do not work out here. Seasonal market demand could not be predicted here.

2. Predominance of Intermediaries with Fragmented Farmers: Many of the agricultural markets is totally controlled by intermediaries. They have predominance in determining prices, buying and selling of agricultural product. So, neither the farmers can get reasonable prices of their products, nor the customers can get the products at cheap prices.

3. Lack of Standardization and Grading: Farmers produce various kinds of goods. But they are not standardized and graded according to their quality. We need to develop a protocol

for standardisation of various farm produce and prices fixed accordingly.

4. Perishability: About 34% of vegetables and fruits from the farm gate is being wasted by the time it reaches to the hands of the consumers, due to its high perishability and poor handling mechanism prevailing.

5. Lack of Storage and Warehousing Facilities: Vegetables and fruits and even certain tuber crops are highly perishable. Their production is also seasonal. But these are demanded throughout the year. This means that agricultural goods need to be stored in warehouses so that they can be made available at the right time in the market. The farmers, who are the producers of agricultural goods, may not have their own storage facilities. This contrasts with the situation in consumer and industrial goods marketing where the producers have their own warehouses. Absence of storage forces the farmers to sell their produce at the earliest. Sometimes, they sell at a very low price in the market. Thus, the farmers, as the producers, get a very low price.

There is no proper warehousing facility for storing agricultural products and controlled storage facility to increase the shelf life. The farmers have the compulsion to sell their products at cheap price on the one hand, the quality of goods declines, and quantity decreases due to the leakage on the other.

6.Lack of Exclusive Logistic Management System for Agri-Produce: Transportation facilities need to be extended from the farmers' field to the retail outlets in an intelligent manner which is lacking now. The cost of produce is increased many folds due to transportation alone which need to be addressed, Aggregation at small farmer's field to be prioritised.

7. Effective Financial Support System: The individual farmers financial support during the production till marketing is often inadequate and this leads him to distress sale leading to lower margin of profit in many cases.

8. Dearth of Standardisation and Non-Availability of Standardised Planting Materials/ Seeds: Non availability of uniform quality planting material according to the defined agro ecological zones is a major constraint. The major hassles in grading, and demand forecast is not addressed till now.

9. Base Price Assurance System: The present system of base price system needs to be reworked. Better saturation of scheme at farmer level, more vegetables, and fruits to be brought under the scheme, refining the registration process to include production planning, periodic refining of base price (at least once in a season) ensuring involvement of PACS in procurement, refixing the minimum productivity standards essential.

Table 13 *Agricultural Supply Chain in Kerala (Output side)*

Commodity/ Commodity group	Supply chain type	Remarks
Paddy	Farmer Producer- Rice mills	Mostly existing in Kuttanadu and other major producing areas. Major agency for distribution of benefits
	Farmers Producer- Co-operatives	
	Farmer Producer- collection agents of private companies	
	Farmer Producer- Government agencies (Krishi Bhavans etc)	
	Individual- Padasekhara samities/ collectives - Govt agencies/mills	
Coconut	**Fresh Coconut** Farmers – Farm gate trader-Wholesale trader-Retailer -Consumer Farmers-Wholesale trader – Retailer-Consumer Farmers – Farm gate traders – Aggregators-Vendors – Consumers Farmers-Aggregator-Exporter	7230 coconut producers' society, 467 coconut producers' federation, and 29 coconut producers'' company in Kerala.
	2. Copra/Coconut Oil Farmers – Copra – Traders-Processors/Mills-Distributor-Retailer-Consumer Farmers-Cooperative Societies – Copra – Oil-Distributor-Wholesaler-Retailer-Consumer Farmers- FPO-Copra-Coconut oil-Distributor-Retailer-Consumer	CPS, CPF and CPC are the three-tier structure of coconut FPOs. (please refer to appendix tables for more details).
	3. Tender Coconut Farmers –Aggregators-Vendors-Consumers Farmers-Vendors-Consumers	
Vegetables / banana	Farmer producer- buyer	
	Farmer producer- VFPCK- Buyer	
	Farmer Producer	

	Producers – Retailers – Consumers	
	Producers – Wholesalers – Retailers – Consumers	
	Producers – Traders - Wholesalers – Retailers – Consumers	
	Producers – Vazhakulam Market – Consumers	
Fresh Pineapple	Producers – Processor – Retailers – Consumers	
	Producers– Processors – Distributors – Retailers – Consumers	
	Producers – Traders – Processors – Retailers – Consumers	
	Producers – Local processors – Processors – Distributors – Consumers	
Mango	Producers- commission agents-wholesaler-distributor-retailor-Consumer	For grade 1 and grade 2
	Producer- collection agent-intermediary 1-exporter-intermediary 2-ditributor-retailor-consumer	For grade 1 only
	Producer-trader-wholesaler-retailor-consumer	For grade 2
	Produer-collection agent-trader-retailor-consumer	For grade 3
	Produer-collection agent-trader-procer-distributor-retailor-consumer	For grade 3, with processing

	Farmer-Village trader- Upcountry Wholesaler- Internal wholesaler-consumer	In Idukki and Wynadu
	Farmer- village trade-upcountry wholesaler-exporter-consumer	In Idukki and Wynadu
	Farmer-upcountry wholesaler-internal wholesaler-consumer	
Pepper	Farmer-pre-harvest contractor-village trader-upcountry wholesaler-exporter-consumer	
	Farmer- upcountry wholesaler-exporter-consumer	
	Farmer-Village trader- Upcountry Wholesaler- Internal wholesaler-consumer	
	Farmer- village trade-upcountry wholesaler-exporter-consumer	
Cardamom	Producer- Village trader-Auctioneer-Wholesaler-Retailer-Consumer	Domestic market targeted (49%)
	Producer- Auctioneer-Wholesaler-Retailer-Consumer	Domestic market (32%)
	Producer-Village trader-Auctioneer-Exporter-Consumer	Export market targeted
	Producer-Auctioneer-Wholesaler-Upcountry wholesaler-Retailer-consumer	Upcountry wholesaler
	Producers - VFPCK/SwasrayaKarshaka Samithi - Primary wholesalers - Secondary wholesalers - Retailers - Consumers	
Vegetables	Producers - VFPCK/SwasrayaKarshaka Samithi - Wholesalers - Retailers - Consumers	
	Producers - VFPCK/SwasrayaKarshaka Samithi - Commission agents - Primary wholesalers - Secondary wholesalers - Retailers - Consumers	Most of this have iactive involvement of a Government agency. The prices fixed based on the Government norms.
	Producers - VFPCK/SwasrayaKarshaka Samithi - Commission agent - Wholesaler - Retailers - Consumers	
	Producers - Commission agents - Wholesalers - Retailers - Consumers	
	Producers - Retailers - Consumers	

CHAPTER 3
SUPPLY CHAIN OF AGRICULTURAL INPUTS

The challenges that farmers face in input markets are considerably different from the challenges that they face in the output markets. The Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India (SAS), collect information pertaining to 17 inputs used by farmers in farming. Among these, labour cost is the biggest component, while fertiliser and manure has the biggest share in the material input costs. As per the SAS 2018-19, only 22 percent of farmers rely upon own seeds for cultivation, indicating the need for drastic change in the commercialisation and market for seeds. The following section covers the major inputs used in the agricultural production and its existing supply chain with respect to Kerala, and then identifies the weaknesses in the existing system.

The supply chain/ existing situation about major inputs like seeds/ planting materials, land, bio control agents and labour/ machine are outlined below.

LAND PRICES AND LAND RENT

Availability and accessibility to land is central to boost agricultural production and to reform agricultural sector into a viable economic enterprise that could yield a decent living to the person seeking a livelihood out of the land. Even though Kerala State has high value of output per hectare of land, it is mainly because of the plantation economy. Attaining economies of scale in cultivation in Kerala is rather a difficult proposition to be surmounted because of the very low size of operations holding and scattered nature.

Kerala is pioneer in implementing land reforms in India. As on today, Kerala along with Jammu and Kashmir and Manipur are the States in India that have legally prohibited leasing out of agricultural land. The restrictive land leasing regulations have dissuaded investments in informally leased in land, as the property rights were insecure. However, the land leasing is prevalent in several locations either to individuals or farmer groups on informal agreements and terms and conditions. Bringing out the un-utilised land into cultivation is a necessity of the times and is critical to turn agriculture into a viable proposition for Kerala, towards which an enabling leasing policy and regulation is of paramount importance. With upward mobility of the population, emergence of non-farm employment, and migration more lands are likely to be kept idle in Kerala. Currently about 8.55% of the total cultivated area in Kerala is on lease, albeit not supported by law.

The demand for land for agricultural purpose in Kerala is on increase due to emergence of farmers' organisations in agriculture, private investment by individuals and companies. This warrants legalisation of the tenancy rights which takes into consideration the interest of the landowners as well as those demand land on lease. This could help farmers to get the land released for cultivation and the landowners to earn some economic returns in term of rentals for the land without losing title to the land. An institutional arrangement for operationalising land lease market for the sake of its economic utilisation, agricultural growth, equity and rural transformation is of paramount importance.

The Model Act 2016 of NITI Ayog envisages free operationalization of the land lease markets, with the Government having very little role in fixing the terms and conditions of the lease agreement in terms of rental amounts, the mode of payment, and tenure of tenancy. It further specifies the rights and responsibilities of the landowner (lesser) and rent farmer (lessee), terms of resumption of lease agreement, heritability of the lease agreement, and compensations for investment made and enforcement of lease agreement and dispute resolution.

Some other consideration in the agreement in the context of Kerala is:

- The land lease regulations in Kerala is to be far sighted taking into consideration the long term changes in the demographic pattern of the State, increasing share of elderly populations in total population, potential cropping pattern, possibility of the high value agriculture and emergence of institutional arrangements that facilitate collective farming and agro-tourism.
- It to consider the demand for farm produces including livestock products and fish, and the constraints faced by the sector. For example, scarcity of green fodder and feed is the major constrains faced by the livestock sector including goatery, and therefore the land lease policy also need to factor in development of pasture and grass lands. The unutilised low-land areas can be potentially used for fish farming, after developing it without affecting the quality of land.
- The need for collective/ group- based cultivation of paddy, vegetables, and plantation crops also to be reckoned. To fix the participation of the collectives in the land leasing, necessary legal provisions including identification of responsibility is to be fixed. Since the agreements entered by relatively inexperienced groups may have certain risks from the lessor point of view, such agreements are to be backed up by the sponsoring agencies, in case the groups become dysfunctional.
- To streamline the system for IT applications, the land lease agreements are to be digitised in such a way as to flow the supports for services and inputs to those who cultivate the land. To facilitate that, the land-lease agreement for farming is to be registered with minimum cost.
- In view of many outmigration happening in Kerala (within Kerala and outside Kerala including other countries), still retaining the land ownership but willing to lease out land for cultivation in order to overcome the practical difficulties faced by them in executing lease agreements, an institutional mechanism is to be formed with sufficient legal backup to facilitate such transactions. Such institutional mechanism would act on behalf of the land owners who are willing to lease out. The agency can be operated at the level of local administration. The agency can fix a fair minimum rental for land, which rather serves as an indicator.

SEEDS AND PLANTING MATERIALS

Seed is the basic and most critical input in agriculture and is considered to be the cheapest input when compared to other inputs like fertilizers, pesticides, water etc. Studies reveal that keeping other inputs constant, use of quality seeds alone can improve the rice yields by 15-20 percent. In the absence of quality seeds, use of other inputs including extension

activities may not yield the desired results.

Paddy

Rice seed supply chain in Kerala can be broadly classified into two; Formal rice seed supply chain and informal rice seed supply chain. Informal rice supply chain constitutes farmer saved and exchanged seeds, whereas formal rice seed system is mainly through public sector institutions such as KSSDA (Kerala State Seed Development Authority), Kerala Agricultural University (KAU) research stations and KAU participatory rice seed production units and also through National Seeds Corporation (NSC). High yielding varieties coverage in rice is estimated at around 97 percent of the total area under rice cultivation in the State. The rest of the area is under traditional rice varieties, amounting to less than four percent (approx.6850 ha) of the area under rice. The traditional seeds do not come under the purview of Seed Certification Agency, due to the absence of varietal notification for traditional varieties. These seed are usually produced and exchanged between farmers through the informal system of seed production.

Dearth of quality seed is a major constraint faced by paddy farmers in Kerala. The need for genetically superior and disease resistant seeds require emphasis keeping in view that more than 127 million ha of land is put under food grains, the supply of certified seeds being meagre. Thus, a tremendous effort has to be made if quality seed is to be guaranteed to the farmers. The certified seeds of paddy required to cover the HYV area in 2018-19 (191182ha) is 15295MT. As per the data collected from KAU and KSSDA, the paddy seed supply is only 7275 MT in 2019-20. (7457 MT in 2016-17). Presently, the State Government machinery is able to supply only 50% of the quality paddy seed requirement of the State. The NSC accounts for about 2% of the seed supply and the remaining demand is met by private agencies and through farmer seed exchange.

Unlike the traditional varieties, seed distributed for cultivation of high yielding varieties is produced through the generation system of seed production viz., Nucleus seed- Breeder seed-Foundation seed and Certified seed class. The Nucleus seed (NS) and Breeder seed (BS) of HYVs are produced at the farms of Kerala Agricultural University. The BS thus produced is lifted by the State Seed Farms in the State as well as by National Seed Corporation and other farms of University for production of Foundation seed (FS). The FS sometimes undergo one more cycle of multiplication to produce FS –Stage II. The FS-I or FS-II is further used for production of Certified seed (CS) under the Registered Seed Growers Programme (RSGP) implemented by the Department of Agriculture Development and Farmers Welfare or used by University for CS production through Farmers Participatory approach.

The quality of seed produced (CS) under RSGP programme is monitored at field level as well as seed quality checked at appropriate intervals by officials of Department of Agriculture Development and Farmers Welfare, Government of Kerala (serving as the Seed Certification Agency in the State). Only seed lots that are certified as standard are procured via Kerala State Seed Development Authority (KSSDA), GOK as Certified seed and distributed to the end users (farmers) for general cultivation. Existing rice seed supply chain in Kerala is summarised in the figure given below:

Chain 1: KSSDA Rice Seed Supply Chain

Kerala State Seed Development Authority (KSSDA) functions under the Department of Agriculture Development and Farmers' Welfare, Kerala as an autonomous body. Promotion of multiplication, production, procurement, processing and marketing of paddy and other grain seeds is one of the main objective of KSSDA. The seed production programme is carried out with the co-operation of Kerala Agricultural University, State Seed Farms, Krishibhavans and registered PadasekharaSamitis at panchayat level. The Registered Seed Growers Programme (RSGP) is now being implemented in Ernakulam, Thrissur, Palakkad, Malappuram and Kannur districts in an area of 2000 ha per year. In this chain breeder seed is distributed from research station to State Seed Farms (SSFs) which is then multiplied to foundation seed. Foundation seed is procured by KSSDA and is distributed to registered rice seed growers through Krishibhavans. Registered rice seed growers under the supervision of agricultural officer multiply foundation seed. After seed testing and certification process certified seed is procured back by KSSDA through Krishibhavan which after cleaning and processing is distributed to rice famers for cultivation.

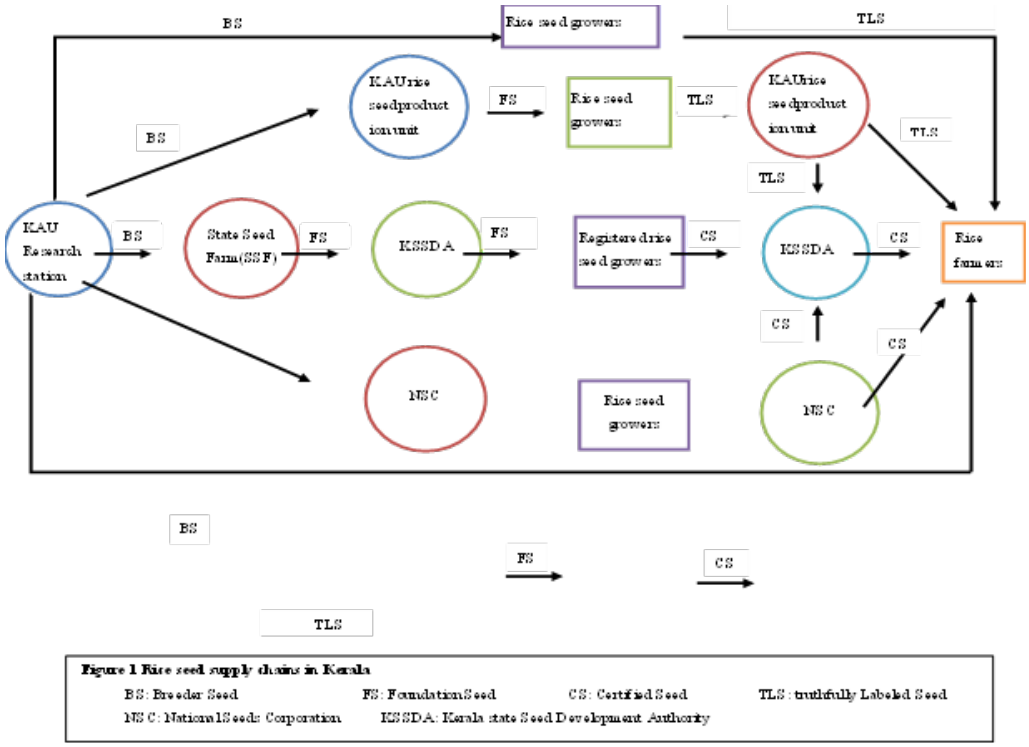
Chain 2: NSC Rice Seed Supply Chain

National Seeds Corporation Limited (NSC) is a company functioning under Government of India, established in the year 1963 with the sole objective of production of foundation and certified seeds. The regional offices located at Kanjikode, Palakkad and another at Karamana, Thiruvananthapuram distribute seeds in Kerala. In NSC rice seed supply chain, breeder seed is procured from agriculture research stations and is multiplied to foundation seed. Foundation seed is distributed to registered growers for multiplication under the strict supervision of experts in the field. After seed testing and certification, seed is procured and processed to make it ready for distribution to rice farmers. Marketing of seed is either through distributors/dealers, Government (State/central) and also through NSC owned sales counters.

Chain 3: KAU Rice Seed Supply Chain

Kerala Agricultural University (KAU) through its research stations produce both breeder seed and foundation seed. The foundation seed is supplied to participatory rice seed growers, who multiplies FS for distribution to rice farmers. Seed production in farmers' field is carried out under the strict supervision of seed production unit officials. Roguing is done by the skilled labourers trained by the unit. Before procurement samples will be taken for ensuring seed quality and is distributed as Truthfully Labeled Seed (TLS) to rice farmers. TLS production is also being done in KAU research stations and directly sold to rice farmers for cultivation.

Fig. 9 *Existing Rice Seed Supply Chain in Kerala*



Strength of Existing Supply Chain in Paddy Seeds

- Presence of organized rice seed production and distribution system
- High viability and shelf life helps to reduce the loss during supply chain activities

Issues Related to Supply Chain Management of Paddy Seeds

- At producer level: Issues in timely access to quality rice seed. Even though the institutions are assuring the quality standards, farmers were constrained with poor quality seeds.
- Lack of varietal availability: Farmers as well as intermediaries were severely affected by lack of sufficient varietal availability.
- Expensive storage and transport issues.
- Certification issues: As per the existing system, the seed producer (Agri dept./ KSSDA) itself is acting as the seed certifying agency, which is in violation of the seed production protocol in Seed Act. Complications in certification at farmer point as well as at the middle of supply chain.
- Lack of sufficient staff to monitor the supply chain.

Supply Chain of Seed if Kerala Targets Self-Sufficiency in Rice Seed Production

The seed and area required to meet the Certified seed for general cultivation (to cover 191182 ha under HYV based on an estimation done by KAU during 2018-19) is given below.

Assumptions:
a. Seed yield/ha in Foundation Seed and Certified Seed stage is 2500kg/ha
b. Seed yield/ha in Breeder Seed stage: 2000kg/ha
c. Seed rate of rice in the State: 80kg/ha
d. Foundation seed is to be produced in State Seed Farms, GOK
Only 50 percent of area in State Seed Farms is suitable for rice seed production

Table 14 *Estimating the Seed / Area Requirements*

No.	Item	Details
1	Total area under rice cultivation during 2018-2019	198026 ha
2.	Area under Local / traditional varieties during 2018-19	6844 ha
3.	Area under HYVs varieties during 2018-19	191182 ha
4.	Total requirement of Certified seed (HYV) during 2018-19	15294560 kg
5.	Total area under RSGP/ Farmers' Participatory programme required to produce 15294560kg of CS	6117.82 ha
6.	Foundation seed required to cover 6117.82 ha under CS production	489425.6 kg
7.	Total area under State Seed Farms required to produce 489425.6 kg of Foundation seed	195.77 ha
8.	Total area under State Seed Farms, GOK producing rice seed	353.09 ha
9.	Area available for rice seed production in State Seed Farms, GOK assuming that only 50 percent of total area comprise of wetlands	176.54ha
10.	Total requirement of Breeder seed (HYV) to sow 167.51 ha for production of Foundation seed	13400.62 kg
11.	Total area under Farms of Kerala Agricultural University required to produce 13400.62 kg of FS	6.70 ha

Source: **www.ecostat.org & estimation by KAU scientists**

The gap in foundation paddy seed production in Kerala is approximately 48175kg, from an area of 19.23 ha. Utilising 20 ha of the available land in seed farms, this could be overcome. The above estimates indicate that by effectively utilising the State Seed Farms under GOK, sufficient quantity of quality Foundation seed for multiplication of certified seed required for the State could be done. The expertise of Kerala Agricultural University in the farmers participatory seed production programme could be channelized for this.

Seed Registration and Certification

The New Seed bill 2019 (draft) stipulates that there should be strict registration of varieties and that there should be an independent State Seed Certification Agency. The State Government has to register all seed producers and seed processing units as per the specifications of the Central Government.

The Geographical Indications (GI) of goods act came into effect on 15 September 2003 in India and as per this Act it aims to provide for registration and better protection to

producers of products such as rice so that they can differentiate their production from generic commodity. This is also supposed to help them in securing premium prices. Out of 12 GIs registered in India for rice, six are from Kerala. They are "Navara Rice," "Pokkali Rice," "Palakkadan Matta Rice," "Wayanad Jeerakasala Rice," "Wayanad Gandhakasala Rice," and "Kaipad Rice."

Seeds of Traditional Rice Varieties

The major channel for traditional seed is through farmer exchange. Another channel is as part of biodiversity conservation project funded by GoK. Kerala Agricultural University runs a project for germ plasm conservation of traditional varieties of crops, including rice. The traditional paddy seeds thus conserved are multiplied in a farmer participatory mode in their original locality and supplied to farmers.

PLANTING MATERIALS FOR HORTICULTURAL CROPS

Horticulture has always been the thrust area of Kerala's agricultural scenario. Kerala's predominance of commercial horticulture is of national importance in terms of valuable foreign exchange earned through exports and foreign exchange saved through import substitution. The State has virtual monopoly in pepper production (81 %), rubber (92 %), cardamom (74 %), and coconut (44 %), besides coffee (22 %), cashew (15 %) and tea (8 %). Kerala contributes 88 percent of export earnings from pepper, 72 percent from cardamom, 54 percent from cashew kernels, 56 percent from ginger and 21 percent from turmeric.

Coconut

Coconut is a versatile crop closely woven with the life and livelihoods of people of Kerala. The Coconut Development Council was constituted in 2018 with a 10-year development vision for reviving coconut farming in the State. It is targeted to expand coconut cultivation in an additional area of 1.44 lakh ha and replant in 3 lakh ha. The "Keragramam" programme is yet another initiative for reviving coconut cultivation in the State through removal and replanting with new coconut seedlings. The quantity of coconut seedlings produced and distributed through public sector agencies in the State is given below in the table.

It is estimated that on an average about 30 lakh coconut seedlings are required every year. However, the coconut nursery infrastructure available with public sector agencies including State Department of Agriculture and Farmers' Welfare, ICAR-CPCRI, Kerala Agricultural University and Coconut Development Board and a few private nurseries put together are able to produce and distribute annually about 10 lakh coconut seedlings in the State. There is a huge gap between demand and supply of coconut seedlings and many unscrupulous elements exploit the situation and cheat the coconut growers in the State by selling inferior quality seedlings which would adversely affect production and productivity of coconut in the long run.

Table 15 *Coconut Seedling Production through KAU & Agriculture department*

	Total seedlings		Hybrids	
Year	Agri. Dept	KAU	Agri. Dept	KAU
2015-16	464089	82917	58715	26336
2016-17	503502	144353	58587	73217
2017-18	347353	126806	41198	93795
2018-19	325918	209051	45064	149489
2019-20	444585	223273	66088	112578
2020-21	775096	343777	68798	74455
Total	2860543	1130177	338450	529870

The foremost strategy for improving the coconut production in Kerala is the massive cutting and removal of senile and disease affected coconut palms which are beyond recovery, removal of over-aged palms; regulating the palm density and replanting with high yielding planting materials along with adoption of suitable agro-management practices in farmer participatory cluster mode. Replacing old palms will require enormous quantity of seedlings. Hence, urgent action should be initiated for replanting such seed gardens with parental lines of new and improved varieties recommended for the respective regions. Further, to increase the capacity for hybrid seedling production, a decentralized production mechanism is to be envisaged by maintaining a centralized pollen storage and supply mechanism.

In the country as a whole, the average annual requirement of coconut seedlings is estimated at 15 million. However, production and supply of coconut seedlings by the public sector research and developmental agencies including ICAR-CPCRI, State Agri./Horticulture Departments and Coconut Development Board is only 4.2 million seedlings per year thus revealing a huge gap between demand and supply.

Formation of third-party monitoring/suggestive mechanism for the planting material production by the State department of agriculture would ensure the proper implementation of the programme. Decentralised registered coconut nurseries under LSGs with less incidence of coconut root wilt can be utilised for production of coconut seedlings. Locally procured quality seed nuts from elite mother palms may be used as seed nuts in these nurseries.

Floriculture and Horticulture Nursery

Floriculture is emerging as an important commercial venture, owing to its multiple uses, satisfying the aesthetic needs of the people, creating more employment, ensuring higher rate of returns to rural people and facilitating earning more foreign exchange. Government of India has identified floriculture as a sunrise industry and accorded it 100% export-oriented status. Commercial floriculture is reported to have higher potential per unit area than most of the field crops and is therefore a lucrative business. The liberalization of industrial and trade policies paved the way for development of export-oriented production of cut

flowers. The new seed policy had already made it feasible to import planting material of international varieties. Resultant of these favourable policies, the floriculture industry has shifted from traditional flowers to cut flowers for export purposes. India's total export of floriculture was Rs. 575.98 Crores/77.84 USD Millions in 2020-21. More than 50% of the floriculture units are based in Karnataka, Andhra Pradesh and Tamil Nadu. Flowers include Rose, Tuberose, Gladiolus, Anthurium, Carnations, Marigold etc. Cultivation is undertaken both in open farm conditions as well as State-of-the-art poly and greenhouses.

Horticultural Nursery Business

Success of any horticultural production programme mainly depends upon the quality of seeds and planting materials supplied for the production. The Planning Commission's Working Group on Horticulture and Plantation Crops for 12th Five Year Plan (2011) has reported that even though there was an increasing trend in case of area of horticultural crops in the country, the system of production planning for quality seeds and planting materials for horticulture crops proportionate with crop and variety wise targets for area expansion has not been put in place. Unavailability of adequate quantity of quality seeds and planting materials has been reported as one of the most important problems affecting the development of the horticulture sector in the country. Horticultural nurseries play a crucial role in local economic development, providing employment opportunities for technical, skilled, semi-skilled and unskilled labour. But the private sector nurseries in most of the States are not monitored and regulated properly. Even though the India Seeds Act and Nursery Registration Act are in operation since 1966, it was not properly implemented in various States. According to the report of Working Group on Horticulture, Plantation Crops and Organic Farming for the XI Five Year Plan 2007-12, the Nursery Registration Act is in operation in only eight States in the country. In Kerala recently only some initiative at the registration is seen done by the department of agriculture.

Characteristics of Nursery Business in Kerala

- Scattered production units: Most of the nurseries are operating in leased in lands near the roadside. Such nurseries have sales outlets near the main roadside. Area of the nurseries varies from 10 cents to more than 10 acres.
- Nursery business as village cottage industry in the location
- Large-scale purchase of plants from outside Kerala: They purchase plants for sale from other States namely Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra and West Bengal.
- Predominance of labourers from other States
- Low wage rate to the labourers: Wage rate of nursery labourers are comparatively low when compared to the market wages of agricultural labourers. But this low wage rate is being compensated by the provision of regular employment almost throughout the year.
- Less developed infrastructural facilities
- Presence of Agri-Horti Nursery Association (AHNA)
- Services other than supply of plants: Some of the nurseries in the study area provide services like garden setting and landscaping, polyhouse construction and settings,

seeds, organic fertilizers and organic pesticides, coloured pots and other garden setting items apart from the supply of plants.

- Container nursery and field nursery: In container nurseries the plants are grown in containers like plastic pots, earthen pots, fibre pots and polythene cover. According to the type and size of the containers, the price of plants varies. In field nurseries plants are grown in the field and on customer demand, the plants are uprooted and sold. Lawn grass, some palms and bamboos etc. are grown in field nurseries. Coconut is grown both as container nursery as well as field nursery crop.
- Predominance of wholesale business: Even though both wholesaling and retailing methods of sale are observed, most of the nurseries in the study area are wholesale nurseries. Wholesale of plants is the main method of sale in the region. Nurseries from all over Kerala and neighbouring States, farmers, homesteads, garden setting contractors, corporates etc. are the major customers of the nursery industry.

Supply Chain in Nursery Business

Supply chain map of private sector horticultural nurseries

Figure 10 *Supply chain map of private sector horticultural nurseries*

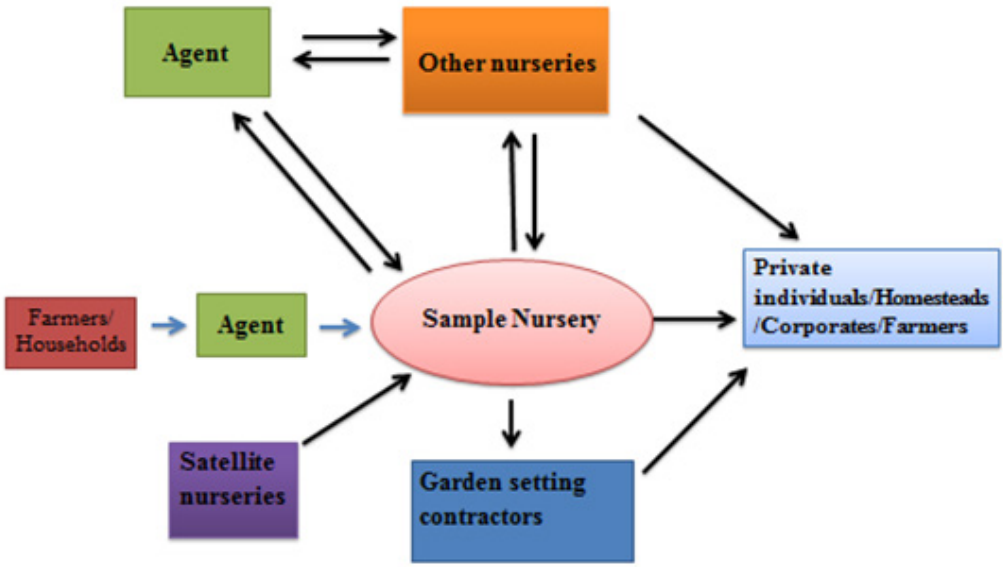
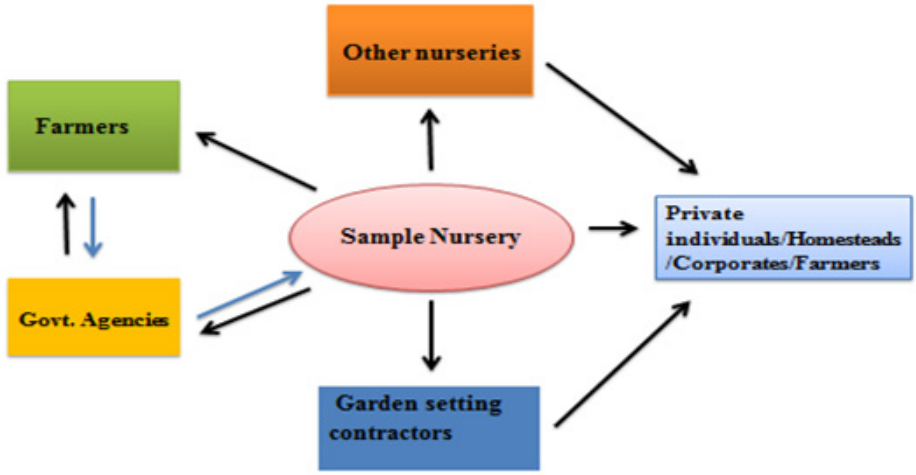


Figure 11 *Supply Chain Map of Public Sector Nurseries*



In private sector nurseries two major categories of supply chains were identified, i.e., supply chain of plants produced in the nursery and supply chain of plants purchased from other nurseries.

Vegetable Seed Production

The success story of the 13th Plan was in vegetable production. Between 2015-16 and 2018-19, Kerala could nearly double the area cultivated with vegetables as well as production of vegetables. The area rose from 46,500 ha to 82,166 ha and production rose from 6.3 lakh metric tonnes (MT) to 12.1 lakh MT (SPB, 2021). But this production still contributes to less than 50% of the vegetable requirement of the State. The level of demand for vegetables in Kerala was estimated at 27.1 lakh MT in 2009-10 according to a report prepared by the National Council of Applied Economic Research (NCAER). In 2030, the demand for vegetables is expected to rise to 35.5 lakh MT. Kerala aims at one more doubling of production of vegetables over the 14th Plan period. This would require a sharp rise in productivity as additional area available for vegetable cultivation is limited.

The productivity of vegetable crops can be increased, if good quality seeds and planting materials along with better management could be done.

The existing scenario of vegetable seed production and supply in Kerala is discussed below.

Public Sector Agencies Producing Vegetable Seeds in Kerala

A well-structured and organized vegetable seed production and distribution agencies are present in Kerala under public sector. The agencies are Kerala State Seed Development Authority (KSSDA), National Seeds Corporation (NSC), Kerala Agricultural University (KAU) and Vegetables and Fruits Promotion Council of Kerala (VFPCK) (See Appendix Table 1). According to experts in this field, public sector agencies cater to not greater

than 20% of the vegetable seed requirement of farmers. For the rest, farmers, especially, commercial vegetable growers depend on private agencies and suppliers. The existing policy of the Governments regarding 'hybrid seed research and seed production' leaves the market to private competitors. Kerala Agricultural University is mainly engaged in the production of Nucleus seeds of vegetables and these breeder seeds are used by other seed producing agencies to produce certified/TLS seeds.

VFPCK Seed Production Programme

Vegetable seeds of 19 different types of High Yielding Crops suitable to the Agro Climatic conditions of the State are produced by 100 plus trained Seed Growers under the technical guidance of the Seed Technologist. This Public - Private Participatory (P.P.P) model of vegetable seed production has developed a harmonious and long standing relationship with the farmers of ChitturTaluk of Palakkad over the past 14 years. Even though this unit is widely acknowledged as the only centre capable of engaging in the commercial production of vegetable seeds in Kerala operating in an economically viable manner, of late complaints regarding the quality of seeds is being raised by farmers. According to plant breeder scientists, participatory seed production is not feasible for cross pollinated vegetables. Seeds of vegetables like cowpea etc can be produced with quality in such cases.

VFPCK Seed Production – Highlights

- Seed Production without formal contract
- Only commercial seed producer in Kerala
- Lion's share of vegetable seed production in public sector
- Competitive price when compared to other PSUs in Kerala
- Exclusive full-fledged Seed Testing Lab for Vegetables
- Well trained trustworthy and efficient seed growers
- Plays vital role in promoting high yielding varieties
- In VFPCK Seeds are produced by farmers for the farmers
- VFPCK acts as a facilitator to maintain genetic and physical purity of seeds

Critical Gaps Identified in Seed / Planting Material Supply Chains of Horticultural Crops

Private nurseries are the major players in commercial horticulture nursery business dealing with planting materials of plantation crops and floriculture.

- Demand-supply gap for seeds and planting materials of vegetables/ fruits: The public sector initiatives of KAU, VFPCK and department of Agriculture mainly deal with seeds and seedlings of vegetables and banana. (See Appendix Table 1) The production and supply of planting materials by the public sector agencies is much short of the demand.
- Private players selling hybrid seeds in the market: Kerala not having a hybrid seed production policy, has led to a situation wherein, private agencies alone are the market players. The yield potential of hybrids being manyfold, commercial vegetable growers prefer to cultivate hybrids and they procure the seeds from the formal agencies is being

issued for the Government programmes in general.

- Availability and cost of raw materials were the next most serious issues, followed by labour shortage, unavailability of land for business expansion, credit constraints, pest and diseases and weather-related problems also affect the business environment in Thrissur.

The COVID-19 lockdown has not spared the horticulture nursery business too. The reports from different countries say that nursery input, transport, and selling tasks were affected most owing to the pandemic and it forced the nursery owners to adopt several strategies to manage the loss.

Nevertheless, if media reports from India, "the business of gardening continues to bloom across India amid the pandemic" could be taken as a cue; there is a silver line ahead.

Suggestions for improvement:

- Directorate of seed certification, nursery registration and quality control with independent authority.
- Skill training to Kudumbasree/ FPOs/ VFPCK registered seed growers on quality seed production in participatory mode.
- Considering the great export potentiality, collaborative efforts from the part of Government agencies and private nursery owners for the transfer of new techniques in plant propagation, suitable policy to use fallow, unfertile land for establishing nursery, nursery management practices, and record keeping should be there.
- Capacity building programmes have to be undertaken to improve the nursery management skills and planting material production skills.
- Training on quality seed production to registered farmer groups.
- Modernising the seed supply chains integrating the plant breeder, the grower, the distributor, the retailer, the designer and the contractor, everyone needs to work smarter and collectively to reach the end consumer.
- Backward integration in the existing supply chains of agro produce integrating Co-operatives at suitable place may be developed.

Arecanut

Suggested Strategies for Improving Arecanut Production through Supply Chain Management

- Rejuvenation of senile and unproductive areca gardens with high yielding varieties/ hybrids
- Soil test based Integrated Nutrient Management practices
- To reduce the cost of production and increase the unit level farm return arecanut based intercropping, mixed cropping and mixed farming should be practiced
- Improvising domestic markets for arecanut is indubitably a key issue of debate especially in the context of growing concern on the social costs of promoting the crop.
- The supply chain of the arecanut crop is long as well as complex one wherein more than 75% of the domestic arecanut trade lies in the hands of private traders. Therefore,

steps are to be taken to streamline the marketing systems by making it much more organized one.

- In the recent period, the low quality/low grade arecanut is imported to India in huge quantum. Therefore, adequate trade policy measures should be taken in this regard along with enforcing stringent food safety-based trade barriers to safe guard the remunerative prices in the domestic sector.
- Additional area expansion both in traditional and non-traditional areas is to be strictly prohibited and simultaneously the arecanut based cropping systems should be encouraged in the existing arecanut plantations in the country.
- We need to have a futuristic vision to evolve integrated and scientifically planned areca based cropping models in the country which include livestock, fishery component, and staple food/nutritional components.
- Evolving region specific arecanut based sustainable cropping system models and promoting multi species cropping system in collaboration with Directorate of Arecanut and Spices Development should be given emphasis.

SUPPLY CHAIN - FARM MACHINERY

Farm mechanisation is one of the crucial elements in modernisation of Indian agriculture. Use of improved implements has potential to increase productivity up to 30 percent and reduce the cost of cultivation up to 20 percent. Among the Indian States, farm power availability in Punjab, Haryana, Western Uttar Pradesh and Western part of Rajasthan is

Table 16. *Mechanisation Level of Principal Crops of Kerala*

Major crops	Area (ha)	Mechanisation level (%)
Paddy	234265	80
Tapioca	87241	60
Pulses	3903	35
Pepper	153711	30
Sesamum	576	30
Ginger (Dry)	7421	30
Turmeric	2782	30
Banana	54739	30
Coconut	787769	20
Arecanut	97492	20
Rubber	517475	20
Groundnut	1733	20
Cotton	1152	20
Cashew	53007	10

Source: www.kcaet.ac.in

higher than the national average, while Kerala records farm power availability of 0.8 kW/ha. The mechanisation level of principal crops of Kerala is shown in table below.

Among the crops, paddy cultivation is highly mechanized (80%) and cashew shows the least level of mechanization compared to other crops.

Existing Agencies

Agro Industries Corporation (1968) in the State is the main agency for the development and supply of farm machineries for the State. Kerala Agro Machinery Corporation Ltd. KAMCO) is originally conceived by Kerala Agro Industries Corporation Ltd. (KAICO), as a central Government and State Government joint venture, to promote agro-based industries in Kerala by manufacturing farm equipment, machinery and implements required for mechanized farming. The manufacturing wing of KAICO was separated to form KAMCO.

Kerala State Agricultural Mechanisation Mission (KSAMM)

Agro Service Centres (ASC) at Block level and Karshika Karma Sena (KKS) at Panchayath level are the two major components under the programme of Agro Service Delivery Systems by the Government of Kerala. The district wise details of ASCs in Kerala are provided in tables below. A total of 99 ASCs was established till date. KKS was established in selected 399 panchayaths and the aim was to provide agriculture labour force for farmers for all agricultural activities. It is estimated that various KKSs hold 1726 machines and implements.

Challenges

- Small and scattered land holdings
- Capital intensive machines and poor after-sale services
- Lack of small farm machines and tools
- Non-systematic marketing of agricultural equipment
- Lack of skilled labour

Table 17 *District-wise Details of ASC in Kerala under KSAMM*

District	2012-13	2013 -14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Total
Thiruvananthapuram	2	-	-	-	-	3	2	-	7
Kollam	-	2	2	-	-	1	1	-	6
Pathanamthitta	-	2	-	-	2	-	-	-	4
Alappuzha	-	2	1	2	1	-	2	-	8
Kottayam	-	1	1	2	-	1	3	-	8
Idukki	1	1	1	1	1	-	1	-	6
Ernakulam	-	3	-	2	-	-	2	-	7
Thrissur	-	3	1	4	-	2	1	-	11

Palakkad	2	-	-	-	-	2	2	1	7
Malappuram	3	-	-	-	-	-	3	-	6
Kozhikode	5	-	-	3	-	1	1	1	11
Wayanad	-	3	-	1	-	-	-	-	4
Kannur	2	-	4	-	2	2	-	-	10
Kasargod	1	1	1	-	-	1	-	-	4
Total	16	18	11	15	6	13	18	2	99

Source: Annual Report, KSAMM (2019-20)

Table 18 *Status Report of Machineries at Agro Service Centres*

Agricultural machinery	Working condition	Not working	Total
Sprayer	401	55	456
Bushcutter	265	141	406
Coconut climber	312	35	347
Tractor	152	11	163
Pumpset	112	6	118
Garden tiller	81	25	106
Transplanter machine	59	33	92
Power tiller	80	11	91
Chainsaw	58	27	85
Conoweeder	56	19	75
Arecanut climbing machine	62	5	67
Pruner	62	4	66
Thresher	46	13	59
Power reaper	28	10	38
Erath auger	14	2	16
Mini tiller	7	3	10
Combine harvester	2	0	2
Total	1797	400	2197

Source: Annual Report, KSAMM (2019-20)

Suggestions

In a State like Kerala, constrained very much due to labour shortage, mechanization and developing efficient supply chain for custom hiring of machinery is crucial.

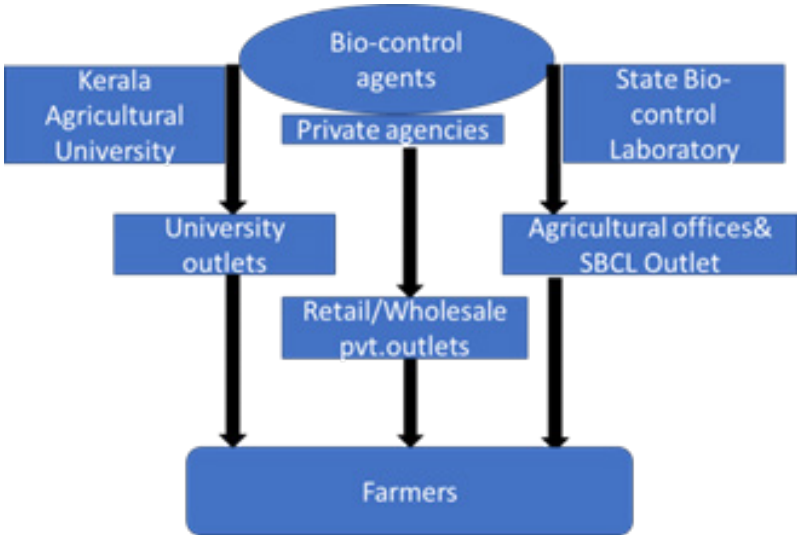
Linking the supply chains for farm machinery service with FPOs/the Agro- service centres through Karma senas , and with credit support from Co-operatives
Custom hiring services through KSAMM
Focussed research, development and distribution of small farm machineries
Roping in Startups for machinery/farm equipment development.

BIO-CONTROL AGENTS

The bio-control agents protect plants from their natural enemies like parasites, predators, etc. They help in controlling the infestation of plant pests such as weeds, nematodes, insects, and mites. The biological control agents are specific to harmful organisms and do not kill useful organisms present in the soil. In addition, they are environmental-friendly, cost effective and self-sustaining in nature. *Pseudomonas* and *Trichoderma* are the most commonly used microbial biocontrol agent in Kerala. Entomopathogenic fungi such as *Beauveria, Metarrhizium* and *Lecanicillium* is also used to a lesser extent. The production of these biocontrol agents is done by agencies such as Kerala Agricultural University, State Bio-control Laboratory and large number of private agencies.

Farmers rely on the Krishi Bhavans or the sales outlets of KAU/Department of Agriculture for the procurement of these biocontrol agents due to the comparatively high price quoted by private agencies. The number of sales outlets is limited in number and the Krishi Bhavans

Figure 12 *Supply Chains of Bio-control Agents in Kerala*



stock these biocontrol agents as part of some schemes. Enhancing the availability of these biocontrol agents close to the farmers can further enhance the adoption of these biocontrol agents.

Figure 12. indicates the supply chain of bio-control agents in Kerala

Data collected from SBCL and KAU indicates that, production of bio control agents from public entities has significantly increased in 2019-20 in comparison with the production level of 2016-17. Based on the budgetary allocation, all these public institutions are investing more on bio-control agent production infrastructure. This indicates the possibility of higher level of production in the upcoming years. The declaration of the State Government to encourage eco-friendly farming practices and the implementation of similar Central sector schemes necessitates the need to enhance the infrastructure and technical skill in production and sales of biocontrol agents and bio fertilizers.

Constraints in Supply Chain of Bio-Control agents

- Low quality of produce (observed with both public and private agencies)
- Lower acceptance among farmer due to the slow action of bio-control agents
- Improper/insufficient quality control and standardisation mechanism
- Over pricing by private institutions
- In sufficient number of production units in the public sector
- Unauthorised and unscientific production and sale of produce by agencies

Suggestions

- To enhance the adoption, local production units with trained educated youths can be established at block level – Production of biocontrol agents and bio fertilizers needs technical skill and knowhow, as the microorganism count is very crucial. This can be organised by training educated youth as a start-up or Agri-business venture.
- Establishing a production unit is a capital-intensive process and also have regulatory issues. So, the co-operatives may be encouraged to support in establishing production units at the block level.
- A consortium of FPOs or production units may be formed to overcome the regulatory hurdles.
- Quality control of the bio-agents in production and supply chain must be ensured setting up an independent Quality Control Agency with testing facilities.
- Registration of production units as well as the products to be made mandatory.
- Utilise advanced technologies such as liquid formulations and capsule-based formulations for acceptability. The untapped potential for Bio control agents/ bio fertilisers in urban agriculture need to be tapped.
- Assistance from technical institutions to be provided to production units for an economically viable and technically sound production and marketing system. Production protocols to be developed by the scientific institutions.
- The ecoshops/ PACS can serve as the retail outlets for the sale.
- IEC activities to be strengthened for popularising bio control agents in farm production, depending on the scale of production.
- A base price with a price range for biocontrol agents may be fixed

Table 19 Availability and Sales of Major Fertilizers in Kerala

S. No	Fertilizer	Kharif				Rabi			
		2016-17		2017-18		2016-17		2017-18	
		Stock	Sales	Stock	Sales	Stock	Sales	Stock	Sale
1	Urea	0.89	0.6	1.67	0.73	0.86	0.54	0.9	0.6
2	DAP	0.44	0.17	0.48	0.19	0.42	0.13	0.3	0.12
3	MOP	0.69	0.48	1.06	0.58	0.94	0.4	1.01	0.45
4	NPK	1.17	0.57	1.5	0.6	1.65	0.37	1.53	0.56

FERTILIZERS

The availability and sales of major chemical fertilizers in Kerala has been showing a downward trend for the past few years from 2011 onwards. In Kerala very low levels of fertilizers usage is noticed and it is very evident from the table that the use of P fertilizers is

Fig 13 *Fertilizer Distribution Channels in Kerala*

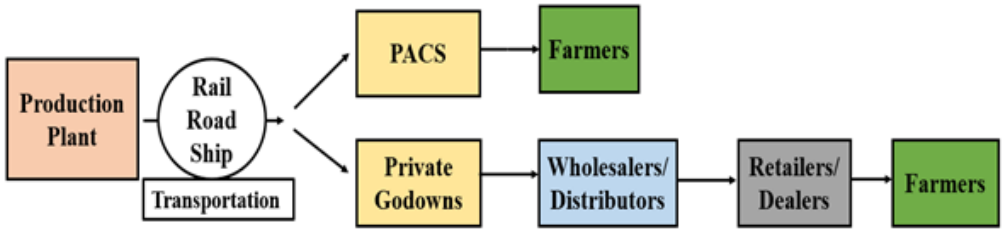
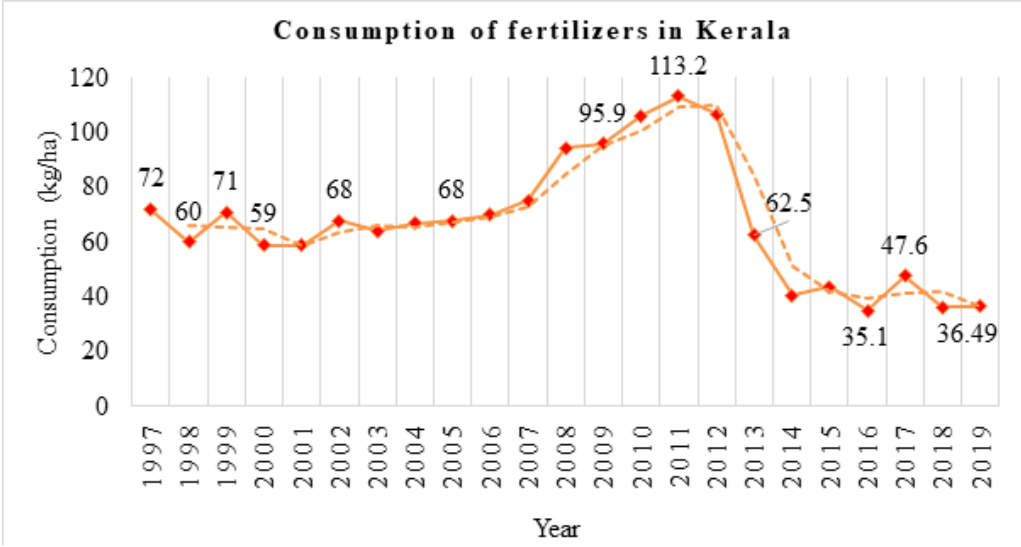


Fig 14 *Consumption of Fertilizers (kg/ha) in Kerala*



the least. The total bio fertilizer production in the State is around 6040 thousand tonnes.

Fertilizer Distribution Channels in Kerala

Fertilizer distribution in Kerala is mainly through Co-operatives. For field crops such as paddy, which is cultivated in a collective form, distribution of fertilizers is through Co-operative banks and other inputs like seed is through the Krishi Bhavans

CONCLUSION

The scenario of inputs in agriculture sector discussed above is just indicative, and as seeds and planting materials are the most critical input in production, more focus has been given to them. At the same time, the supply chain for each crop is different and hence a common model will not be feasible. Hence for low value highly perishable annual/seasonal crops localised production units and supply chains involving trained SHGs and PACS channel would be better option. For high value perennial crops, planting material production and supply should only be allowed through registered/ accredited nurseries.

CHAPTER 4
BUILDING UP A FUTURE STRATEGY

The development of future supply chain strategy needs vision the value chain of agricultural commodities for next 5-10 years. There are several social, economic, technological, and institutional changes that would shape the future value chain. The major elements that would affect the value chain could be advancements in information and communication technology, concern for nutrition, quality standards and environment, urbanisation leading to more market dependence, online-purchase and home delivery of agricultural products including fresh vegetables, demand for residue free agricultural produces, labour scarcity, demand for convenient vegetables (cut pieces) and ready to eat food and so on.

The innovations in the supply chain are to be developed taking into consideration the capabilities that are already made in the Kerala society and its future course. They include a large number of individual small-scale traders/shops; thriving local markets, upcoming super markets where the footfall is increasing gradually, large number of women self-help groups like Kudumbashree groups, a large network of co-operatives which have experience in procurement operations, Government departments having proven capability in procurement and large scale sale operations during Onam and other festivals, technological capability in developing IT platforms, and an atmosphere for start-ups in food sector.

AGGREGATION AS THE MAJOR STRATEGY

A large number of agencies operate in the procurement of agricultural commodities, both falling under public and private. The major public agencies including VFPCK, DoA, Horticorp and Co-operatives. However, the retailing is dominated by a large number of private sector. The retailing is one of the major sector that provide employment.

However, the major requirement for agricultural development is to induce the farmers to utilise the land to the maximum[1], enable the surplus produce to reach the market, bridge the gap between marketed and marketable surplus, and provide them a remunerative price which increases their farm income. One major consideration that is to be taken for policy formulation is that the production is dominated by many small farmers having small amounts of marketable surplus. Aggregation of the products from many small holders does not offer economies of scale, and therefore, a large share of the income is diverted as transaction cost, which disincentivizes the farmers to even undertake cultivation. The aggregation strategies have to keep in mind the peculiarity of Kerala agriculture. The aggregation strategy needs to be region specific as well as crop specific, with some allowance to the transaction costs involved and the number of suppliers. The issues with regard to aggregation that the hilly regions face will be very different from the issues that the coastal regions are facing. For example, major crops cultivated in Idukki district and that in coastal regions are different.

[1] When we divide the land into the land that is available for cultivation (including cultivable waste and fallow land) and land that is not available for cultivation, the data shows that the land that is available for cultivation comes around 57.9 percent of total geographical area. The current net sown area is 52 percent of the total geographical area and this shows that the gap between the land available for cultivation and the current net sown area is very negligible so an increase in output is possible only through an enhancement of productivity.

AGGREGATION MODELS: HUB AND SPOKE MODEL AND ICT PLATFORM

Hub and Spoke model is one of the important aggression strategies considered the world over. The focus is to provide access to fresh and locally produced food with acceptable quality and safety so as to enhance the income of the producers and satiate the demand of the consumers through a network of centres which offer a multitude of services. In a hub and spoke distribution model, a centralised hub exists, and products can be originated from this hub or is sent to the hub from the local points for marketing and distribution. In the Kerala context, crops specific local collection points can be identified/ developed which is integrated with centralised hubs. The digital and IT platform can be utilised to disseminate the supply, demand, price and quality related information.

It envisages involvement of farmers' groups (can be collectives like Kudumbashree units as well) who collectivise the farm producers and the cultivated products at designated places, and undertake supply/sale operations (for local markets). The excess production can be transported to the centralised major hubs which can undertake sale operations. There should be backward and forward linkages between these hubs and local production centres. In order to clear the market, the hubs are to be linked to major traders/exporters/processors or any other demand centres (centres that demand the quantities in bulk). Registration of the producers and sellers can be made through electronic mode (like mobile app) which can register the quantities to be supplied by the farmers and that demanded by the major demand centres/ traders.

The hub and spoke model also offer services including inputs and information supply. They can bring together economies of scale in the operations, and faster information delivery. FPOs can also act as a major agency under the hub and spoke model, with suitable federated structure.

One major constraint would be providing remunerative prices, as the products might be available at a relatively cheaper prices from other locations (neighbouring States). The options to overcome them will require offtake for value addition and higher order activities in the value chain including niche marketing. Start-ups could be roped in for this. An option is to set up Safal type[2] network of FPOs and Co-operatives to sell fruits and vegetables procured from local sources with a better quality (say organic or the one produced following good agricultural practices, GAP) at a premium prices. Increased consumer awareness in the State can also help strengthening the system.

The usage of ICTs is of critical importance. It involves registration of farmers (supply centres) traders, exporters and processors (demand centres). The experience of Palliakkal can be of use in developing such a platform.

At present there is clear absence of farmer level organisations which cater to the entire supply chain. Ideally, the State should encourage the post production works to be undertaken by private entrepreneurs. Ihe Government department should limit their activity in

[2] *It is an organised retail network of fruits and vegetables operated in the National Capital Region of India with around 400 retail outlets.*

this area to providing support mechanisms and creating an enabling environment. The process should be in tandem with the development of the alternative agencies. Further, these alternative agencies should be hand-holded in the supply chain operations by experienced agencies. The purpose of such a change is to enable harnessing economies of scale, creating employment, involving stakeholders in the supply chain operations, linking with local self-governance agencies and establishing vast supply chain network taking into account the local peculiarities and quick decision making at local level than the rather centralised decision making process of the Government.

AGGREGATION AND PRICING

Managing Market Gluts and Price Fluctuations

Seasonal gluts in the market are leading to a steep fall in the prices of many agricultural commodities. The farmers end up receiving a low price, which dissuades them from producing further. Therefore, protecting farmers from extreme vagaries of markets is a necessity. This in no way mean to interfere in the smooth functioning of the demand-supply force, but intends to provide farmers a protection against the extreme fluctuations. The Co-operatives or Producer Organisation need to procure the entire quantity of the produce from the farmers, at a minimum price/ base price. The following modalities are recommended:

- The department of agriculture is to arrive at indicative base prices for any particular season by taking into consideration the historical market prices and cost of production.
- The Co-operatives can largely follow the base price proposed by the State department of agriculture. However, the Co-operatives are free to have their own base price depending upon the local situation. The base price proposed by the co-operative should not fluctuate by more than 25% on either side. As the co-operatives are free to operate the forward transactions with any entity, it is in a position to bargain for higher prices for the farmers.
- However, in case of extreme market situations leading to very low prices, the co-operatives should support the farmers by utilising a revolving fund scheme in the line of price stabilisation fund.
- The price stabilisation fund can be of a tripartite contribution -State, co-operatives and farmers. A part of the revenue realised by the farmers, say 1% can be retained from the contribution of the farmers towards price stabilisation fund. The Government can earmark a certain amount towards price stabilisation channelled through each panchayat for the Co-operatives under its ambit.
- Similar to developed countries, Kerala can also come up with decoupled income payments to farmers which are delinked from current prices and current production but payment rates are fixed based on the historical acreage of cultivation enrolled by the farmers. These payments are known as direct payments and very less market distortion and are permissible under the WTO. These kind of payments will help Kerala to address the WTO related concerns that may arise in the future due to any other forms of product specific direct price interventions. Developed countries place these payments under the green box category. These payments can be made from the

above price stabilisation fund on yearly basis or on need basis.

- In a market system, operation of price manipulation schemes creates penalty in terms of excess supply. The excess supply is to be cleared through innovative methods, including processing. For this, arrangements are to be made with various agencies, processing firms and exporters. This also requires storage facility. The Co-operatives can enter into a forward contract with private retailers, have its own retail facility, shopping malls, or agencies outside State.
- The Co-operatives can value add by grading, certification and primary processing. Grading has to follow prescribed norms. The certification is to be done by approved agencies. The certification can be in the line that creates value to the farmers and Co-operatives and protecting consumers.
- The niche advantage provided by the geographical indicators are to be utilised effectively. There are several products that enjoy geographic indications. This would help in better price determination.
- Wherever, the Co-operatives are stronger they can undertake these activities and it can link with the FPOs, farmer groups., Kudumbashree units etc. In case where other farmer groups are stronger in terms of institutional capacity and networking, they can undertake these operations. However, the Co-operatives, because of its Pan-Kerala presence is in a unique position to undertake these operations.
- The major consuming centres are the cities and therefore, the existing retail chain, particularly of VFPCK and HORTICORP has to accelerate their outlet operations in the cities.
- Registration of farmers can be undertaken, and can be integrated with the traceability system to certify that the production follows Good Agricultural Practices (GAPs) or even organic. Such products could attract better prices.
- Every Co-operative should have access to the real-time prices of agricultural produces in major wholesale and retail markets. The prices in the markets are to be collected and disseminated widely.
- Better prices can be leveraged only if the farmers organise themselves into groups and engage in the marketing activities in groups. In this context, the Panchayats should encourage farmers to organise groups. The Government agencies including Krishi Bhavans can reach to a larger number of persons through the group approach. The Government organisations are to be encouraged to service the groups. The modern communication channels can be better used towards this purpose.
- Information regarding the extent of cultivation in small pieces of land are to be collected and compiled. Data generation and data collection are essential for better service delivery and policy formulation.
- Every panchayat is to prepare a commodity production situation, ward wise, with social participation. If the exercise can be done at least once in a few years, say 5 years, it would serve as an alternative source of information that can serve in policy formulation and market intervention.
- The Panchayats and the Co-operatives are to encourage formation of farmers groups

targeting agricultural production, processing and value addition.

- The Co-operatives are to provide credit facilities for the farmers'/ farmer groups and device repayment plans linking with marketing activities.
- The decentralised procurement can be linked to larger platforms in the line of AMUL in due course of time.

Creation of a Directorate of Marketing and Price Intelligence

The existing WTO wing can be modified into a larger mandate of agricultural marketing as well. This would help in aligning policies of domestic markets and external markets, and developing and implementing policies targeting marketing as a whole.

Improve the existing system with innovations in the value chain.

The steps include:

- Development of a Pluggable Database for Interlinking Various Market Institutions - Each marketing institution will have its own accounting and inventory system which need to be brought under a single platform to the maximum level possible so that decision making process on production, processing and marketing will be easier and more accurate. Proper backward linkage is possible with this data in developing specific crop cycle as part of production planning with stress on GAP and harvest, post-harvest practices to ensure quality and better product life. Thus, an input supply centre alongside to ensure availability of quality inputs.

- Development of a Centralised Market Information System which includes private vendors mainly for vegetable and fruits arriving from all sources including that of other States. Market information based on the 4 pillars of market intelligence of Price, Place, Produce, and time/ seasonality intelligence. The existing MIS on market information such as Agmarknet could also be integrated to the possible level. This will enhance our planning process and act as a decision-making tool at farmer level, outlet level and administrative levels.

- Revitalising and Revamping the Existing Market Outlets under the Department- There was multiplicity of objectives in initiating these outlets and many of them are not able to cater the objectives. Revamp these outlets and create an SCM system both for farm produce and planting materials and develop the cluster markets into CBBO. These clusters could be able to cater standard planting materials for many crops such as banana suckers, tubers, and rhizomes under each AEZ and aggregation from farmers' field is routed through these outlets. They can also be linked in the hub and spoke system. FPOs could be entrusted in managing these outlets at least at block level integrating the village level supply chain. Multiplicity of aggregation points could be optimised and existing ones could be graded, based on farmers' utility (1 or 2 in a LSGI). Bringing these in a block/ district under FPOs will get the benefit of economies of scale.

- Standardisation of Various Agri-Produce: Price fixing to be based on base price system.
- Restructuring Base-Price Assurance Scheme- More vegetables, and fruits to be brought under the scheme, and refining the registration process.

- Re-oriented Agriculture - within this paradigm, digitalization, automation and artificial intelligence play a major role in crop production, agricultural supply chain and value chain. Possibilities to be discussed in detail and implemented.
- Promotion of FPO – FPOs to be assigned at block level for aggregation and storage grading packing and marketing with thrust on local farm produce. Minimal processing activities such as grading/ sorting, cold storage and transportation facilities could be entrusted in them.
- Empowering Primary Co-operative Societies in uniform production processing and marketing their own produce through their own outlets, So many models to
- Logistic Management Services - Improved logistics: intelligent transportation system based on demand mapping, ensuring cold chain wherever necessary, using the possibilities of IoT and Replication of Kissan Rath.
- Base Price Assurance Mechanism - Number of fruit crops and vegetables to be included must be based on the real time data on market. The inclusion of crops and pricing mechanism must be dynamic. This will enable the farmer to produce those crops which are in demand seasonally and regionally. The base price fixation could be made more seasonal and regional as the cost of production varies regionally. Price fixation must be using the data available from public domain. The base price fixation is a cumbersome process now. The data migration process to AIMS portal need to be made easier by having a pluggable DBM will avoid the delay in getting the payment to farmers.
- Farmers credit facility and collateral security guarantee system – Just like CGFT, the term loan facilities to farmers could be arranged to farmers through single window facility system in the co- operative sector. Seed capital/ revolving fund/ credit linked subsidy to effect immediate payment to farmers to be incorporated. The Co-operative have greater role in channelising credit to the farm sector. A system to channelise credit from all the major institutional agencies should be initiated.

AVAILABILITY OF INFRASTRUCTURE

Infrastructure Available with the Department for Wholesale Marketing

Kerala State does not have a regulated market system unlike other State for managing the farmers produces through a regulatory framework. To tackle the issue in a better way the department has initiated 6 wholesale markets during 2003 with the financial and technical support from the European Union. During the first phase the management was fully owned by the Central Government and handed over to the Department of agriculture, Kerala. Later on, it was transferred to a management committee for transparent and speedy decision-making mechanism.

Three markets ply in rural areas and 3 in urban area. All the markets are having similar infrastructure and management committees headed by the district committee in connection with handling of agricultural produce, internal administration and price management. Agricultural produce from the farmers are aggregated here and sold to wholesalers

through auction process. The markets can cater the need of even the nearby districts also having enough storage and parking spaces. For example, the Anayara market is meant for aggregation of farm produce from three district namely Thiruvananthapuram, Kollam and Pathanamthitta.

There are about 50 independent store outlets for the sale of agricultural produce right from vegetables, fruits to milk and meat products. This is apart from the auction yard. Every market is having four cold storage chambers for storage of vegetables and fruits having a capacity of about 5 tonnes each. All the amenities such as farmers rest room, canteen, weighing platforms, ATMs, uninterrupted power are also ensured here.

The ownership of the markets is with the department of agriculture, but the administrative powers are given to a committee chaired by the District Collector and department staff, and prospective farmer representatives. These markets designed in such a way that any quantity upto 100MT could be brought at a time and transacted.

Each market handles agricultural produce of regional importance. For example, the markets of Anayara and Nedumangadu handles more of vegetables and fruits. Movattupuzha deals mainly with pineapple and Vengeri more of coconut.

All the markets except Sulthan Bathery are in breakeven points in the financial matter of administrative cost. However, the capacity utilisation is much less to the tune of less than 5 tonnes per day and turn over about 2 lakhs only per day. These wholesale markets could cater the needs of handling the farmer produce regionally if the full capacity is utilised in a professional manner.

Some of the reasons for the deficient performance are: -

- Vegetables and fruits including Cavendish banana are available at a cheaper rate from neighbouring States such as Karnataka and Tamil nadu so that wholesale vendors could not be attracted and retained.
- Lack of market intelligence system such as price and arrival, which causes many uncertainties which need to be addressed first.
- Need of linkage with farmer producers and private venders, both internal and outside the State.
- Electronic system of auctioning and virtual auctioning system using E- Nam portal could not be integrated here or any the markets.
- Intelligent logistic management services for farmers for movement of agricultural produce from their farms to these markets.
- Dearth of handling protocol or mechanism for internal movement of these perishable agricultural produce and owing to this the vegetables and fruits are deteriorated at a higher level.
- No standardisation and grading protocol for the farm fresh vegetable having regional importance and all are sold at more or less the same rate.
- Market segmentation of our farm fresh vegetables and fruits not done under the logo of “Kerala Farm Fresh”.

- Underutilisation of infrastructure such cold rooms, handling mechanism such as forklifts etc which are lying idle in the market.
- Untrained labourers who manage internal movement of the farm produce.
- Lack of management professional- The administrative committee should be a mix of market professional with marketing skills along with agricultural professionals.

Suggested intervention

- Department and Kerala Agricultural University must develop a handling protocol for Kerala Farm Fresh Vegetables and fruits.
- Implementing eNam mode of auctioning and further transactions in all the markets with immediate effect for interlinkage and transparency.
- Protocol at least for 16 items under base price scheme on standardisation and grading. For example, Nendran Banana Grade-I.
- Brand value creation of existing" Kerala Farm Fresh" logo using high voltage campaign.
- Market segmentation of our produce so that our produce gets a better price and higher demand.
- Strengthening the existing retails outlets under department and linking with the new supply chain system in the hub and spoke model.
- Logistic management using the existing block facilities such as cold Vans being implemented this year. The logistic management including transportation is to be integrated with the renewed hub and spoke model system. Here also an intelligent system must be integrated such as Kissan Rath model at the micro level. The supports and initiatives available at central Government level should be fully utilised.
- There are 55 regional warehouses under the Warehousing Corporation, Kerala. Semi-perishable and non-perishables agricultural produce could be stored in these warehouses in controlled conditions by modifying the storage area and could be utilised for better bargaining. However, the capacity utilisation and availability of produce need to be assessed.

INTEGRATING THE LSGIs IN THE HUB AND SPOKE MODEL FOR A UNIFIED SUPPLY CHAIN

Integration

The output supply system is to be based on the hub-spoke model which can integrate the farmers and farmer producer organisations or collectives at grass root level and various kinds of buyers at the other end. In order to better utilise the system, it should be integrated with the local self-governance system and the institutions available with the public and private sectors. The major changes required in the aggregation under production and marketing are elaborated.

Production Oriented

- The supply chain for inputs and outputs can be strengthened by using information technology. Database for major crops / agro catchments in block / taluk / panchayat / district wise need to be developed, mainly for the major crops. This can be developed at the grass root level, with the help of farmers' collectives, and local self-Government. This would enable assessment of area, production, input requirement and supply, and

output marketing. The database can be used by the agricultural department also to target extension activities and devising input requirement.

- Digitisation of data on area and production with expected date of harvest
- Documentation of the list of Co-operatives and FPCs functioning in the area (maybe documented on a district basis)
- Input support coordinated through LSGIs, Co-operatives and farmer producer organisations/ companies. Agency for supply of inputs could be identified at State/ regional level or at regional level. An administrative mechanism for this is to be developed.
- Seed/seedling supply (traditional/local/improved varieties) could also be coordinated so that in the long run, there is homogeneity in produce and also diversification of products. Co-operatives and FPOs involved in seedling production should go through proper quality control, by Government agencies or designiated organisation.
- As far as seed material is concerned, the farmers' / farmer producer organisation at the grass root level can identify mother plants which can be verified and certified by the official of Department of Agriculture, and earmark them. A policy towards developing and supplying seed material from identified mother plants is to be initiated, at district level. Seedlings from locally well-performing mother plants could be better suitable for that particular agro climatic conditions.
- Agriculture faces severe labour issues. In order to meet the labour requirement, the labour bank system is to be initiated at local level, at the nodal agency level. The willing labourers are to be trained for skill development and be enrolled as members of the labour bank.Labour intent could be provided through registration portal and labour provided at approved rates which shall be coordinated by the LSGI . The labour bank members shall be made eligible for welfare fund schemes as well.
- Various agricultural and plant protection operations could be undertaken through labour bank.

Marketing Oriented

- The output marketing is to be through the hub and spoke model.
- Member farmers can input the data on the expected harvest minimum 3 days before harvest.
- Consolidated data on the expected harvest will give an indication on the expected produce arrival. There will be variations, but better than produce coming unexpected. Even produce from home gardens/ kitchen gardens to be encouraged.
- Consolidated data on arrivals will be obtained at every level- block/district/State - This will help in movement of produce to other areas, identifying major institutional buyers, exporters, etc.
- Explore methods by which local traders can be brought into collaboration - Provide incentives/ stipulate conditions to local outlets for buying local agricultural produce.
- Assess surplus and find institutional buyers/processors/private players, etc.
- Quality assurance operations are to be undertaken at the Co-operative level through sorting, grading, etc., so that premium price is realised for the produce, differential

pricing for graded products.

- Traceability of products - block chain-based end to end supply is to be developed. The online database could serve as an ideal platform for this. A unique id to each farmer is to be developed with the help of Krishi Bhavan.
- Mode of sale could be auction for better transparency. Gradually online marketing to be promoted. The suitability of modifying e-NAM for the local conditions is to be ascertained in detail.
- Database on the available vendors for different products needs to be created.
- Buyers should also register in the district and input their demand. Private buyers, institutional buyers, processors etc. also to be included.
- The nodes in the hub and spoke model can decide the marketing operations including the days of purchase etc.
- Financial support for marketing infrastructure for aggregation, weighing, sorting etc. is to be devised.
- The infrastructure requirement is to be identified and constructed at the local/ block / village level, as required in the hub and spoke model. The infrastructure could include Cool chamber, packhouses, pre-cooling facilities.
- Logistics for bringing produce to the point of aggregation - Common vehicle to bring in farmers produce to the market area/Transportation assistance. Collection agents can be appointed at the local level by the nodes of aggregation (eg. Co-operative), and locally convenient mode of transport can be utilised.
- A proper accounting system may be developed. It would be preferable if the system can accommodate most of the crops, sale transactions and payment.
- Local youth may be preferred for employment.
- Development of protocol for weight loss-tabular chart indicating weight loss with passage of time
- Payment to farmers through DBT
- Customised innovations or technologies to improve shelf life through better post-harvest handling could be undertaken
- Harness synergy from central Government schemes: Initiate activities to harness the effectiveness of the central Government schemes like Agri Infrastructure Funds, RKVY etc. for funding support, branding and marketing support etc.
- Production linked incentive for farmers who adopt crops recommended
- Indigenous crops used as raw material/ingredient in many industrial formulations and efforts to connect these industries with farmers or vice versa needs to be developed.
- Lack of raw materials in off-season or surplus raw material in season is the major challenge faced and this affects agro processing industries too. Scattered cultivation may be encouraged, wherever possible, for the crops which are seasonal.
- Small scale processing, primary processing, minimal processing in association with SHGs, Kudumbasree etc. could be undertaken, and linked with the hub and spoke model.

CHAPTER 5
DIGITAL INTERVENTIONS IN AGRO-SUPPLY CHAIN AND QUALITY MANAGEMENT

Kerala has a predominance of small and marginal farms; the average holding size, as per the Agricultural Census, is 0.18 ha or 0.4 acres. Lower farm size is also a constraint in the aggregation of produce at the local level, which weakens the bargaining power of farmers in output markets and therefore to this lower farm income and resources.

WEBSITE AND MOBILE APPLICATION TO SHARE FARM RESOURCES

Add a new feature to our existing application or create a new website and mobile application to help farmers share or sell their resources. Farmers already have this sharing arrangement, but that is through informal networks and less efficient. Through this app/website, farmers can share/sell their resources such as equipment, transportation, workers, storage facilities etc. This solution will help better utilisation of the resources and reduce the overall cost and will give a chance to earn more income. Farmer Co-operatives can facilitate this resource sharing in a much efficient manner. This can fit well with the hub-and spoke model for supply chain.

Sharing of Production Plans on public portal to forecast supply and demand

- Farmers don't have a formal system to know the demand and supply of a particular crop in that year. If there is a high demand for crop "A" in 2021, most farmers generally anticipate that the same will happen in 2022, resulting in more supply than demand hence, low margins or losses. So we need to incentivise the farmers to share their crop production plan in advance. The Co-operatives can collect the data regarding the crop the farmers will be producing that year. The data of total supply and demand can be made publicly available on the website in real-time, so that farmers can make an informed decision about growing a crop or other. The demand and supply data will be visible on this platform in real-time. There can be another tab on the website or mobile app to put the basic information about the crop, season, area etc.; The application will show the demand and supply data of that particular crop.
- Demand data: Develop a database where we store all the historical data. The basic forecasting algorithms can be used to anticipate the current years' demand. It will be shown on the dashboard/website all the time.
- Supply data: It is a challenging part of the whole process. Farmers may not be keen to share such information so they need to be incentivised.

Explaining by example,

- Let's say a crop "P" is there, and its planting season starts in December '21 and ends in March '22.
- The incentives will last from Aug '21 to September '21 in that particular year. During this period, farmers have to give the details of the crop they will be growing in December '21. The exact nature of incentives need to be worked out.
- All this will be shown in real-time on the dashboard/website from Aug' 21-Sept'21.

Farmers can see the demand-supply gap and make the informed decision of increasing or decreasing the quantity or even switching to some other crop. The system will get efficient with the time, and after 4-5 years, it can provide very reliable data to all the stakeholders.

- The data can be aggregated for a large geographical region and can be used for forecasting demand and supply situation.

BLOCKCHAIN

A block chain-based governance mechanism needs to be set up, for quality assurance and facilitating trade. The price to the FPOs for their produce will be decided taking into consideration the market conditions and in this process human intervention will be minimized with the help of big data analytics. Though base price system is in vogue, the price fixation depends on market conditions also. Payment and Settlement systems driven by technology should ensure daily settlement and payment to the bank accounts of farmers/ beneficiaries. The same day payment will act as an incentive for demand led production.

An umbrella organization which will act as a Resource Support Organisation- RSO (at least for initial three years) should be developed in the State with the support of professionals. This organization should act as a One- Stop Solution for all the needs of the FPOs i.e., nurturing them, handholding for various organizational and business needs including loan syndication. The FPOs should be registered with Registrar of Companies (RoC) as this is the best way to ensure business freedom, expansion, profit generation and incentivization of farmers. The RSO may also develop capabilities for developing traceability mechanisms and for Safe Food certification. The demand led production should kickstart in the State especially in bigger land pieces owned by private and Government farms (Like Aralam where 3500 acres are readily available and Attapady where 1000 acres are available).

TOMS - MOBILE APPLICATION TO CONNECT FARMERS AND CONSUMERS

In Kerala, mobile application namely TOMS (Tuber crops Online Marketing System) developed by ICAR- Central Tuber Crops Research Institute, Sreekariyam is envisaged to bridge the gap between the farmers and consumers by linking them directly through digital marketing. Farmers can even get their queries solved and manage supply chain directly through applications on their phone. TOMS application has increased the efficiency of market system by improving the direct involvement of buyers and sellers under same platform.

DIGITAL INTERVENTION IN THE FIELD OF PRODUCTION AND MARKETING

In the present world, in every sector, digitalization is gaining momentum at a high pace. Digitalisation has opened up a new world of opportunity in agriculture also. Developments in electronics and communication are the basic elements of such digital revolution. Digital technologies, including the internet, mobile technologies and devices, data analytics, artificial intelligence-are changing the face of agriculture sector and thus by the food system. Digital farms are now attaining global attention as they reduce the demand of manual labour. Vital advantages of digitalization in agriculture are-:farm machinery

automation allows fine-tuning of inputs thus reducing the man power to a great extent; artificial intelligence data and various sensors improves the accuracy and reduces the cost of monitoring crop growth, pest and diseases etc. Internet of things (IoT) devices, softwares and mobile application are the main components of digital farming.

An example is an IoT device called electronic crop (eCrop) has developed by ICAR-Central Tuber Crops Research Institute to provide farmers with real-time information on the crop, for a reliable estimate of the yield. It communicates to the farmer directly from the field, providing the status of the crop and its input requirements to achieve a targeted yield. eCrop collects real-time data on the maximum and minimum temperature, solar radiation, relative humidity, precipitation, soil moisture content, wind velocity, and wind direction. The system simulates crop growth in response to weather and soil parameters and generates an agro-advisory via SMS. Daily advisories include the volume of irrigation water needed, and the amount of fertilizer to be applied to get the targeted yield. The agro-advisory generated by the device can do fertigation in the field automatically and thereby increasing the crop yield. eCrop has been validated for sweet potato. For sweet potato, SPOTCOMS model generates advisory for precision farming. Web interface of e-Crop helps to add more crops, soil types, locations, fertilizers, farmers, more e-Crop units etc to the cloud from which it can be configured for each device.

Another component of digital farming is the softwares and mobile application. The ICAR-CTCRI has developed HOMS i.e. Horticulture-crops Online Marketing System (http://www.ctcritools.in/homs), an online platforms to help marketing of fruits, vegetables including tuber crops which is available in Google Play Store. The e-market mobile application works with the registration of individual farmers, consumers, and other supply chain members free of cost. Sellers can upload their product's information, quantity price etc. Buyers on other hand can compare and negotiate for price with sellers. Similar system can be developed for linking the farmers/ farmers producer companies/ Co-operatives etc from the production side and various buyers from the purchase side. Apart from linking buyers and sellers, it can be used to link input suppliers, logistics, service providers and procurement agencies with the beneficiary farmers or producers. The ICAR-CTCRI has also developed an online platform to help marketing of tuber crops alone.

SMART PRODUCTION - SMART FARMING

Smart farming is the precision farming done with the help of modern information and communication technologies (ICT). Sustainable use of natural resources for increasing production with the use of modern ICT technologies by protecting the environment is the major objective of smart farming. It is based on the incorporation of ICT into machinery, equipment, and sensors in agricultural production systems. ICT technologies use large data of agriculture fields like data on weather, soil, pest and diseases, marketing, production, processing, livestock and fisheries. Collection and analysis of this data with the help of ICT technologies is the basis of Smart farming. Use of smart devices and sensors for data collection is one of the major factors of its success. After processing the data collected, the system takes a decision on what action to be performed. If the action decided is to switch on the fertigation device, the message to switch it on may be sent to the mobile of the

farmer or automatically switch on the device. The whole process from data collection to action happens automatically. This way resource utilization become more efficient and the production increases. The components of smart farming are:

IoT devices , Requisite Software, Sensors, Internet, and Machinery for various activities like production and processing.

Devices under the category Internet of Things (IoT) is the most important component as far as smart farming is concerned. Components of IoT devices are connected through internet. The sensors collect data and through internet it goes for processing. After processing of the data, the device takes decision about the action to be performed. The decision may be to do fertigation, spray pesticide using drones, send messages to farmers etc. These actions will be performed through actuators or through any other means. IoT devices play a very important role in implementing AI for precision farming by which farming reaches new heights. Data of each plot can be analysed to provide information on soil, weather, crop growth patterns, and give actionable geographically relevant timely insights to prevent losses and optimize productivity of each plot on farm. Farmers can even get their queries solved and manage supply chain directly through applications on their phone. Through pre-harvest and post-harvest management of farms, digital farming can to take over all the aspects of farming from farm to fork.

Digital technologies can potentially act as an enabler for enhancing the agricultural supply chain performance measures both in qualitative and quantitative dimensions. Identification and tracking of the key performance indicators(KPI)on these qualitative and quantitative dimensions of interest is the critical step in this intervention. In Kerala context, some of the relevant and indicative KPIs are

Qualitative

- Self-perceived recognition of the farmer
- Trust on a geographically identified produce
- Mutual trust: farmers, aggregators, logistic service providers, retailers, customers, etc
- Adherence to good package of practices and provability of such actions
- Perception on the Kerala Agricultural Brand Products in international market

Quantitative

- Resource utilization - land, water resources, human labour, input supplies, etc.
- Availability/accessibility data on agricultural inputs
- Aggregated data on product availability (temporal, spacial)
- Lead time for sourcing a specific product in a specified quantity
- Quantified quality parameters of a product
- Sanctity of reported data

Approach

The measurement and analysis of the relevant KPIs are possible only if credible data get captured in one or more of the following contexts:

- Farm/Farmer - land, environmental, agricultural inputs, and package of practices,

achievable price points, etc
- Aggregators and warehouse/logistics providers - mode of operation, geographical, regulatory compliances, market intelligence, etc
- Processing Industries, Retailers and Consumers - lead time, quality of products, market intelligence, etc
- Physical Markets and Marketplaces - geographical, consumption patterns, price sensitivity on categories of products, etc.
- Agricultural Input Suppliers - geographical, sectorial, mode of operation, etc
- Government/Regulatory Bodies - individualized and aggregated data on all the above 5
- Knowledge Providers - innovations and practices, definition and propagation of good practices, geographical, etc.

Digital interventions are possible in the above context including, but not limited to
- Demand Aggregation - domestic and export with data on geographical, seasonal, price sensitivity, etc. kind of dimensions
- Resource Availability, Utilization and Productivity - geographical, agricultural inputs to consumable produce
- Process Efficiencies - availability of knowledge, input supplies, resources, timeliness, etc.

In the Kerala's context data exists in silos either in digitally captured form, or otherwise (even as tacit knowledge) across various agencies handling specific crops or organizations with varied service mandates and market access mechanisms. In a nutshell, there is only limited actionable data available and that itself is not in a clean, unified fashion.
In this context, the immediate next steps can be:
1. Critical analysis of the suitability and scalability of various transactional ICT systems existing with different organizations.
- This will involve a study of the various IT systems employed by the different agencies working with a specific geography (e.g. various interventions by Agri-Co-operatives), agricultural segments (Eg. Coconut Farming specific) or operating with a particular market access mechanism (Eg. VFPCK, HORTICORP, etc.)
- Study of the suitability of extending their use for other crops/segments/marketing mechanisms.
- Scalability Studies

2. Extension of Agricultural Information Management System portal (AIMS) with sufficient APIs for integration with other transactional and analytics systems.
AIMS should serve as the Master Data Management system for Farms/Farmers.
3. Sector specific, highly scalable, transactional systems with pluggable workflows (on well-defined microservices) and a clean, unified data layer(for analytics and intelligence) needs to be implemented.
- This can be done only after the competition of Step 1.
- Building highly scalable, unified transactional systems to collect, store and manage Agricultural Product Availability Data, Movement and Consumption is the purpose

here.

- All such systems should interface with AIMS for Farm/Farmer Related Data

4. All transactional systems built should be interoperable with API integrations.

5. All generic services such as multi-channel communications, authentications, payments, security services, knowledge management channels should be built as common services chargeable at actuals for the various systems mentioned above. Some of these can be:

- AIMS identity based farmer/farm authentication
- Common SMS gateways, email suits
- Standardised Forms, Diaries, and Formats

6. Sector-specific Data Marts for actionable intelligence needs to be built.

- This will integrate with
- Master Data Management System
- Transactional Systems
- Analytics Dashboards

7. A globally branded, Government owned digital marketplace for Agro Product Brand creation and promotions in various sectors of interest may be interesting. This portal can integrate the following services

- Sector specific product aggregation data from specific transactional systems through appropriate API integrations
- Product Traceability Services - Pluggable Traceability as a Service for transnational systems built over Blockchain Technology
- Traceability Service can help to achieve premium pricing models - export markets
- Traceability helps in branding process

Digital interventions provide a huge opportunity for improving the supply chain efficiency in agricultural sector of the State. Even though digitisation exists in siloed forms in different transactional systems built/used by different agencies, no serious effort have happened for integration, and unification of such systems to build ICT systems capable of secure transaction enablement across platforms, data aggregations, traceability or for enabling analytics/intelligence. Hence the need of the hour is a thorough review of existing systems for potential resistibility, scalability, and unification. Development, deployment and adoption of a State-wide, unified, sectorial data management enabled, API powered, ICT system with pluggable work flows allowing aggregation of data (input supplies, schemes, farm/farmer, products, markets), secure transactions enablement without boarders (including e-Commerce for Brand Building), traceability, and analytics/intelligence should be the potential target.

8. Mobiles for weather alerts and sharing information on agriculture

Mobile phonies have emerged as an essential part of modern life. The mobile phone can serve as a fast and efficient medium to communicate, particularly information on weather and agricultural operations. In the hub and spoke system, SMS service can be made as an important element to inform registered farmers.

Mobile Apps are also important source of information and an extension medium, which

can be used effectively in agriculture. For example, Farm Extension Manager is mobile phone-based app that provides information on more than 100 crops. Mobile application can be developed to facilitate the hub and spoke model.

Information and communication technology has great role in facilitating supply chain development in agriculture, and for aggregation of farm produce. Further, it has role in farm extension services as well.

CHAPTER 6
KEY RECOMMENDATIONS AND SUGGESTIONS

LAND

Land leasing is not legally permitted in Kerala, and this is affecting the land available for cultivation. Large area of land remains unutilised due to the hesitance of the landowners to lease out land, as they fear losing the ownership. The current land leasing is on informal basis, which preclude many tenants from accessing several institutional facilities towards agriculture. In this context, the State has to comprehensively review its land leasing policy with a purpose to legalise it. This is to be seen as an initiative to institutionalise land lease market for the sake of its economic utilisation, agricultural growth, equity and rural transformation.

Large outmigration happen in Kerala and these migrants retain the land ownership, but are willing to lease out land for cultivation. Several hurdles exist in execution of land lease, and therefore an institutional mechanism is to be developed which facilitate the execution and land lease agreements and maintain it. Such institutional mechanism would act on behalf of the land owners who are willing to lease out. The agency can be operated at the level of local administration. The agency can fix a fair minimum rental for land, which rather serves an indicator.

NITI Ayog has put forward a Model Land Leasing Act. The Model Act envisages free operationalisation of the land lease markets, with the Government having very little role in fixing the terms and conditions of the lease agreement in terms of rental amounts, the mode of payment, and tenure of tenancy. The provision of the act forms a basis for land leasing, but it is to be suitably modified with the interest of better utilisation of land while allowing the farmers to retain the land rights, within the limits of land reforms.

The land lease market is to be enacted in such a way that it facilitate group farming/ farming by farm collectives/ FPOs/ Farmer producer companies and contract farming. This would help in better utilisation of land by farm collectives and other emerging institutions. The rights of the lessee and lessor are to be protected through clear legal provisions.

Policy on land is to consider the demand for land for alternative purposes including using dwelling purpose, fisheries, cultivation of green fodder, and livestock and animal husbandry. The policy also needs to consider restriction of usage of land for certain purpose which may harm the sustainability of environment. The land lease policy needs to keep in mind other existing policies on land utilisation, including that restricting conversion of paddy land.

In order to streamline the system for IT applications, the land lease agreements are to be digitised in such a way as to facilitate flow of support for services and inputs to those who cultivate the land. In order to facilitate that the land-lease agreement for farming is to be registered with minimum cost.

COCONUT, ARECANUT, AND COCOA

Satellite micro-level procurement hubs to be established (that connected to big hubs at district/region level) for both raw coconut and copra utilising the existing three-tier FPO

system in the coconut wherein an autonomous council including representatives from Krishi Bhavan, Co-operatives and CPSs will be responsible/accountable for the efficient procurement.

Streamlined tender coconut market outline with a common brand and assured high-tech hygienic/food safety measures across Kerala wherein enterprising youths (collectives) should be encouraged.

In the case of arecanut, as of now, the share of Co-operatives in the trade is less than 10 percent, and to ensure the optimal share for the farmer in the arecanut value chain, it is of paramount importance to increase the share of Co-operatives at least up to 30 percent. In this regard, the State should chalk out modalities to form/strengthen an agency/existing agencies in the line of CAMPCO with the participatory share of the FPOs.

For the newly planned arecanut gardens and the existing (one ha and above) arecanut gardens, make it mandatory to integrate scientifically planned areca-based cropping models, including livestock, fishery component, and staple food/nutritional components.

Development of exclusive market yards and assembling places for cocoa beans and the adoption of high-quality food safety standards would be a proactive step for realising better bean prices. Assured buy-back systems developed in the frame of contract farming under the Government's stake (tripartite arrangement) can help the sector's growth.

PLANTING MATERIAL AND NURSERIES

- Seed and planting material are of critical importance to the State. Lack of seed is a serious constraint in paddy cultivation. The Government agencies supply only about half of the total seed required for the State. In view of the scarcity of seeds, the Government to take initiative to address this constraint. The seeds are to be produced in the public sector wherever possible. In case the public agencies are unable to meet the requirement, it is to be licensed to private parties/ farmers with technical help from public sector. This could be a buyback arrangement. By effectively utilising the State seed Farms under GOK, sufficient quantity of quality Foundation seed for multiplication of certified seed required for the State could be done. The seed producing farmers who supply seed to the Government are to be given remunerative prices towards this taking into account the cost of production and existing market price.
- The existing paddy seed certification programme have several issues, which are not in compliance with the the seed production protocol in Seed Act. A committee should be formed with involvement of scientists, officials of department of agriculture and KSSDA, NSC, KAU, other offices concerned and farmers organisation to examine the issues and develop modalities to streamline the seed certification process in the State, in line with the Seed Act. There should be a State Seed Certification Agency as stipulated in the New Seed bill 2019 (draft), towards which the State govenemtn has to take initiatives.
- The State has to take initiatives to register the unique traditional varieties under Geographical indication, and this is to be continued. However, the economic usage

of the GI registration is not tapped to a significant level. This gap is to be addressed earnestly, and there should be promotion to cultivate the varieties with GI registration and exploring niche markets for the same. The farmers groups / FPOs can undertake this and explore markets. The activity can be incentivized as well.

- The State faces shortage of planting material of perennials like coconut, pepper, cashew, and several spices. The State should develop a mechanism to assess the demand for planting materials each year, and supply to the farmers at reasonable cost. Since a perennial crops is an investment for several years, usage of quality seedlings is of critical importance. Therefore, an awareness programme is to be initiated to propagate the importance of quality planting material. The required seedlings are to be produced by approved farmers/ procured from approved farmers/ producer organization following proper verification procedure.
- To improve coconut production, the old palms are to be replaced by newer seedlings, for which mother palms are to be identified in decentralized way, and the planting materials are to be produced following prescribed scientific methods in registered coconut nurseries. The seedlings are to follow traceability so that the customer/ farmers could be assured of the quality of the seedlings, variety and place from which it was procured. The Kudumbasree/ FPOs/ VFPCK registered seed growers etc are to be promoted for seed production, and they are to be given proper training by institutional agencies.
- There should be a mechanism to ensure quality of seeds/ seedlings for which there should be registration of all the nurseries and producers of seedlings and seeds with the State department. The planting material should follow all the scientific methods so as to ensure the agro-climatic suitability, genetic superiority, purity and that it is free from pests, diseases and weeds. Therefore, a third-party evaluation of the registered planting material producers and suppliers are to be ensured. Only the seedlings from the registered firms are to be sourced for supply through Government and private agencies, so as to reduce unscrupulous practices, ensure quality and assure public confidence. Therefore it is recommended to establish Directorate of seed certification, nursery registration and quality control with independent authority.
- Seed villages can be identified for specific crops, and seed production activities can be undertaken with the help of the Co-operatives, farmer groups, FPOs, and line departments and KAU, where seed/ seedling production can be undertaken following scientific methods.

FARM MACHINERY AND BIOCONTROL AGENTS

- The State has to promote small machineries that has the potential for use by the small holders, women friendly and can reduce drudgery associated with large machinery. A preliminary estimate of demand and supply of the farm machinery are to be undertaken by the department of agriculture.
- Establish custom hiring service of farm machineries, particularly for large machines and implements. Co-operatives/ farmers organization / FPOs can be promoted towards this and supported though credit from Co-operatives. Start-ups can be promoted in

this domain.

- Promote decentralised production of biocontrol agents with trained educated youths at block level. Production of biocontrol agents and bio fertilizers needs technical skill and knowhow, as the microorganism count is very crucial. Training programmes are to be arranged by KAU, department or registered private parties on production of biocontrol agents. The production units are to follow scientific methods and proper quality management and certification procedure. The State has to develop a third-party certification procedure to ensure the quality of biocontrol agents supplied in the State.

FERTILIZER AND PESTICIDES

- Fertilizer usage in the State is one among the lowest in India. There is wide spread opinion shared in certain corners that the State should completely stop usage of chemical fertilizer as the soil has plenty of untapped nutrients which can be tapped by other means. Such corners recommend adopting natural farming or complete organic farming. The committee, after deliberations, is of the opinion that the State should promote only scientific farming, guided by science- and evidence-based farming practices. Fertilizer usage is to be based on soil tests and crop requirement. The States policy also should consider the need to improve productivity on a per hectare basis and farm income, while adopting fertilizer use policy.
- Shortage of certain chemical fertilizer is felt during peak cropping seasons, particularly for paddy. Therefore, the State should estimate the fertilizer requirement in advance and take necessary steps to make the fertilizer available to farmers.
- Organic products and those products produced by not applying chemical fertilizers fetch higher prices. However, the prices need to compensate the yield loss due to reduced/ no use of fertilizers and other agro-chemicals. In order to fetch higher prices, the organic products, cultivated for commercial purpose is to target niche markets. In order to tap the potential of niche markets for organic products, branding and certification is necessary. The State should take steps to promote branding of organic products, third party certification and establishing traceability. Also, there should be steps to undertake regular inspection for regulatory requirement of such products, in view of consumers' rights and promotion of such products.
- In order to improve the use efficiency of fertilizer, scientific methods are to be followed. Application of fertilizer uniformly over the crop area is to be achieved. Further, the persons who apply fertilizer over the field physically tends to develop certain health issues. In view of these circumstances, drone can be promoted to apply agro-chemicals.
- In order to prevent leakage and black marketing of fertilizers and to ensure traceability, the distribution of fertilizer needs to adopt electronic methods, using biometric authentication.

DIGITAL INTERVENTIONS

As a matter of policy, the State should promote information and communication technology to its fullest extent to promote aggregation and achieve supply chain efficiency. This would help in achieving economies of scale in information transmission, aggregation, distribution of inputs and marketing of outputs, ensuring traceability and for efficient distribution of State supports.

A digital platform (in mobile preferably) is to be developed at each hub level which would have the farmers/ farmer groups as members so that the members can indicate their cropping pattern, input requirement, marketable surplus etc for each crop the member cultivates.

Promote block chain in transaction for efficient governance mechanism, quality assurance and facilitating marketing and trade.

Develop and promote digital platform for transmission of information to all farmers regarding weather, prices and other crop related information. On a large scale it can be targeted to provide customized information for each farmer based on his crop pattern and agricultural operations.

MODEL FOR AGGREGATION

- Supply of inputs and marketing of agricultural outputs are key areas that affect the performance of agriculture. Kerala has to develop a futuristic institutional mechanism for effective delivery of agricultural inputs and market the agricultural outputs, involving public, private and co-operative sectors. The mechanism has to take into account the socio-economic and demographic feature of Kerala, harness the economies of scale in its operation, promote modern scientific farming, generate income and employment and gender equality. The model should inculcate business approaches within the spirit of demographic principle.
- The committee suggests Hub and spoke model for aggregation of agricultural commodities. The focus is to provide consumers access to fresh and locally produced food, with good quality and safety and link it with producers so as enhance the income of the producers as well. In the model, a centralised hub can be developed from which the products originate or to which products can be sent from the local points, and can be distributed further. The hubs and local centres should have backward and forward linkages, so as to collect the products to the maximum and clear the markets with zero/ near zero wastage with minimum cost. The central agency can be the one with large linkage with farmers- Co-operative societies. It can operate retail outlets as well- either its own, or by franchise, like in Safal model operating in NCR, Delhi. Successful local models in this directions can be replicated. Infrastructure including cold storage and vehicle for transport should be developed.
- Market clearing would be a challenge, for which it is to be linked with private and public agencies/ traders and other stakeholders. The operation of the model should be based on the market forces, but in case the market prices are highly volatile affecting the interest of the producers, administrative price mechanism as decided by the Government /Government policy like base price can be operated through the hub and spoke model. The potential burden on the exchequer can be compensated by the

Government, or can be found out from the hub-level itself (which can operate using business principles and generate margin). There can be mechanism to manage the prices and deal with gluts. This could include:

Price discovery and administrative price mechanisms (Base price)
Price stabilisation fund operated at hubs, with tri-partite contribution
Subsidies under "green box" category of WTO
Undertaking value addition and niche marketing.
Linking farmers with credit institutions, mainly the Co-operatives.
Promote formation of farmers' groups
Coordination with LSGI (Mainly Panchayats)

The farmers/ farmers groups and traders can register by using electronic methods, or even mobile platforms. The quantity of marketable surplus can be indicated in the electronic media, which can either be supplied directly to the designated collection centres/ agencies or can be collected by collection agents. The supply of inputs can also be made through the system, and the demand can be raised with the agencies (both public and private) regarding the demand for fertilizer, seedlings etc so that advance planning can be done to a great extent.

The system can venture into infrastructure development, like cold chain facilities for a hub/ panchayat or a group of hubs. This can be either directly by the hubs or in partnership model with private parties with a proper memorandum of understanding. The guidelines for this can be developed at State level.

The committee recommends creation of a Directorate of Marketing and Price Intelligence, for which the existing WTO cell can upgraded. Price intelligence, adherence with WTO and other bilateral and multilateral agreements and development of agricultural marketing are to be mandate of the Directorate.

The committee recommends detailed analysis of the operation and public sector units involved in marketing of agricultural products (HORTICORP, VFPCK etc) in terms of its operation and impacts, with a purpose of strengthening and enable them to act as effective arms of the Government to intervene in the value chain.

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Appendix
Table 1

Kerala Agricultural University

Seeds and Planting materials Production

Sl.No	Crop/Varieties	2017-18	2018-19	2019-20	2020-21
1	Paddy (MT)	349.5704	803.3447	804.93	178.392
	BS	25.529	12.0998	14.817	9.637
	FS		0.253	18.526	1.003
	TLS	324.0409	790.99192	771.586	167.7519
2	Vegetable (MT)	8.54	8.52111	7.598	37.889
	BS kg				20.5
	TLS (tonnes)	8.54	8.555	7.598	17.389
	Vegetable seedlings	1674352	1966069	1764562	3215276
	Vegetable seed pkt		194627	312388	449886
3	Coconut - Nos	131926	238233	261762	380760
	WCT/OP	21076	38970	98115	256469
	Hybrids	93795	149489	112578	74455
	Komadan	11456	18430	10755	11250
	Dwarfs	479	2162	1825	1603
	Seed nuts	2800	19741	104	36983
	Hybrid Seed Nuts	1541	12740	38385	
4	Arecanut	151217	343502	211330	310849
	Mangala	58812	57679	34084	58894

	Mohitnagar	65751	208469	141664	212567
	Sumangala/Saigon	2666	14022	12193	16231
	South canara	21689	19375	9144	4211
	Sreemangala	2299	0	4245	1425
	Arecanut seed nut		52267	10000	17521
	other varieties		12230		
5	Pepper Rooted	1140462	1211862	2443662	676282
6	Bush Pepper	5013	3950	9201	5465
7	Nutmeg(Grft &Sdlings)	29623	24127	7218	8601
8	Clove	32701	9503	11036	13495
9	Cardamom		9006	5398	
10	All Spice	1539	3032	1061	5011
11	Cinnamon	23900	4297	5671	3765
12	Garcinia (Grft &Sdlings)	22934	19705	10217	22712
13	Coffee	36801	27038	68729	61419
14	Mango	121293	153103	149014	219451
15	Sapota	12833	28114	23487	50935
16	Jack	23156	52099	52087	61466
17	Citrus	10388	9695	11116	63097
18	Banana suckers	13598	19528	83580	19165
19	Pineapple suckers	27094	9788	9217	5823
20	Guava	25884	37997	22721	67612
21	Mangostein	14980	5870	9378	3544
22	Other fruits	204148	257222	146326	448379
23	Bread fruit	0	201	142	2287
24	Cashew	120221	171059	190496	91838
25	Cocoa Seed pods + Buds	68651	204469	94035	54726
26	Sugarcane setts (t)		11.669		7.6
27	Ginger (Kg)	561.5	10855.225	5840.06	9923.83
	Ginger seedling (Nos)		9570	3240	8096
28	Turmeric (Kg)	5347.7	10485.21	13348.2	25134.51

	Turmeric seedling (Nos)		382	52	149
29	Tapioca (m)	1890	9344	6251	5787
30	Yams(Kg)	1864.8	7081.1	8513.5	9137.968
31	Coleus Seeds		45	89.5	176.5
32	Coleus Cuttings	94550	120159	33478	31050
34	Pulses & Oil Seeds (Sesamum)Kg	887	1548.7	3447.88	13576.38
35	Ornamental Plants	52914	399857	130533	188302
36	Foliage Plants	4173	10250	27706	34307
37	Flower seeds (Kg)	0.144	10673.03	124.524	1
38	Orchids/Anthuriums	110	2227	3570	1187
39	Roses		2658	7310	4524
40	Heliconia	60	166	100	
41	Gladiolus corms (Nos)		0		
42	Lawn grass (sq.ft)	575	149	120	230
43	Medicinal Plants	11654	145950	64232	46091
44	Lemon Grass (Kg)		0	214	30
45	Fodder crops slips (Nos)	43265	109367	62124	115551
46	Forest Plants	19795	105608	23616	115003
47	Vetiver	8377	20650	28250	27357
48	Others	797	15653	14019.55	18546
	TC Plantlets Nos		434734	393905	492071
49	Banana	292459			
54	Orchid	1039			

Table 2 VFPCK Krishi Business Kendra Kakkanad & Bio Lab Own production

Year	Metarhizium(Kg)	Paecilomyces(Kg)	Verticillum(Kg)	AMF	Azospirillum	P-Solubilizer	Azotobacotr	PGPR Mix II	PGPR Mix II
2017-18	1924	925	1636	500					
2018-19	5062	26412	8895	8245	2613.5	1418	11	4028.636	5819.636
2019-20	2151	6920	9762.5	9374.5	2453.5	1366	983	5866	1291
2020-21	3517	5833	10898.68	8614	1535.5	812	248	7859	830.5

Figure 1: Biocontrol Agents Supplied by KAU

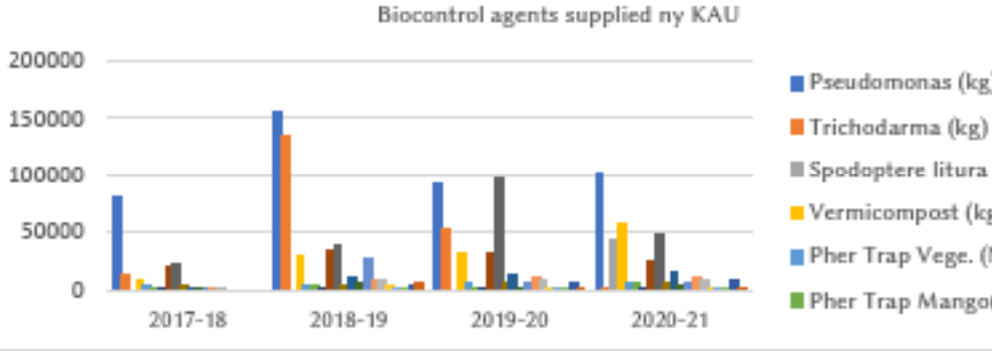


Table 3 VFPCK Krishi Business Kendra Kakkanad& Bio Lab production

	2020-21	2019-20	2018-19
Ayar Micro nutrient (in Kg)	81328	4628	43625
Banana Special micronutrient (in Kg)	7328	6982	35773
Vegetable Spl micronutrient (in Kg)	4705	3491	24160
Cue Lure traps(Nos)	1291	4107	5809
Oriental Fruit Fly Lure traps (Nos)	910	1458	790
Mc Phail trap (Nos)	1668	2185	813
Fish Amino Acid (Ltr)	601	351	605
Panchagavyam (Ltr)	314	538	993
VAM (kg)	100		
Waste decomposer(Ltrs)	70		

Table 4 List of coconut Producers' Society, Federation and Company formation in Kerala as on 31-Mar-2019

	District	Coconut Producers Societies (CPS) registered with CDB	Non Federated CPSs	Federated CPSs	Coconut Producers Federations (CPF) registered with CDB	Coconut Producers Companies (CPC) registered
1	Kasaragod	580	126	444	33	2
2	Kannur	496	69	415	29	2
3	Kozhikode	1807	90	1712	117	9
4	Malappuram	1306	100	1198	99	5
5	Palakkad	457	128	328	26	1
6	Thrissur	476	189	286	26	2
7	Ernakulam	220	73	146	14	1
8	Alappuzha	719	202	506	50	2
9	Kollam	255	97	158	11	1
10	Trivandrum	307	169	135	14	2
11	Kottayam	276	50	223	21	1
12	Pathanamthitta	26	10	16	2	
13	Waynad	114	3	107	9	1
14	Idukki	181	53	112	13	

Table 5 District wise of CPS registered with Coconut Development Board (CDB)

District	CPS registered with CDB	Number of Farmers	Area Covered under CPS (in ha)	Yielding Palms in CPS	Non Yielding Palm in CPS	Total Number of Palms in CPS	Production per year
Kasaragod	573	32164	54241.85	1941891	306083	2247974	111509106
Kannur	490	29479	19489.75	1600096	938971	2539067	107015537
Wayanad	112	7913	5060.59	331406	87157	418563	21094544
Kozhikode	1804	357315	63498.6	78169751	1014434	79179608	508701904
Malappuram	1298	88956	4368.29	575296	623316	6375912	414110084
Palakkad	457	26105	19900.78	2419252	340334	2759586	177490848
Thrissur	475	30496	11212.77	1728722	298165	2026887	89877027
Ernakulam	220	15335	5872.36	694092	216170	910262	26274188
Idukki	175	12111	8409.81	470875	188079	658954	25564344
Kottayam	275	12952	26229.02	686831	250363	937194	25214602
Alappuzha	710	43811	1870.35	2174218	658686	2832904	9855089
Pathanamthitta	26	1697	535.28	80126	31870	111996	524298
Kollam	255	14716	13313.2	685419	172510	857929	24919285
Thiruvananthapuram	304	18551	9402.98	1298270	265814	1564084	61542214
Total	7174	691301	304315.63	98033545	5391952	103420920	169718270

Source: Coconut Development Board (CDB)

Appendix - I

PROCEEDINGS OF THE MEMBER SECRETARY

STATE PLANNING BOARD

(Present: Sri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) – Constitution of Working Group on Agriculture and Cooperation – Revised Proceedings - reg.

Read: 1. Note No. 297/2021/PCD/SPB dated: 27/08/2021
2. Guidelines on Working Groups
3. This Office order of even number dated 08.09.2021

ORDER No. SPB/342/2021-Agri(1) Dated:14.09.2021

As part of the formulation of Fourteenth Five Year Plan, it has been decided to constitute various Working Groups under the priority sectors. Accordingly, the Working Group on **Agriculture and Cooperation sector** is constituted. For the smooth functioning of the Sectoral Working Group (SWG), it is decided to split the Working Groups into Expert Sub Groups (ESG). Hence the Working Group is categorized into eleven Expert Sub Groups as indicated in the proceedings. The names of the members of the SWG are indicated under each ESG. The Working Group shall also take into consideration the guidelines read 2nd above in fulfilling the tasks outlined in the ToR for the Working Group.

1. A PLAN TO IMPROVE THE EFFICIENCY OF WORKING OF KRISHI BHAVANS

Co-chairperson

- Dr C. Bhaskaran, Professor of Agricultural Extension (Retd), Kerala Agricultural University
- Mr T. V. Subash IAS, Director, Agriculture

Members

- Dr P. Jayaraj, Programme Coordinator, KVK, Kannur
- Dr Sreevalsan J. Menon, Associate Director of Extension, Directorate of Extension, KAU
- Mr V. G. Sunil, Assistant Professor, Agricultural Extension, Communication Centre, Kerala Agricultural University
- Mr P. V. Jinraj, Assistant Director, Agmark Laboratory, Thiruvananthapuram
- Ms Asha K. Raj, Assistant Director of Agriculture, Small Farmers Agribusiness Consortium, Thiruvananthapuram
- Mr Kariyam Ravi,115 Journalist colony, NCC Nagar, Peroorkada
- Mr G. K. Manivarnan, Agricultural Officer, Pallikkal Grama Panchayath
- Mr R. Ajith Kumar, Assistant Professor, IIITM-K

- Mr Joy Sebastian, MD, VCONSOL
- Mr Sidharthan A.K, Assistant Director of Agriculture (Q C),Kozhikkodu

Terms of Reference

- To assess the present functioning of Krishi Bhavans in Kerala and suggest how to improve their effectiveness.
- To identify advanced technologies for use in Krishi Bhavans to ensure better delivery of services and their convergence with LSGIs, Cooperatives, FPOs, and KAU.

2. A PLAN TO EXPAND AND MODERNIZE SUPPLY CHAINS IN AGRICULTURE

Co-chairperson

- Dr Poornima Varma, Faculty, Centre for Management in Agriculture, IIM-Ahmedabad
- Dr A. Prema, Professor & Head, Department of Agricultural Economics, College of Horticulture, Vellanikkara, Thrissur

Members

- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission, Kerala
- Dr A. Suresh, Principal Scientist, CIFT, Kochi
- Dr S. Jayasekhar, Senior Scientist, Social Science Division, CPCRI, Kasaragod
- Mr Valsan Panoli, Kerala Karshaka Sangham, Vapushas, Koothuparamba, Kannur
- Mr.V. P. Unnikrishnan, MFH Flat No.2003, Vrindavan Garden, Pattom Palace P O Thiruvananthapuram
- Ms Deepthi S. Nair, Deputy Director, Marketing, Coconut Development Board, Kochi
- Dr S. Asharaf, Professor, IIITMK
- Mr Mathew Abraham, Assistant Director, Marketing, Department of Agriculture
- Dr Sangeetha K. Prathap, Assistant Professor, School of Management Studies, Cochin University of Science and Technology, Kochi.
- Ms Chitra K. Pillai, Assistant Director of Agriculture, Agricultural Urban and Wholesale Market, Maradu
- Mr L. Subhash Babu, Deputy Director (Retd.), Department of Agriculture and Farmer's Welfare
- Mr Joy Sebastian, MD, VCONSOL
- Mr Ashar Thattarath, PGP IIM, Ahmedabad
- Mr Manu K.G, Public Relations Officer, Directorate of AD & FW

Terms of Reference

- To suggest a design of a unified supply chain for farm inputs and outputs with specific reference to aggregation/procurement, storage, and marketing.

- To suggest a framework where LSGIs, Cooperatives and FPCs can be effectively integrated into the unified supply chain.
- To suggest ways to ensure that the supply chains are integrated with the objectives of trade, value addition and processing - domestic and global – as well as agricultural finance institutions.
- To suggest ways in which the private agencies in procurement, trade and marketing are integrated with the supply chains.
- To ensure that the supply chains meet the requirements of *niche* sectors, such as organic farming, in certification and traceability.
- To suggest the major technological changes and infrastructural investments required to equip the State's supply chain systems to meet the needs of the farming community as well as domestic and international trade.

3. HOW CAN KERALA DOUBLE ITS VEGETABLE PRODUCTION IN THE NEXT FIVE YEARS?

Co-chairperson

- Ms C. A. Letha. IAS, Secretary, Agriculture, Government of Kerala
- Dr T. Pradeep Kumar, Director (Planning), Kerala Agricultural University, Thrissur

Members

- Dr P. Rajasekharan, Chairperson, State Agricultural Prices Board
- Mr V. Sivaramakrishnan, CEO, VFPCK
- Mr J Sajeev, Managing Director, Horticorp
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr K. M. Sreekumar, Professor of Entomology, College of Agriculture, Padannakkad
- Mr Sridhar Radhakrishnan, Thirunelly Agri Producer Company (TAPCo)
- Mr Reghulal, Deputy Director of Agriculture (Rtd)
- Dr K. Mini, Deputy Manager, VFPCK, Idukki
- Mr Prakash Puthanmadathil, Assistant Director of Agriculture, Vengara
- Ms S. K. Preeja, Kerala Karshaka Sangham, Pallichal, Nemom, Trivandrum
- Mr R Balachandran, Chithiramangalam, Ulloor Medical CollegePO, Thiruvananthapuram,
- Mr Reji Jacob, Kunnamkotu House, Nediyassala PO, Thodupuzha, Idukki
- Ms Bindu.J, Assistant Engineer, Office of the Assistant Executive Engineer, Malampuzha, Palakkad

Terms of Reference

- To assess the progress achieved in increasing area, production, and productivity of vegetables in Kerala over the past five years.
- To suggest a roadmap to double vegetable production in Kerala over the next five years with special focus on increasing productivity and farmer's income.

- To examine the ways in which the institutions of LSGIs, Cooperatives and FPCs can be utilised to participate in vegetable production efforts.
- To suggest ways in which existing systems of vegetable production are modernised and integrated with the different schemes of the government as well as post-production activities.
- To review the existing procurement and distribution systems, including government initiatives, and suggest a transparent, technology-driven platform with the active support of LSGIs, Cooperatives and FPCs.
- To suggest ways to reform the existing government schemes to support vegetable production.

4. CONSTRAINTS TO TECHNOLOGY ADOPTION AND THE POTENTIAL TO RAISE PRODUCTIVITY IN KERALA AGRICULTURE

Co-chairperson

- Dr C. Chandra Babu, Vice Chancellor, Kerala Agricultural University
- Dr K. C. Bansal, Former Director, National Bureau of Plant Genetic Resources, Indian Council of Agricultural Research (ICAR), New Delhi

Members

- Dr M.N. Sheela, Director, CTCRI, Sreekaryam
- Dr C. Thampan, Principal Scientist, CPCRI, Kasargod
- Dr Madhu Subramonian, Director of Research, KAU
- Dr Jacob John, Professor & Head, Integrated Farming Systems Research Station, Karamana, KAU
- Dr P. Indira Devi, Director of Research (Retd), KAU
- Dr R. Beena, Assistant Professor, College of Agriculture, Vellayani
- Dr Archana Sathyan, Assistant Professor, Agricultural Extension, CoA, Vellayani, KAU
- Dr P. Rajeev, Principal Scientist, IISR
- Adv. Thomas V T, Varacheriyil, Pala PO, Kottayam
- Dr Nishanth K. Raman, Assistant Professor, CoA, Padannakkad, KAU
- Mr Rijish Rajan, CEO, Simplified Enterprises Management, Palakkad
- Dr Thomas Aneesh Johnson, Soil Survey Officer, Office of the Deputy Director and Soil Survey, Thrissur (North)

Terms of reference

- To assess the status of productivity of major crops of Kerala and estimate yield gaps.
- To identify linkages between the adoption and use of modern technology and the gaps in yield in major crops.

- To examine the potential for raising productivity in major crops with the existing technologies.
- To identify gap in the availability of technology and suggest measures to hasten the development of these technologies.
- To suggest measures to improve the research-extension linkages in Kerala's agriculture.
- To suggest a policy framework to transform homesteads into profit centres through the practice of technology-driven agriculture.

5. PREPARATION OF SOIL AND LAND USE PLANS IN LSGIs FOR AGRICULTURAL GROWTH

Co-chairperson

- Dr Srikumar Chattopadhyay, Faculty, GIFT
- Mr S. Subramanian IIS, Director, Soil Survey & Soil Conservation, Trivandrum

Members

- Mr T. Gangadharan, Extension Faculty, KILA, KSSP
- Mr K. S. Hiroshkumar, Scientific Officer, IFSRS, Karamana, KAU
- Mr B. P. Murali, Member, Nagaroor, Kilimanoor Block (KBPA)
- Mr R. Sukhalal, Swararagam,Cherthala South PO, Alappuzha
- Mr A. Nizamudeen, Land Use Commissioner, Kerala State Land Use Board
- Mr K.P. Abdussamad, District Soil Conservation Officer, Kannur
- Mr Anand Vishnu Prakash, Agricultural Officer, Manakkad Krishibhavan, Idukki

Terms of reference

- To critically assess the status of preparation of land use plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of land use plans, and its integration with watershed plans and agricultural production systems.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on land ownership, land use and agriculture to facilitate regular updating of land use plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of land use plans at the LSGI-level over a period of six months.

6. WATERSHED-BASED PLANNING AND AGRICULTURE: THE POTENTIAL IN KERALA

Co-chairperson

- Dr Ishita Roy IAS, Agriculture Production Commissioner
- Mr I. B. Satheesh, MLA, Kattakada Constituency

Members

- Dr K. K. Sathiyan, Dean, KCAET, Thavanur
- Dr Celine George, Senior Principal Scientist & Head, CWRDM, Manimalakunnu
- Dr Anu Mary C. Philip, Assistant Director, Soil Conservation; IWDMK, Chadayamangalam
- Mr S. U. Sanjeev, Assistant Director of Agriculture (Rtd.)
- Mr U. Janardanan, CEO, Mayyil Rice Producer Company Ltd., Kannur
- Dr A. R. Durga, Assistant Professor, Department of Agricultural Economics, College of Agriculture, Vellayani, KAU
- Mr M. Prakasan Master, Kerala Karshaka Sangham, Pranavam, Azheekode South, Kannur
- Mr T. K. Rajan Master, Nini Nivas, Edachery PO, Kozhikode
- Mr Jo Jose, Assistant Principal Agricultural Officer, PAO Office, Kottayam
- Mr Mohanachandran, Deputy Director (Retd), Kollam

Terms of reference

- To critically assess the status of preparation of watershed plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of watershed plans, and its integration with land use plans and agricultural production systems with active support of geospatial technologies.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on water, water use, land use and agriculture to facilitate regular updating of watershed plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of watershed plans at the LSGI-level over a specified minimum period.
- To study the different successful models of watershed plans prepared by LSGIs in the State and study the possibilities of replications, and preparation of a set of best practices.
- To provide guidance on linking the existing schemes of the government with a broader watershed-based strategy of development planning.

7. A PROGRAMME TO MODERNIZE AND UPDATE STATISTICAL DATABASES IN AGRICULTURE

Co-chairperson

- Dr Madhura Swaminathan, Professor, Indian Statistical Institute, Bengaluru
- Mr P. V. Babu, Director, Dept of Economics & Statistics

Members

- Dr U. S. Mishra, Professor, Centre for Development Studies, Trivandrum
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr Brigit Joseph, Professor, Dept of Agricultural Statistics, CoA, Vellayani
- Dr K. P. Chandran, Senior Scientist, CPCRI, Kasargod
- Mr T. Paul Lazarus, Assistant Professor, Agricultural Economics, CoA, Vellayani
- Dr Pratheesh Gopinath, Assistant Professor, Agricultural Statistics, CoA, Vellayani
- Mr Deepak Mercy Johnson, Senior Fellow, Indian Statistical Institute, Bangalore
- Mr S. Ajayghosh, Vrindavan, Vadakkan Mainagapally PO, Kollam
- Mr Ramesh P K, TA to Director of Agriculture, Directorate of AD and FW

Terms of reference

- To critically assess the status and robustness of Kerala's statistical databases in agriculture and identify areas of concern.
- To suggest measures to improve the design, collection, analysis and dissemination of statistical data, such as area, production, yield, costs of cultivation, trade, farm harvest prices, wholesale prices, retail prices, market arrivals and so on, related to agriculture.
- To provide a framework for a better use of new technologies to improve the statistical system related to agriculture.
- To suggest ways in which Kerala's statistical system in agriculture should be geared towards meeting the challenges posed by integrated multiple-/inter-cropping based in homesteads and garden lands, apart from wetlands.
- To examine the possibilities of integrating all data on agriculture collected by different agencies in a single electronic platform.

8. A PLAN FOR VALUE ADDITION AND INDUSTRIAL INVESTMENT IN KERALA'S POST-HARVEST AGRICULTURE

Co-chairperson

- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr Manu George, Strategist, Agency for the Development of Food Processing Industries in Kerala (ADFIK), KINFRA

Members

- Mr Rajeev Bhushan Prasad, Chief Coconut Development Officer, Coconut Development Board
- Dr E. Jayashree, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr Lijo Thomas, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr M. R. Manikantan, Principal Scientist, Harvest & Post Harvest Technology, CPCRI, Kasargod
- Mr K. K. Rajendrababu, Kunnath Veedu, Alappad PO, Thrissur
- Mr R. Manikuttan,Santhivila, Vandanmedu PO, Idukki,
- Dr V. R. Sinija, Professor & Head, Business Incubation Unit, IIFPT, Thanjavur
- Dr M. S. Sajeev, Principal Scientist & Head Crop Utilization Division, CTCRI, Sreekaryam
- Dr P. R. Geethalakshmi, Assistant Professor, Department of Post-Harvest Technology, College of Agriculture, Vellayani
- Ms K. Thulasi, Kerala Karshaka Sangham, Novelty, Matoor, Kalady, Ernakulam
- Dr P. Nisha, Principal Scientist, CSIR-National Institute for Interdisciplinary Science and Technology, Trivandrum
- Mr Abraham John Tharakan, Chairman, Amalgam Foods
- Mr Madathiveetil Ramesh, Director, Brahma Indic Nutriments Private Limited
- Mr Appu Anitha Muraleedharan, Theeram Agro World
- Ms Mini Srinivasan, Annam Flour and Batter Solutions, Coimbatore
- Mr Ajoy Sukumaran, Assistant Director of Agriculture, Directorate of AD and FW

Terms of reference

- To prepare a roadmap for the development of an entrepreneurship-driven system post-harvest value addition in agriculture while ensuring the generation of employment and skills.
- To suggest measures to effectively integrate the functioning of LSGIs, Cooperative institutions, including FPCs, and line departments towards the development of value chains in post-harvest agriculture.
- To suggest measures to ensure facilities for investment, quality control, traceability, logistics and export, including the necessary arrangements for payment systems.
- To suggest measures to augment Kerala's export of processed products, particularly in high value and *niche* segments.

9. EASE OF ENTREPRENEURSHIP IN AGRICULTURE: REFORMS IN POLICY AND ADMINISTRATION

Co-chairperson

- Mr S. Harikishore IAS, Director, Industries & Commerce Department
- Dr K. J. Joseph, Director, Gulati Institute of Finance and Taxation, Trivandrum

Members

- Dr Binoo P. Bonny, Professor & Head, Department of Agricultural Extension, CoA, Vellanikkara, KAU
- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr G Prakash, Joint Director, MSME Institute, Thrissur
- Mr Roshan Kynadi, Agripreneur, Kynadi Plantations
- Mr T. Thulasidasa Menon, Krishnakripa,Thrithalangode PO, Malappuram,
- Mr M. Ramesh, Industry Expert, RABI-KAU Incubation Committee
- Mr Saji George, CEO, BIONEST
- Mr Shan Kadavil, MD, Fresh to Home Foods Private Ltd
- Mr Jamsheed, Agricultural Officer, Kannamangalam, Malappuram

Terms of reference

- To suggest a broad quantitative framework to regularly assess ease of entrepreneurship in agriculture in Kerala.
- To identify the constraints to the flow of entrepreneurial capital into the processing and value addition segments in agriculture.
- To suggest short-term, medium-term, and long-term measures to improve the ease of entrepreneurship in agriculture.
- To suggest legal and administrative measures to be initiated at different levels of governance, including LSGIs, to improve the ease of entrepreneurship in agriculture.

10. HOW CAN KERALA USE THE POWER OF COOPERATION TO RAISE AGRICULTURAL GROWTH?

Co-chairperson

- Mr P B Nooh IAS, RCS, Kerala
- Mr James Mathew, Ex- MLA, Taliparamba

Members

- Dr P. S. Geethakutty, Professor (Retd.), KAU
- Mr Salin Thapasi, Project Leader, SFAC

- Mr Paleri Ramesan, Chairman, ULCCS
- Mr James, Perambra Coconut FPC
- Fr John Choorapuzhayil, Chairman, BIOWIN, Mananthavady, Wayanad
- Dr J. Thomas, PDS Organic Spices, Kuttikanam, Idukki
- Mr G. R Rajeev, Kollam
- Mr Bimalghosh, MD, Aralam Farming Corporation
- Ms Rema K. Nair, Deputy Director of Agriculture (Retd.), Department of Agriculture
- Mr V Ravindran, Senior Manager, Kerala Bank

Terms of reference

- To critically assess the role and position of Cooperative institutions in Kerala's agricultural development pattern.
- To identify weaknesses in the cooperative institutional framework with respect to their contribution to the agricultural production processes.
- To chart out a pathway to effectively leverage Kerala's historical strengths in cooperative action – including both cooperatives and farmer producer companies (FPC) – to improve agricultural growth and farmer's income.
- To critically assess the performance of Kerala's cooperative credit system to finance agricultural activities.
- To suggest measures to modernise the functioning of Cooperatives in the State.
- To suggest measures on how cooperatives can contribute to the development of supply chains and value addition in agriculture.
- To suggest measures to improve coordination across line departments, LSGIs, Cooperatives and FPCs to contribute to agricultural growth.
- To suggest measures for transforming Kerala Bank to support the resource needs of the productive sector of the State.

11. COOPERATIVE BANKING IN KERALA: REVAMPING THE ROLE OF KERALA BANK

Chairperson

- Ms Mini Antony IAS, Secretary, Corporation

Co-Chairperson

- Dr Pallavi Chavan, Director, Reserve Bank of India, Mumbai

Members

- Mr Sasikumar M V,Director, Institute of Co-operative Management, Parasinikkadavu, Kannur
- Mr Jose T Abraham, Additional Private Secretary to the Finance Minister

- Mr K. C. Sahadevan, Chief General Manager, Kerala Bank
- Mr V. Raveendran, Senior Manager, PACS Development Department, Kerala Bank
- Mr Raja Kurup, Board Member, Kadirur PACS, Kannur
- Mr Anoop Kishore, Development Standing Committee Chairman, Wadakkanchery Municipality and District Facilitator of Decentralised plan
- Mr Romio Kattapana, President, Thankamony Service Co-operative Bank
- Mr K.C.S Nambiar, Director, Ancharakandy FSC Bank and Sahakari Coconut Processing facility
- Mr P. R. Sanjeev, Managing Director (Retd.), MILMA
- Mr R K Bhoodes Pillai, Chairman, Federation of Indian Cashew Industries, Former CEPCI
- Mr Sudheer K, Additional Director of Industries and Commerce
- Mr Damodhar, President, Kerala State Small Industries Association

Terms of reference

- To suggest broad measures to deepen and expand the participation of the cooperative sector in the process of economic growth of the State, and to involve youth in the cooperative movement in the State.
- To suggest measures to upgrade the use of technology in the functioning of primary cooperatives, such as the introduction of unified software.
- To suggest measures to improve professionalism in the functioning of cooperative societies in the State.
- To prepare a guidance note on Business Process Reengineering of the Kerala Bank to serve as a key provider of resources to the productive sectors, such as agriculture and MSMEs as well as tourism.

Convener

Sri. S S Nagesh, Chief, Agriculture Division, State Planning Board

Co- Convener

Smt. G C Roshini, Agronomist, State Planning Board

Terms of Reference (General)

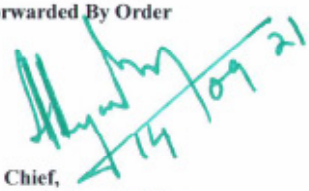
1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to TA as per rules if reimbursement is not allowed from Departments.

2. The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board "3451-00-101-93"- Preparation of Plans and Conduct of Surveys and Studies.

The order read as reference 3 is modified to this extent.

(Sd/-)
Member Secretary

Forwarded By Order



Chief,
Agriculture Division

To

The Members concerned

Copy to

PS to Vice Chairperson
PA to Member Secretary
CA to Member (Dr.Ramakumar.R)
Economic Advisor to VC
Chief, PCD,SPB
Sr. A.O, SPB
The Accountant General, Kerala
Finance Officer, SPB
Publication Officer, SPB
Sub Treasury, Vellayambalam
Accounts Section
File/Stock File