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THE INDIAN SOCIETY OF AGRICULTURAL ECONOMICS, MUMBAI

Aims and Objects:

To promote the study of social and economic problems of agriculture and rural areas and also to promote technical competence for teaching and research in Agricultural Economics and allied subjects through:

(a) research in problems of agricultural economics and rural development;
(b) periodical Conferences and Seminars;
(c) publication of books, reports, papers or summaries of papers either separately or collectively, or in a periodical which may be issued under the auspices of the Society;
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PAPERS READ

AT THE

EIGHTIETH ANNUAL CONFERENCE

OF THE

INDIAN SOCIETY OF AGRICULTURAL ECONOMICS

at

Centre for Agricultural and Rural Development Studies (CARDS),
Tamil Nadu Agricultural University,
Coimbatore (Tamil Nadu)

February 10-12, 2021

<u>SUBJECTS</u>

1. Institutions for Agricultural Development: Farmers' Collectives/Producers' Organisations including Efficient Supply-Chain Management

2. Agricultural Labour, Skill Development, Labour Productivity and Employment

3. Agricultural Trade with Special Reference to Plantation Crops and International Trade Agreements

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ACKNOWLEDGEMENT

We are grateful to Indian Council of Social Science Research for providing financial support for publication of four issues of Vol. 75 of the Journal for the year 2020.

We are grateful to National Bank for Agriculture and Rural Development for providing financial support for publication of this Conference Number (October-December 2020) of the Journal which contains the papers accepted for discussion on the three themes at the 80th Annual Conference of the Indian Society of Agricultural Economics.

PREFACE

The Eightieth Annual Conference of the Indian Society of Agricultural Economics is scheduled to be held virtually February 10-12, 2021 under the auspices of Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu).

The following subjects are selected for discussion at the Conference:

1. Institutions for Agricultural Development: Farmers' Collectives/Producers' Organisations including Efficient Supply-Chain Management

2. Agricultural Labour, Skill Development, Labour Productivity and Employment

3. Agricultural Trade with Special Reference to Plantation Crops and International Trade Agreements

The Keynote papers on Subject I, II and III are being hosted in our Society's website www.isaeindia.org with a view to enabling the researchers, well in advance, to come prepared for discussion and deliberations at the Conference. These papers would be subsequently revised in the light of discussions at the Conference and published in the January-March 2021 issue of our Journal.

We have received a large number of papers contributed by more than 300 researchers. However the President of the Conference, on the recommendations of the Rapporteurs, has accepted in all 64 quality papers for discussion at the Conference. Out of these, 14 papers are published in full and 50 in the form of Summaries in this issue which also includes the Rapporteurs' Reports on the three subjects. The Editorial Board would like to place their record and appreciation to the Rapporteurs and Conference President for their careful refereeing and shortlisting the papers under different categories of this volume.

We regret it has not been possible to publish, in full length, a large number of papers because of the time constraint and the exorbitant increase in the cost of printing. We do hope the contributors whose papers could not be published in full would appreciate our difficulty and bear with us. We are thankful to the keynote paper-writers and to all the paper-writers for sending their papers and to the Rapporteurs for preparing their Reports embodying the main points made in the papers and also outlining issues for discussion.

December 31, 2020

C.L. Dadhich
Editor

Indian Journal of Agricultural Economics
Vol.75, No.4, October-December 2020

SUBJECT I
INSTITUTIONS FOR AGRICULTURAL DEVELOPMENT: FARMERS' COLLECTIVES/PRODUCERS' ORGANISATIONS INCLUDING EFFICIENT SUPPLY-CHAIN MANAGEMENT

Production of Turmeric in North East Hill Region of India: A Value Chain Analysis

Ram Singh*, **S.M. Feroze**† **and Shiv Kumar****

ABSTRACT

The paper demonstrates the economics of turmeric in the in North Eastern Hill region by focusing on the states, viz., Mizoram, Meghalaya, Manipur and Sikkim through value chain analysis approach. The cost of cultivation analysis has shown that the turmeric crop is economically beneficial across the states and it has been more beneficial in the state of Sikkim as the product in Sikkim has been certified as organic. The factor share as well as cost and returns analysis both have attracted the scientists; policy makers for both pre- and post-harvest interventions. The pre-harvest arrangements include rhizome storage, developing small machinery to reduce drudgery as most of the work have been performed manually in turmeric farms in the region. The mapping of value chain actors and value addition analysis has shown that the processed (powder) and semi-processed (slice/flakes) of turmeric earned good returns, although the powder turmeric was made and sold by a few number of turmeric growers across the states. Making powder as well as slices was not possible for all the turmeric growers as it needs slicer, dryers, grinders and packaging machine and all these are not affordable by the turmeric growers of the region. Therefore, establishment of slice/flakes maker, dryers, grinder, storage for rhizome and packing machines are the need of the hour in the region to enhance their due share in the consumers' price of turmeric and its by-products.

Keywords: Value, Chain, Actor, NEHR, Turmeric and Price Spread.

JEL.: J54, P32, Q02, Q13

I

INTRODUCTION

Turmeric *(Cucurma longa)* is a highly commercial spice of India. The rhizome of turmeric spice contains yellow pigments called *curcumin* which is the main active compound as well as the main colouring agent which also has certain therapeutic properties. Turmeric is part of Indian's culture: it is an important ingredient in curry dishes; it is also used in many religious observances, as a cosmetic, a dye, and it enters in the composition of many traditional remedies. As a dried rhizome of an herbaceous plant, turmeric is closely related to ginger (Dahal and Idris, 1999). This spice is also sometimes called "Indian saffron" because of its yellow colour. This

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The authors are grateful to ICAR-NIAP for collaboration of this research project with Central Agricultural University, Imphal from which this research article has been prepared. The authors are also thankful to anonymous reviewer for giving the constructive suggestions to improve this article.

golden spice contains the highest diversity comprising 40 species (Ashraf *et al.*, 2017) and some are important varieties exported outside (Table 1). Turmeric is mostly traded as a whole rhizome, which is then processed into powder or oleoresin by flavour houses and the industrial sector (ASTA, 2002) rhizomes come as fingers, bulbs and splits. Since *curcuminoids* (the colour constituents of turmeric) deteriorate with light and to a lesser extent, under heat and oxidative conditions (Buescher and Yang, 2000), it is important that ground turmeric be packed with protective packaging and appropriately stored.

TABLE 1. MAJOR TURMERIC CULTIVARS GROWN IN INDIA

State (1)	Cultivars/varieties (2)
Kerala	Alleppey Finger
Maharashtra	Rajapore, Karhadi, Waigon
Andhra Pradesh	Nizamabad, Armoor, Vontimitta
Tamil Nadu	Erode local, BSR-1, PTS-10
West Bengal and Assam	Pattant
Meghalaya	Lakadong, Lashein, Ladaw, Lakashain and Megh-I
Mizoram	Lakadong and RT-1
Manipur	Lakadong and local variety
Sikkim	Lakadong and local variety

Source: APEDA, 2018.

Turmeric Production in India

In India, turmeric crop occupies about 6.05 per cent of the total area under spices and condiments grown (Government of India, 2017). Turmeric ranks fourth in production in the country with a total production of 1056.10 thousand MT under a total area of 193.4 thousand ha in the year 2016-17 (Government of India, 2017).The country is not only the largest producer and consumer but is also the largest exporter of turmeric in the world. India dominates the world production scenario contributing 78 per cent followed by China (8 per cent), Myanmar (4 per cent), Nigeria and Bangladesh together contributing to 6 per cent of the global production (Viraja *et al*., 2018). Telangana state is the leading state under turmeric cultivation (51 thousand ha) and in terms of production (294 thousand MT) contributing about 27.84 per cent to the total country's production in 2016-17. The others major states in turmeric production in the country are Maharashtra (177.85thousand MT), Tamil Nadu (112.59 thousand MT) and Andhra Pradesh (79.73 thousand MT) (Table 2).

Turmeric Production in NEH Region

Spices are low volume and high export-oriented commodities that has great economic significance in India (Sugasini *et al.,* 2018). The NEHR, green belt of India which comprises states, namely, Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim harbours a rich flora on account of its varied topography, climate and altitudes and has great potential for the development of

TABLE 2. TOP TEN STATES IN AREA AND PRODUCTION OF TURMERIC IN INDIA (2016-17)

State/ UT	Area ('000 ha)	Per cent	Production ('000 MT)	Per cent
(1)	(2)	(3)	(4)	(5)
Telangana	51.00	23.00	294.00	27.84
Maharashtra	10.71	4.83	177.85	16.84
Tamil Nadu	29.31	13.22	112.59	10.66
Andhra Pradesh	19.18	8.65	79.73	7.55
Karnataka	14.99	6.76	76.49	7.24
Gujarat	4.10	1.85	65.50	6.20
Odisha	27.86	12.56	54.50	5.16
West Bengal	18	8.12	45.50	4.31
Mizoram	7.2	3.25	27.82	2.63
Haryana	1.5	0.68	22.00	2.08
Overall total in India	221.78		1056.10	

Source: Government of India, 2018.

horticultural crops including spices. It is the hub of major spices like large cardamom, ginger, turmeric, black pepper, chilli, bay leaf, etc. which are in great demand and has tremendous potential (Hnamte *et al*., 2012). NEH Region is home to some niche spice crops like *Lakadong* turmeric, *Bird's eye* chilli, *King* chilli and *Nadia* ginger which has high market demand for their unique features (Momin *et al.,* 2018). Turmeric is an important cash crop in the NEH region and shares about 8.30 per cent of the total production in the country. Mizoram, with a total production of 27.82 thousand MT is the leading state in the region followed by Meghalaya (16.63 thousand MT) and Manipur (15.40 thousand MT)**.**The agro-climatic conditions of the region characterised by warm and humid summers with abundant rainfall and cool winters are favourable for turmeric cultivation (SFAC, 2012). Like other food crops grown in the NE region, turmeric is cultivated using the traditional knowledge of the inhabitants which are generally eco-friendly, less expensive and organic inputs.

Turmeric spice has a great market potential domestically and abroad which brings forth the need for a value chain analysis. The analysis will help to understand the flow of the produce from the turmeric producers level to the end consumers and the value added to the commodity along the flow. Moreover, turmeric commodity can be sold-off in the raw or in the processed form (dry flake/powdered), hence a value chain analysis will help to identify the stakeholders and marketing along the chain. Therefore, keeping this fact in view the present paper attempts to study the value chain in pre- and post-harvest of turmeric in North Eastern Hill Region of India.

II

MATERIAL AND METHODS

The study was conducted under ICAR funded project in North East region of India comprising the eight sisters, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. On the basis of highest area of cultivation of turmeric, four states namely; Mizoram, Meghalaya, Manipur and Sikkim state in

North Eastern Hill region were selected (Table 3). In each selected state, two districts having the highest area under the cultivation of turmeric were selected. From each selected district, 2-4 major collection centres or blocks were selected. Further, a list of all the villages in the chosen collection centres/block was prepared along with the total number of households and the producer of turmeric. A total of 334 number of turmeric producers were selected from the highest turmeric cultivation areas in NEH region (Table 4) by selecting at least 10 per cent of the total farmers from each of the selected villages. A sample of 53 value chain actors were identified in the value chain of turmeric in all the selected states (Table 5). The economics of turmeric cultivation, producers' plus, its disposal and different value chain actors in each selected state were mapped.

TABLE 3. TURMERIC GROWING STATES IN NEH INDIA (2016-17)

State (1)	Area ('000 ha) (2)	Production ('000 MT) (3)
Meghalaya	2.61 (16.35)	16.60 (18.94)
Mizoram	7.20 (45.11)	27.82 (31.74)
Manipur	1.40 (8.77)	16.40 (18.71)
Nagaland	0.70 (4.39)	10.72 (12.23)
Arunachal	0.80 (5.01)	3.84 (4.38)
Tripura	1.30 (8.15)	6.59 (7.52)
Sikkim	1.95 (12.22)	5.68 (6.48)
Total (NEH)	15.96 (100)	87.65 (100)
Total (India)	221.78	1056.10
Per cent Share of NEH	7.20	8.30

Source: Government of India, 2018

Note: Figures in parentheses are percentages to the total of NEH region.

TABLE 4. SAMPLING OF TURMERIC RESPONDENTS (NUMBER)

			Turmeric respondents	
States (1)	Districts selected (2)	Villages selected (3)	Total turmeric producers (4)	Selected turmeric growers (5)
Mizoram	2	7	950	95
Meghalaya	2	9	862	86
Manipur	2	8	746	75
Sikkim	2	9	783	78
Total	8	33	3341	334

Source: Household survey, 2017-20.

TABLE 5. SAMPLING OF TURMERIC VALUE CHAIN ACTORS (NUMBER)

		Value chain Actors of turmeric					
State (1)	Market/collection centre (2)	VT (3)	TP (4)	PWR/ PW (5)	R (6)	FPO (7)	Total (8)
Mizoram	3	5	5	5	3	1	19
Meghalaya	4	4	1	4	4	-	13
Manipur	4	2	-	3	4	-	9
Sikkim	4	-	-	3	7	2	12
Total	15	11	6	15	18	3	53

Note: VT- Village Traders; PWR- Processor-cum-Wholesalers-cum-Retailer; PW- Processor-cum- Wholesaler; TP- Trader-cum-Processor; FPO- Farmer Producer Organisation; R- Retailers.

III

DATA

Three year primary data were collected for the year 2017-2020. Data were collected through personal interview approach. The interview schedule was pre-tested against ambiguity and redundancy and necessary modifications were made in the interview schedule on the basis of the result of pilot study and thereafter final format was obtained for data collection. The interview schedule was prepared differently for the different respondents – producers, value chain actors (traders, wholesalers/retailers/processors, etc.) and consumers.

Analysis of Data

Cost and Return Analysis

The cost concepts namely; Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1 and Cost C_2 proposed by Special Expert Committee on 1979, 30th January (Government of India, 1979) were used.

Factor Share Analysis

The physical quantity of each factor input when multiplied by its price and then divided by the value of the total product, will yield factor share input (Dhondyal, 1977).

$\Pi\ (X_1)= P_1X_1/P_y,\ \Pi\ (X_2)= P_2X_2/P_y,\ \Pi\ (X_3)= P_3X_3/P_y,\ \Pi\ (X_4)= P_4X_4/P_y,\ \Pi\ (X_5)= P_5X_5/P_y,\ \Pi\ (X_1)= P_6X_6/P_y,\ \Pi\ (X_7)= P_7X_7/P_y,\ \Pi\ (X_8)= P_8X_8/P_y,\ \Pi\ (X_9)= P_9X_9/P_y$

where,

$\Pi\ (X_1)$= Share of seed	P_1=Cost of seed
$\Pi\ (X_2)$= Share of hired labour	P_2= Cost of hired labour
$\Pi\ (X_3)$= Share of imputed value of family labour	P_3= Cost of imputed value of family labour
$\Pi\ (X_4)$= Share of total human labour	P_4=Cost of total human labour
$\Pi\ (X_5)$= Share of manure	P_5= Cost of manure
$\Pi\ (X_6)$= Share of depreciation	P_6= Cost of depreciation
$\Pi\ (X_7)$= Share of interest on working capital	P_7= Cost of interest on working capital
$\Pi\ (X_8)$= Share of rent paid for lease in land	P_8= Cost of rent paid for lease in land
$\Pi\ (X_9)$= Share of interest on owned fixed asset	P_9= Cost of interest on owned fixed asset
	P_y = Price of the output

Mapping of the Value Chain Actors and their Activities/Function

Value Chain Analysis study helps to map the value chain of a specific product involving various value chain actors, which may use qualitative or quantitative approach. While the produce moves from one chain actor to another chain actor, it gains value in the form of price mark-up. The chain actors, who actually transact a particular product as it moves through the value chain, includes input dealers (e.g., seed suppliers), farmers, traders, processors, transporters, wholesalers, retailers and ultimately the final consumer. Using snowball sampling, the actors involved in the value chain of the selected spices were identified and mapped according to the flow of the commodity. Various value chain stakeholders starting from the supply of raw materials to marketing of processed products were identified. The flow of the produce within the chain and the relationship between various actors are presented with the help of value chain maps. The following actors/stakeholders across the value chain will be targeted in the identified clusters:

- Input supplier
- Producers (farmers or organisation)
- Intermediaries/functionaries (such as commission agent/ village merchant/ wholesalers/retailers etc.)
- Processors (or may be farmers/ Commission agent/ village merchant/ wholesalers/ retailer, etc., act as processors)
- Service providers (Logistics, storage, packages, etc.)
- Government officials (Horticulture department, KVKs, APMCs, etc.)
- Enlisting appropriate number of agency (Organic certification agencies, if any)
- Enlisting FPO (for spices in particular, if any).

IV

RESULTS AND DISCUSSION

Costs and Returns of Turmeric Production in NEH Region

The production of turmeric in NEH region shows that the cost of production in the state of Manipur was the lowest followed by the states of Meghalaya, Sikkim and Mizoram. The sale price of the produce was observed to be more in the state of Sikkim (₹ 34.45/kg) than to Mizoram (₹ 32.77/kg), Meghalaya (₹ 26.92/kg) and Manipur (₹ 21.38/kg). Higher price of turmeric in the state of Sikkim might be due to the preference of consumers for organic produce. Consequently, the producer of state of Sikkim earned comparatively more (₹ 17.07/kg) net return than the state of Mizoram (₹ 9.07/kg), Meghalaya (₹ 10.48/kg) and Manipur (₹ 8.18/kg). Hence, it can be concluded that organic adopter state of Sikkim tend to attract the consumers as the turmeric was organically produced (Table 6).

The cost and returns of by-products of turmeric varies spatially as well as per cultivar of the crop. The conversion of raw turmeric into dry-flakes has been presented in Table 9. The cost of dry-flakes of turmeric varied from ₹ 51.50 to ₹ 89.70 across the states of NEHR. It was notably higher in the state of Mizoram (₹ 89.70/kg) and followed by Meghalaya (₹ 63.50/kg) and Sikkim (₹ 62.38/kg) whereas, it was the lowest in Manipur (₹ 51.50/kg). The dry-flakes produced in the state of Sikkim attracted to fetch higher prices than the dry-flakes of other states. Consequently, low cost and higher prices of dry-flakes produced in the state of Sikkim fetched higher net returns except the state of Manipur (Table 7).

TABLE 6. COSTS AND RETURNS OF RAW TURMERIC (RHIZOME) PRODUCTION IN NEH REGION

(₹ */kg*)

Particular (1)	Sikkim (2)	Mizoram (3)	Meghalaya (4)	Manipur (5)
Cost of production	17.38	23.70	16.44	13.20
Sale price	34.45	32.77	26.92	21.38
Net return	17.07	9.07	10.48	8.18

Source: Household survey, 2017-20.

Note: Figures in parentheses are percentage difference (increase or decrease) with Sikkim.

TABLE 7. COSTS AND RETURNS OF DRY FLAKE PRODUCTION OF TURMERIC IN NEH REGION

(₹ */kg*)

Particular (1)	Sikkim (2)	Mizoram (3)	Meghalaya (4)	Manipur (5)
Cost of production	62.38	89.70	63.50	51.50
Sale price	169.00	135.00	160.00	165.00
Net return	106.62	45.30	96.50	113.50

Source: Household survey, 2017-20; *Include the production and process cost.

Note: Figures in parentheses are percentage difference (increase or decrease) with Sikkim.

Similarly, the conversion of raw turmeric into powder is presented in Table 9. It is evident from the Table 9 that the quality of raw turmeric of Sikkim involves minimum loss in further processing it into dry-flakes as well as powder turmeric. The cost in processing of raw turmeric into powder has been estimated and found to be higher in the state of Mizoram and it was lowest in the state of Manipur. The price offered by consumer was recorded at higher level for the produce of Sikkim state. Hence, the net returns were estimated to be higher in the state of Sikkim and lowest in the state of Mizoram (Table 8).

TABLE 8. COSTS AND RETURNS OF PRODUCTION OF POWDER TURMERIC IN NEH REGION

(₹ */kg*)

Particulars (1)	Sikkim (2)	Mizoram (3)	Meghalaya (4)	Manipur (5)
Cost of production*	72.80	99.70	73.50	61.50
Selling price	258.00	225.00	246.00	195.00
Net return	185.20	125.30	172.50	133.50

Source: Household survey, 2017-20; *Include the production and process cost.

Note: Figures in parentheses are percentage different (increase or decrease) with Sikkim.

TABLE 9. CONVERSION FACTOR OF RAW TURMERIC TO FINAL PRODUCT (DRY FLAKES/POWDER)

(*kg*)

	Sikkim		Mizoram		Meghalaya		Manipur	
Type of final product (1)	Raw product (2)	Final product (3)	Raw product (4)	Final product (5)	Raw product (6)	Final product (7)	Raw product (8)	Final product (9)
Dry flake	3.50	1.0	3.70	1.0	3.74	1.0	3.75	1.0
Turmeric powder	4.70	1.0	4.90	1.0	4.96	1.0	4.96	1.0

Source: Household survey, 2017-20.

Hence, from the analysis of cost of production of turmeric and its by-product it is clear that the processed product has fetched higher returns of the product. The processing is not possible for all resource poor turmeric growers of the region. Therefore, establishment of slice/flakes maker, dryers, grinder and packing machines is the need of the hour in the region to enhance their due share in the consumers' price of turmeric and its by-products.

Factor Share Analysis

Human labour was the key factor of production in turmeric across the states. Labour comprised family labour as well as hired labour for turmeric cultivation. The lowest factor share of human labour in turmeric production was observed in the state of Sikkim (27.25 per cent) comparing to the other state of Mizoram (37.45 per cent), Meghalaya (30.57 per cent) and Manipur (34.61 per cent), respectively (Table 10). In all the selected states, a higher share in the human labour was contributed by family labour, which calls for intervention of machinery to reduce the human labour use. Hence, site-specific mechanisation is the need of hour and must be encouraged to enhanced labour efficiency. Rhizome (seed) was another major factor contributing in the productivity and uniqueness of turmeric crop. The factor share of rhizome has been estimated of 25.33 per cent, 24.42 per cent, 20.45 per cent and 18.37 per cent in Mizoram, Meghalaya, Manipur and Sikkim, respectively. The usage of organic manure was found to be significant contributing only in the state of Mizoram with an estimation of 3.43 per cent. Organic manure helps in enhancing yield of crops as organic matter content in the soil is increased by supply of farm yard manure and other organic compounds (Sharma and Reynnells, 2018). Therefore, the application of organic manures should be encouraged for its use in cultivation of turmeric which has manifold benefits for the turmeric growers. The share of depreciation ranged 0.1 to 0.4. Mizoram was found to be the leading state in this aspect. Usage of new innovative farm tools and implements should be encouraged as farm assets exert a considerable influence on farming activities. Hence, the factor share analysis has provided the way forward for research and development in pre-harvest arrangements.

Producers' Surplus

The producer's surplus estimation is way forward for post-harvest management of the produce. The marketable surplus and marketed surplus of turmeric has been observed more or less equal and there was no distress sale of the produce. The loss of turmeric was a major concern which was estimated in the range of 5.35 qtl to 14.80 qtl across the states (Table 11). Hence, development of suitable storage facilities need to be facilitated in this area.

TABLE 10. STATE WISE FACTOR SHARE ANALYSIS OF TURMERIC PRODUCTION IN NEHR

	Mizoram			Meghalaya			Manipur			Sikkim		
Factors of production (1)	Value (₹/ha) (2)	Turmeric ₹ 32770.49 /ton (3)	Factor share (Per cent) (4)	Value (₹/ha) (5)	Turmeric ₹ 26916.24 /ton (6)	Factor share (Per cent) (7)	Value (₹/ha) (8)	Turmeric ₹ 21380.41 /ton (9)	Factor share (Per cent) (10)	Value (₹/ha) (11)	Turmeric ₹ 34449.66 /ton (12)	Factor share (Per cent) (13)
Output	110764.26	3.38	100	135657.85	5.04	100	112460.94	5.57	100	189817.63	5.51	100
Seed	28051.73	0.86	25.33	33127.52	1.23	24.42	22999.44	1.08	20.45	34863.63	0.01	18.37
Manure	3808.55	0.12	3.43	1535.17	0.06	1.13	2340.56	0.11	2.08	3943.00	0.11	2.07
Hired Labour	11489	0.35	10.37	11726	0.44	8.64	6486.00	0.30	5.76	5385.00	1.16	2.83
Family labour	29988	0.92	27.07	29748	1.11	21.93	32440.00	1.52	28.85	46341.00	1.35	24.41
Total human labour	41477	1.27	37.45	41474	1.54	30.57	38926.00	1.82	34.61	51726.00	1.5	27.25
Depreciation	443.21	0.01	0.4	506.21	0.02	0.37	388.80	0.02	0.34	350.95	0.01	0.18
Interest on working capital	3284.44	0.1	2.96	3517.12	0.13	2.59	2416.11	0.11	2.14	33470.72	0.1	1.76
Rental value of land	3031.84	0.09	1.99	2703.49	0.12	1.99	2340.00	0.11	2.08	1524.62	0.04	0.80

TABLE 11.PRODUCER'S SURPLUS OF TURMERIC IN NEH REGION

(*qtl/hh*)

Particulars (1)	Mizoram (2)	Meghalaya (3)	Manipur (4)	Sikkim (5)
Total Production	2614.40	1632.12	1379.65	1045.06
a) Consumption	14.23	12.19	10.38	5.22
b) Used as seed	526.93	330.60	233.83	236.17
c) Loss at farmer's field	6.85	14.80	5.35	5.43
d) Gift	2.01	-	-	-
Total (a+b+c+d)	550.02	357.93	249.57	246.82
Marketable Surplus	2098.22 (80.26)	1288.99 (78.98)	1135.43 (82.30)	803.67 (76.90)
Marketed Surplus	2091.38 (79.99)	1274.00 (78.05)	1130.08 (81.91)	798.24 (76.38)

Note: Figures in parentheses are the percentage of total production, Source: Household survey, 2017-20.

Mapping of Value Chain Actors in Turmeric

As stated earlier the turmeric crop is disposed-off in three forms, viz., raw (rhizome), dry flakes/slices and turmeric powder. There was only one channel for each of raw and turmeric powder. Whereas, for dry flakes/slices of turmeric two channels were identified in the markets of Mizoram state (Table 12). Out of total production the largest quantity has been disposed-off in the form of dry flakes/slices through channel-I (61.26 per cent) and channel-II (30.86 per cent). Only 5.44 per cent of the production was disposed-off in the form of turmeric powder (Figure 1).

TABLE 12. MAJOR MARKETING CHANNELS AND ACTORS OF VALUE CHAIN OF TURMERIC IN MIZORAM

(*per cent*)

Channels (1)	Actors (2)	Quantity (3)
Raw turmeric		
Channel-I	Producer→ Consumer	2.44
Dry flake/slice turmeric		
Channel-I	Producer→ Village Trader→ Trader-cum-Processor→ Assam	61.26
Channel-II	Producer→ Village Trader→ Processor-cum-Wholesaler-cum-Retailer→ Retailer→ Consumer	30.86
Powder of turmeric		
Channel-I	Producer→ Consumer	5.44

Source: Household survey, 2017-20.

Meghalaya state produces high quality turmeric called *'lakadang'*. It is disposed-off in three forms, viz., raw, dry and powder turmeric. The larger portion as dry flakes is disposed through four major channels followed by raw turmeric which was disposed through four major channels. A meagre quantity was disposed in form of powder turmeric through direct channel (Table 13). For the raw turmeric channel-II was major whereas for dry flakes channel-IV was major and followed by channel-I and channel-III. Only 3.69 per cent of the total production of turmeric was converted into powder and disposed through direct channel (Figure. 2).

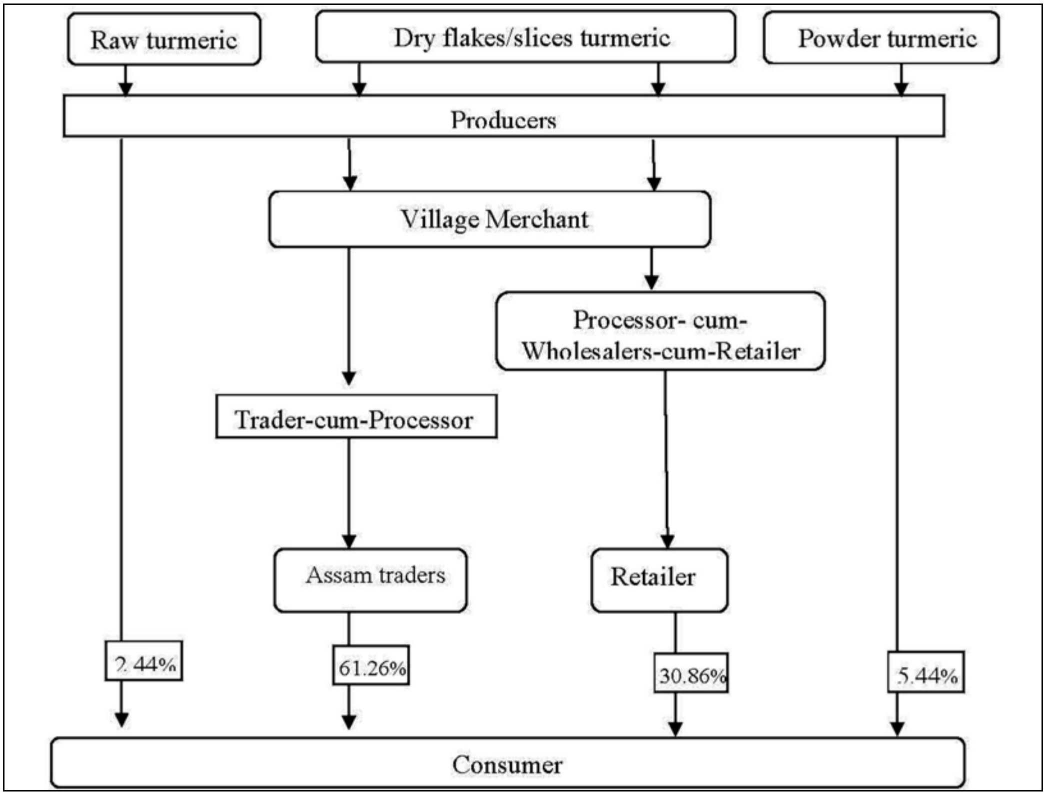

Figure 1. Map of Value Chain Actors of Turmeric in Mizoram.

TABLE 13. MAJOR MARKETING CHANNELS AND ACTORS OF VALUE CHAIN OF TURMERIC IN MEGHALAYA

Channels (1)	Actors (2)	Quantity (per cent) (3)
Raw turmeric		
Channel-I	Producer→ Consumer	1.02
Channel-II	Producer→ Village Trader→ Traders (Assam)	18.63
Channel-III	Producer→ Village Trader→ Processor-cum-Wholesaler-cum-retailer→ Retailer→ Consumer.	3.19
Channel-IV	Producer→ Processor-cum-Wholesaler-cum-retailer→ Consumer	6.19
Dry flake/slice turmeric		
Channel-I	Producer→ Village Trader→ Trader-cum-Processor→ Tamil Nadu/ Kerala	24.67
Channel-II	Producer→ Village Trader→ Trader-cum-Processor→ Consumer	1.03
Channel-III	Producer→ Village Trader→ Processor-cum-Wholesaler-cum-Retailer→ Consumer	14.87
Channel-IV	Producer→ Processor-cum-Wholesaler-cum-Retailer→ Retailer→ Consumer	26.71
Powder of turmeric		
Channel-I	Producer→ Consumer	3.69

Source: Household Survey, 2017-20.

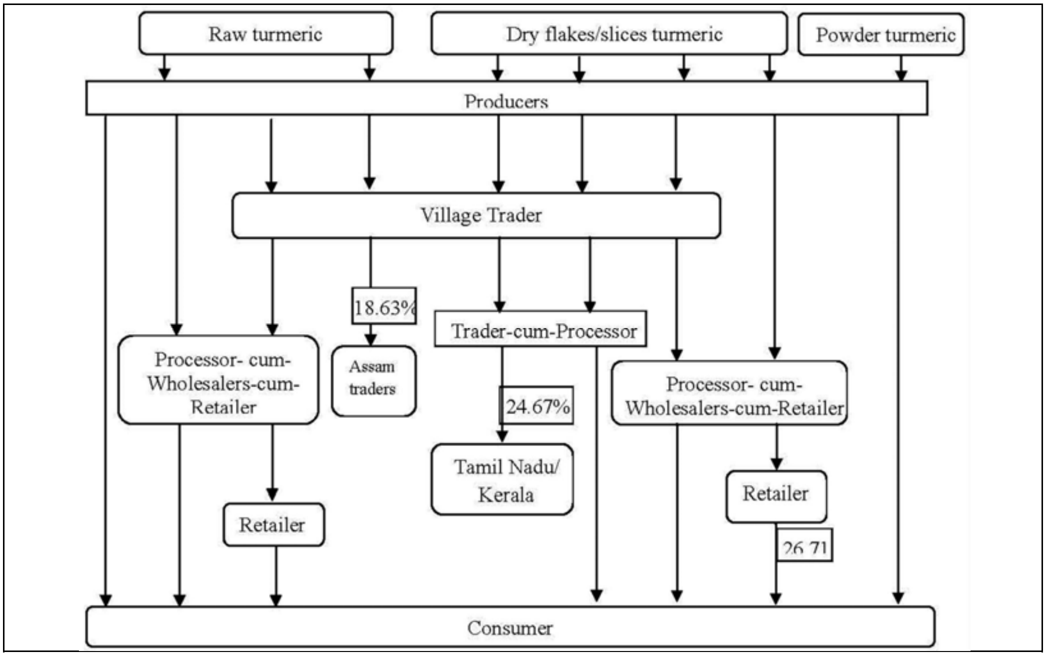

Figure 2. Map of Value Chain Actors of Turmeric in Meghalaya.

In the state of Manipur it has been observed and reported that more than 11 per cent of turmeric (Figure 3) has been converted into powder form and sold through direct channel. The remaining less than 89 per cent turmeric is disposed-off in raw form (Table 14). Hence, the state of Manipur has more scope for turmeric processing at farmers' level.

Similarly, in the state of Sikkim more than 25 per cent (Figure 4) of turmeric has been converted into powder form and sold through two major channels. The remaining was sold in raw form through three major channels (Table 15). Hence, the organic state of Sikkim has also ample scope for processing of turmeric.

Value Addition and Compliance Cost

The channel and extent of disposal of turmeric in different forms has been discussed in the previous section. The value addition (price spread) has been estimated highest in the state of Meghalaya for dry flakes/slices of the turmeric whereas it was lowest in the state of Mizoram across the channels, which fetched less net price of producer. Therefore, the intervention for dry flakes needs to be initiated in the state of Mizoram. Similarly, the value addition cost for powder turmeric has been estimated to be the highest in the state of Sikkim and lowest in Manipur (Table 16). But the net returns were higher in the state of Sikkim and lowest in the state of Manipur across the channels of the commodity, which calls for immediate improvement in price mechanism in the state of Manipur.

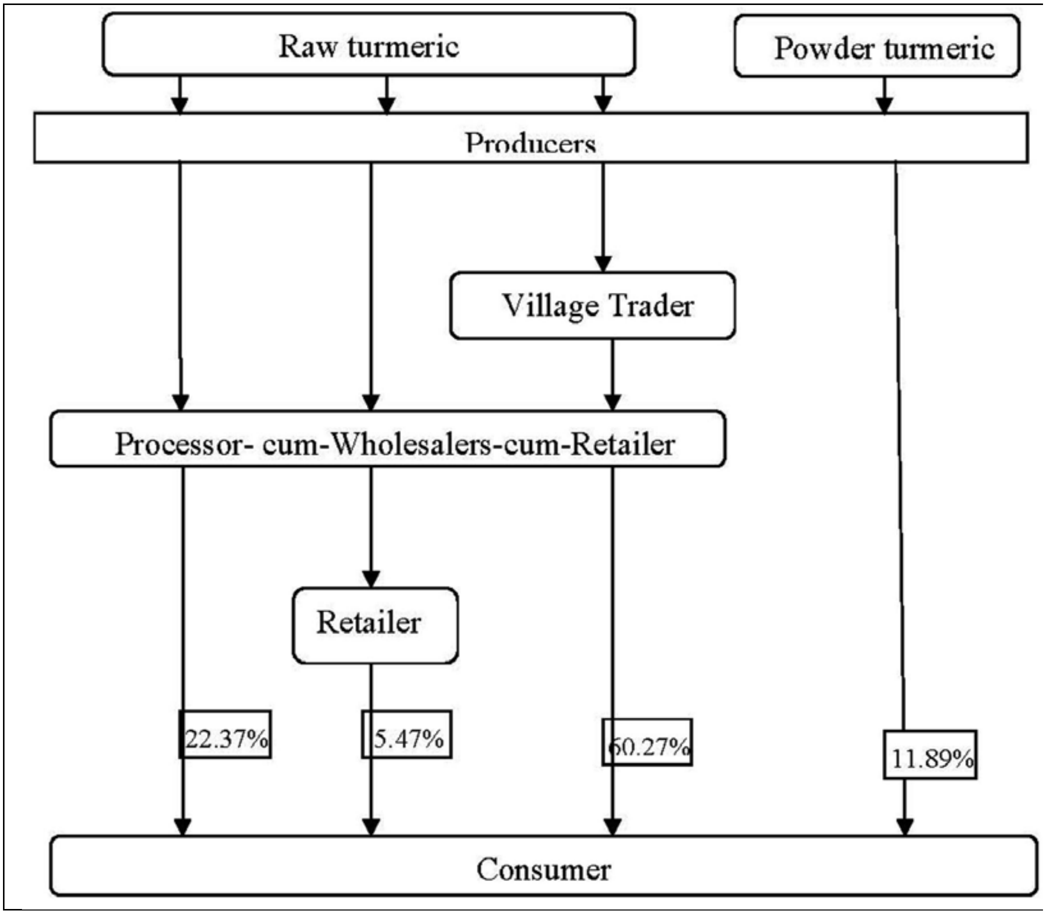

Figure 3. Map of Value Chain Actors of Turmeric in Manipur

TABLE 14. MAJOR MARKETING CHANNELS AND ACTORS OF VALUE CHAIN OF TURMERIC IN MANIPUR

Channels (1)	Actors (2)	Quantity (per cent) (3)
Raw turmeric		
Channel-I	Producer→ Processor-cum-Wholesaler-cum-Retailer→ Consumer	22.37
Channel-II	Producer→ Processor-cum-Wholesaler-cum-Retailer→ Retailer→ Consumer	5.47
Channel-III	Producer→ Village Trader→ Processor-cum-Wholesaler-cum-Retailer → Consumer	60.27
Powder of turmeric		
Channel-I	Producer→ Consumer	11.89

Source: Household Survey, 2017-20

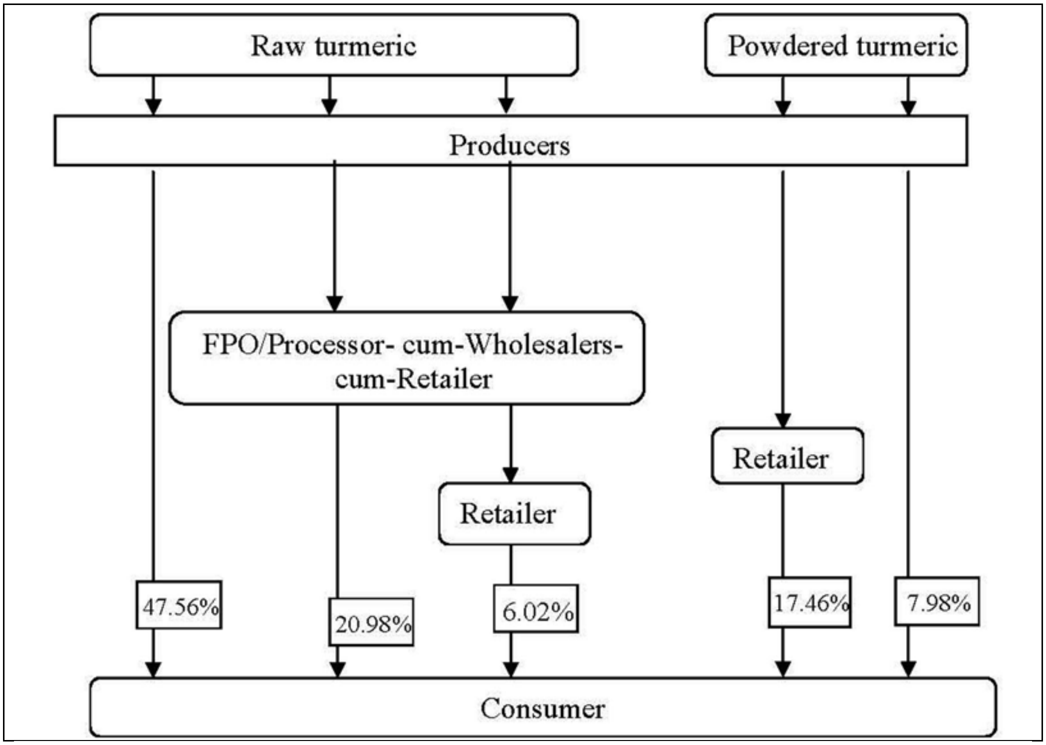

Figure 4. Map of Value Chain Actors of Turmeric in Sikkim.

TABLE 15. MAJOR MARKETING CHANNELS AND ACTORS OF VALUE CHAIN OF TURMERIC IN SIKKIM

Channels (1)	Actors (2)	Quantity (per cent) (3)
Raw turmeric		
Channel-I	Producer→ FPO/Processor-cum-Wholesaler-cum-Retailer→ Retailer → Consumer	47.56
Channel-II	Producer→ FPO/Processor-cum-Wholesaler-cum-Retailer→Consumer	20.98
Channel-III	Producer → Consumer	6.02
Powder of form		
Channel-I	Producer→ Retailer → Consumer	17.46
Channel-II	Producer→ Consumer	7.98

V

CONCLUSION

From the analysis of cost of production of turmeric and its by-product it is clear that the processed products have fetched higher returns for the product. The state wise analysis of costs and returns has proved that the turmeric is highly profitable in the state of Sikkim which has been certified as a state of organic turmeric. Therefore,

TABLE 16. PRICE SPREAD/VALUE ADDITION OF TURMERIC MARKETING IN NEH REGION

(₹ /*qtl*)

State (1)	Channel (2)	(3)	Net price received by producer (4)	Marketing cost (5)	Marketing margin (6)	Consumer's price (7)	Price spread (8)	Producer share in consumer's rupee (9)
Mizoram	Raw	Channel-I	18.97	1.92	-	20.89	1.92	90.83
	Dry flake	Channel-I	44.84	85.27	4.90	135	90.17	33.21
		Channel-II	42.56	87.44	5.00	135	92.44	31.52
		Average	43.70	86.35	4.96	135	91.30	32.37
	Powder of turmeric	Channel-I	122.98	103.69	-	226.67	103.69	54.26
Meghalaya	Raw	Channel-I	36.55	2.38	0	38.93	2.38	93.89
		Channel-II	19.14	0.97	5.89	26	6.86	73.62
		Channel-III	23.83	0.75	3.42	28	4.17	85.11
		Channel-IV	21	-	-	21	-	100
		Average	25.13	1.03	2.32	28.48	3.35	88.23
	Dry flake	Channel-I	52.95	97.42	9.63	160	107.05	33.09
		Channel-II	52.95	93.74	3.31	150	97.05	35.30
		Channel-III	49.90	100.98	4.12	155	105.01	32.19
		Channel-IV	55.23	94.77	-	150	94.77	36.82
		Average	52.76	104.08	4.27	153.75	100.99	34.31
	Powder of turmeric	Channel-I	110.17	104.08	0	214.25	104.08	51.42
Manipur	Raw	Channel-I	20.50	0.52	-	21.02	0.52	97.55
		Channel-II	22.62	1.13	-	23.75	1.13	95.24
		Channel-III	19.95	1.31	7.24	28.50	8.55	70
		Average	21.02	0.99	2.41	24.42	3.40	86.08
	Powder of turmeric	Channel-I	99.34	91.43	0.00	190.77	91.43	52.07
Sikkim	Raw	Channel-I	30.84	1.21	-	32.25	1.21	96.25
		Channel-II	33.18	1.23	-	34.41	1.23	96.42
		Channel-III	44.87	1.29	-	46.15	1.29	97.22
		Average	36.36	1.24	-	37.60	1.24	96.63
	Powder of turmeric	Channel-I	114.57	117.34	33.10	265.00	150.43	43.23
		Channel-II	134.63	124.40	0.00	259.03	124.40	51.97
		Average	124.60	120.87	16.55	262.02	137.42	47.55

the Sikkim model needs to be replicated in the region as a whole. Human labour was the key factor and the depreciation share was minimal in production of turmeric across the states which are matter of concern for mechanisation of the region for farming. Losses during storage of rhizome were also a major concern found through producers' surplus analyses which necessitates the establishment of good storage facilities in the region. The mapping of value chain actors and value addition analysis emphasised the intervention of the channel which was mostly preferred by the turmeric grower, no doubt the net price received was higher in the direct channel of powder but practically such type of channel cannot be encouraged in the market. Therefore, the preference of channel must be encouraged and intervened for further enhancing its efficiency.

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Groundwater Market and Agricultural Tenancy: A New Form of Collective Inter-Linkage in West Bengal

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ABSTRACT

Land ownership in West Bengal has passed through different phases. Initially there were land owners with large tracts of land. Later in the 1960s and 1970s, Government of West Bengal decided to redistribute land from the original land owners to the small and marginal farmers. The operation of this land redistribution was called 'Operation Barga'. In our survey of groundwater markets, we found that land relations are affected by water relations especially in case of groundwater sellers. In this background, the paper attempts to analyse the various water and related land based transactions experienced at the field level in the three agricultural districts of West Bengal. From field level survey of ground water markets and transactions between water sellers and water buyers, it is observed that owners of Groundwater Extraction Mechanisms (WEM), in order to economise their scale of water usage and maximise profit, form a collective monopoly amongst themselves, not only to divide the land to sell water but also to consolidate on the surrounding lands for economies of scale. Although this may lead to higher productivity of agriculture it may also lead to increase in landless farmers. Thus we find a situation in West Bengal which may thwart the very essence of land reforms.

Keywords: Groundwater, Agriculture, Market, Economies of Scale of Water Usage, West Bengal

JEL.: C93, Q15

I

INTRODUCTION

Recent research has used the language of contract theory to motivate descriptive empirical analysis of groundwater markets. Examples include bilateral bargaining (Kajisa and Sakurai, 2003), relational contracting (Kajisa and Sakurai, 2005; Acharyya, 2019), moral hazard and risk sharing (Aggarwal, 2007), and enforcement by social institutions in the shadow of a formal legal system (Rahman *et al*., 2011). Although the principal-agent theory has been most often used to understand water markets, it does not always work at ground level (Acharyya *et al.*, 2018).It seems that the casting of water buyer as the agent and water seller as the principal started with early studies focused on issues of power and taken its vocabulary from the works on land tenure contracts (Wood and Palmer Jones, 1990; Palmer Jones, 2001). These studies identified the water seller, sometimes referred to as the "water lord" as the principal and the waterless farmer as the agent. Subsequent approaches have maintained this identification. In cases where principal and agent are homogeneous or

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where bargaining power is explicitly accounted for, the reversal of roles should not matter.

In this paper, we are not applying any principal-agent problem. Rather, we try to analyse the various transactions experienced at the field level and use a theory that explains most of the features of the water market, especially under land fragmentation. We find from field level survey that owners of Groundwater Extraction Mechanisms (WEM) in order to economise their scale of water usage and maximise profit form a collective not only to divide the land to sell water but also to consolidate on the surrounding lands for economies of scale. Although this may lead to higher productivity of agriculture it may also lead to increase in landless farmers.

II

SURVEY BASED EXERCISES AND ANALYSIS OF CONTRACTS IN WATER MARKETS

We took those districts for our sample survey for studying groundwater markets where Boro cultivation using groundwater is high and where this is done using Electric Submersibles (ESBs). Ranking and matching the districts of the State of West Bengal in terms of the area irrigated by groundwater and number of ESBs, we chose the three districts of Burdwan, Murshidabad and West Midnapore.

The field survey was conducted from end of 2018 when cultivation of Boro paddy starts till August 2019 ending with *kharif* paddy cultivation. Rather than distinguishing between water buyer and water seller, we distinguish between an ESB owner and a non-owner. An ESB owner may be both a seller and a buyer of groundwater, but a water seller could only be the owner of an ESB. Since the average size of land holding is very small, an ESB owner would likely be a water seller in West Bengal. A non-owner is a pure water buyer. So by taking owner and non-owner of ESB, we can look at the market that operates between sellers and buyers.

The survey was conducted at two levels: the village level and the household level. First we asked key village informants about the irrigation status of all the agricultural households in the survey villages. We selected ten ESBs from each village to give equal weightage to the two villages in each block. We surveyed the owners of these ESBs in the village. Thus, we surveyed twenty ESB owners from each block and forty from each district so that in total one hundred and twenty ESB owners were surveyed.

So far as the choice of non-owner/pure buyer of groundwater was concerned, we observed that each ESB owner sells to at least two or more non-owners. Under the circumstances, we chose two non-owner/pure buyer households for each seller.

Plot-specific and farm household specific data were collected from both ESB owners and non-owners. Plot specific data included details on source of irrigation, availability of irrigation water, terms of the water transaction, information on labour and other inputs. Plot specific data is needed to estimate the demand for irrigation water.Farm household data included socio-economic characteristics of the members to help identify farmer-specific effects on production.

III

LAND LEASE AND WATER MARKETS

One additional dimension that has come out from our field survey across all the districts is the fact that other than buying and selling of water, leasing-in of other farmer's land (especially during summer or Boro season) is a common feature among WEM owners. This is not to say that the non-owners of WEM's do not lease in land. But reasons for leasing in seem to be different for the two. Table 1 shows the details of lease-in of land by water sellers and water buyers for Boro and *kharif* seasons.

TABLE 1. LEASING-IN OF LAND IN DIFFERENT SEASONS BY WATER SELLERS AND WATER BUYERS

Season (1)	No. of water sellers leasing in (out of 120) (2)	Percentage of water sellers leasing in (per cent) (3)	No. of water buyers leasing in (out of 240) (4)	Percentage of water buyers leasing in (per cent) (5)
Lease taken in Boro	67	56	106	44
Lease taken in *kharif*	23	20	32	13

Source: Field survey conducted by the author in 2018-2019.

From Table 1 we observe that 56 per cent of WEM owners lease-in land of others in Boro season when groundwater is the main source of irrigation while only 20 per cent do so in *kharif* season. In case of pure water buyers, 44 per cent lease-in land during summer season and 13 per cent do so in *kharif* season. Since in *kharif* or monsoon season, lease-in of land is much less (mainly due to availability of rain water that works as an incentive for many farmers who cannot cultivate their land due to high water price in summer, to do so in monsoon) we concentrate on the Boro season. Most of the lease-in contracts are seasonal in nature and in most cases it is only for one season. In only a very few cases is there an annual contract as shown in Table 2.

TABLE 2. TYPE OF LEASE-IN CONTRACTS IN BORO SEASON

Type of contract (1)	Water sellers (2)	Water buyers (3)
Seasonal	65 (97 per cent)	97 (92 per cent)
Annual	2 (3 per cent)	9(8 per cent)
Total	67	106

Source: Field survey conducted by author in 2018-2019.
Note: Figures in parentheses denote the percentage of total sample size for water sellers and water buyers.

We came to know from the farmers during our field survey, that after Operation Barga, many land owners started fearing that they might lose their land if they lease it out for more than one season to the same farmer.

However, when a land owner leases out his land to a water-seller whose WEM is near his land, the contract is repeated every Boro season as no other WEM owner would give water to his land. Hence the lease contract between a WEM owner and landlord whose land falls within the WEM owner's machine is repetitive in nature. The land owner cannot lease out his land to some other WEM owner, as in most cases WEM owners form cartels among themselves by dividing the area that they would irrigate amongst themselves. Moreover, if the land owner leases out his land to some other farmer, the WEM owner may not give any water in future to the land owner. So it becomes more of a compulsion for the land owner who wishes to lease-out his land, to lease it out to the same WEM owner whose machine lies within the vicinity or closest to his land for every Boro season.

Tables 3 and 4 give us the details of lease-in transactions of land of water sellers and pure water buyers. One important difference here is that the average area of land leased-in by water sellers during Boro season across all districts is almost three times greater than the average area leased-in by pure water buyers. In fact, the average area leased-in by pure water buyers is less than an acre while it is more than 3 acres for WEM owners. The maximum area leased in by both WEM owners and pure water buyers is in the district of Burdwan.

TABLE 3. DETAILS OF LEASE-IN TRANSACTION DURING BOROSEASON AMONG WEM OWNERS

Districts (1)	Avg. area leased in (in acres) (2)	Proportion of output given per acre for lease in (in quintals) (3)	Price per acre given for lease (4)	No of people who pay in output (5)	No of people paying in cash (6)
Burdwan	5.8	6.66	0	29 (100 per cent)	0
Murshidabad	2.27	6.6	6500	6 (75 per cent)	2 (25 per cent)
West Midnapore	2.06	5.92	10000	21 (70 per cent)	9 (30 per cent)
Total	3.71	6.38	9364	56 (84 per cent)	11 (16 per cent)

Source: Field survey conducted by author in 2018-2019.

Note: Figures in parentheses show the percentage of total sample size of water sellers (WEM owners) for a particular district.

TABLE 4. DETAILS OF LEASE-IN TRANSACTION DURING BOROSEASON AMONG PURE WATER BUYERS

Districts (1)	Avg. area leased in (in acres) (2)	Proportion of output given per acre for lease (in quintals) (3)	Price per acre given for lease (4)	No of people who pay in output (5)	No of people paying in cash (6)	No of people paying in both (7)
Burdwan	1.07	6.7	8185	34(81 per cent)	5(12 per cent)	2(5 per cent)
Murshidabad	0.74	5.9	6628	15(68 per cent)	7 (32 per cent)	0
West Midnapore	0.79	6.3	8556	22(52 per cent)	20(48 per cent)	0
Total	0.9	6.44	8083	71(67per cent)	32(30 per cent)	2(2 per cent)

Source: Field survey conducted by author in 2018-2019.

Note: Figures in parentheses show the percentage of total sample size of water buyers for a particular district.

From Tables 3 and 4, we observe that the proportion of output that is given to the land owner per acre of leased-in area on an average in Boro season is almost the same for water buyer and water seller (6.44 quintals per acre). However, when it comes to payment in cash, water sellers have to pay marginally more per acre. This is perhaps due to the higher income of water sellers that allows them to pay more for lease-in and acts as an incentive for the landowner to lease-out his land to the water seller on a regular basis. Majority of the farmers in both the groups of WEM owners and non-owners prefer to pay the price for leasing-in of land in terms of proportional output rather than cash. However on an average, larger number of water buyers was observed to be paying in cash than water sellers for leasing-in of land. We believe that for the landlord, uncertainty works more against pure water buyers than water sellers when it comes to leasing-out land, due to higher income of water sellers. From field experience we observed that many landowners who lease-out their land to landless farmers want the payment for rent in cash to remove the uncertainty of crop failure of which the landless marginal farmers are most vulnerable.

If one reason for leasing-in of land is higher profit for both WEM owners and pure water buyers, there is a significant difference when it comes to ownership of groundwater. While pure water buyers have to purchase groundwater for their leased-in land, WEM owners use their own surplus water (having a shadow price) to irrigate the land leased-in.

In our survey, we asked the question to both water buyers and sellers as to why they lease-in greater area of land during Boro season? While water buyers answered that leasing-in of land during Boro generates higher profit, sellers told us that they get more profit not only from cultivation of the lease-in land but also because there is surplus water that can be used in the lease-in land. For water buyers who lease-in, they have to purchase water. The various reasons that water buyers have given for lease-in of land in Boro season are outlined in Table 5. While a majority have given the reason as greater profit for lease-in, the other reasons include inability of the actual land owner to cultivate his own land, be it due to physical incapacity, financial constraint, labour constraint or absenteeism from land.[1]

TABLE 5.REASONS FOR LEASING-IN OF LAND BY PURE WATER BUYERS

Reasons for leasing in land (1)	Burdwan (42) (2)	Murshidabad (22) (3)	West Midnapore (42) (4)	Total (106) (5)
For more income,	25 (60 per cent)	20 (91 per cent)	42 (100 per cent)	87 (82 per cent)
Lessor is physically unfit to cultivate,	2	1	0	3
Lessor does not stay in the village,	3	0	0	3
Lessor does not have the required labour	2	0	0	2
Lessor has no family member to help in cultivation	2	0	0	2
Lessor feels lease will generate more profit then self-cultivation,	8	1	0	9

Source: Field survey conducted by author in 2018-2019.
Note: Figures in parenthesis show the percentage of total sample size of water buyers for particular district

When it comes to the reasons provided by water sellers for lease-in of other's land in Boro season, most reasoned it on surplus water available from their own

WEMs that gave higher profit from lease-in. We shall discuss about this in greater detail later as a WEM owner can also earn by selling water. The other reason for the water seller to take lease is financial incapacity of the original land owner to cultivate as shown in Table 6.

TABLE 6. REASONS FOR LEASING-IN OF LAND BY WEM OWNERS

Reasons (1)	Burdwan (29) (2)	Murshidabad (8) (3)	West Midnapore (30) (4)	Total (67) (5)
Due to available surplus water and greater profit	27(90 per cent)	6 (75 per cent)	30(100 per cent)	63(93 per cent)
Lessor is financially weak and not in a position to cultivate	2(7 per cent)	2(25 per cent)	0	2(3 per cent)

Source: Field survey conducted by author in 2018-2019.

Note: Figures in parentheses show the percentage of total sample size of water sellers (WEM owners) for particular district.

In case of water sellers or WEM owners, most of them lease-in that area of land which falls within the catchment area of their machine. This is shown in Table 7, where out of the 67 WEM owners who take lease in Boro season, 66 owners cultivate the leased-in land using their own WEM. This means that they do not purchase water to irrigate the leased-in land. The only cost that they incur is the cost of extraction of groundwater for irrigating the leased-in land.

TABLE 7. SOURCES OF IRRIGATION USED BY WEM OWNERS TO IRRIGATE LEASED-IN LAND

Sources of irrigation used to irrigate leased-in land in Boro season (1)	No. of WEM owners (2)	Percentage of WEM owners (3)
Own source of irrigation for leased-in land	66	99
Own source as well as purchased water for leased-in land	1	1
Total	67	100

Source: Field survey conducted by author in 2018-2019.

One major reason for the WEM owners to irrigate the leased-in land with their own machine is land fragmentation that does not allow them to irrigate their whole own land with their machine. Hence, to reap positive economies of scale, the excess capacity or surplus water of the machine is used to irrigate other’s land that falls within the catchment area of the machine. This can be done either by leasing-in other’s land or by selling water. From our survey, we found that one acre of land leased-in during Boro season generates on average a greater profit (on an average Rs.500 more per acre) than selling of water to an acre of land. Hence, for the WEM owner, it is much more profitable to take lease unless and until there is a crop failure due to some natural calamity. Not only that, there are other advantages also. The village institutions are different from formal institutions. It is more inter-personal and localised with a certain village level peer pressure (Bardhan, 1984). Under such circumstances, it is sometimes difficult to retrieve payments for water sold. Time is also a factor since many WEM owners reported delay in payments from water buyers. Under such circumstances, leasing-in of other's land was found to be more convenient as well as profitable by WEM owners rather than selling water.

We ran a correlation between number of years of lease-in of land by WEM owners and number of years of running of ESBs on an average and found a strong correlation coefficient to the tune of 0.99 between the two as shown in Table 8 implying a strong positive correlation between the advent of ESBs and leasing-in of land in Boro season.

TABLE 8. CORRELATION BETWEEN NO. OF YEARS OF LEASE-IN OF LAND AND NUMBER OF YEARS OF RUNNING OF ESBS FOR ESB OWNERS

(1)	No. of years of lease in (2)	Avg no of years of ESB running (3)
No. of years of lease in	1	
Avg. No. of years of ESB	0.998337488	1

Source: Field survey conducted by the author in 2018-2019.

We also looked at the distribution of groundwater that is extracted by WEM owners who lease-in land, in terms of the proportion of area irrigated of the owner's land, of leased-in land and by selling water as shown in Table 9. We also looked at the groundwater distribution for those WEM owners who did not lease-in land but only sold water in Table 10.

TABLE 9. DISTRIBUTION OF IRRIGATED WATER FROM OWN MACHINE IN TERMS OF PROPORTIONAL AREA FOR THOSE ESB OWNERS WHO LEASE-IN LAND INBORO SEASON

Districts (1)	Percent of Self area irrigated (2)	Per cent of other's area irrigated through lease in (3)	Per cent of area of water sold (4)
Burdwan	24.87	36.64	38.49
Murshidabad	15.77	16.04	68.19
West Midnapore	13.07	19.81	67.12
Average	17.90	24.16	57.93

Source: Field survey conducted by author in 2018-2019.

TABLE 10. DISTRIBUTION OF IRRIGATED WATER FROM OWN MACHINE IN TERMS OF PROPORTIONAL AREA FOR THOSE ESB OWNERS WHO DOES NOT LEASE-IN LAND IN BORO SEASON

Districts (1)	Per cent of self area irrigated (2)	Per cent of area of water sold (3)
Burdwan	50.95	49.03
Murshidabad	23.19	76.80
West Midnapore	20.60	79.39
Average	31.58	68.40

Source: Field survey conducted by author in 2018-2019.

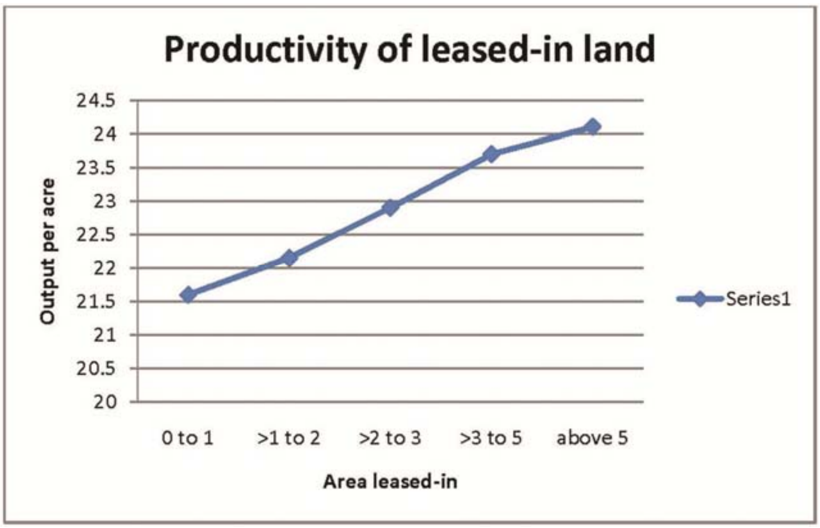
From Table 9 we observe that across all the districts, proportion of area of leased-in land irrigated is greater than the proportion of area irrigated of own land. This is purely due to land fragmentation which does not allow the seller to irrigate his own whole land with his own machine. We have already seen that most of the leased-in land of WEM owners fall within the catchment area of their machines, suggesting that ESB owners make greater profit from leased-in land (which we have already shown) and also consolidates land holding to reap positive economies of scale. This is shown in Table 11. Consolidation of land holding within the catchment area of the machine leads to a higher productivity and output.

TABLE 11. NET AREA LEASED-IN BY ESB OWNERS IN BORO SEASON

Area leased in (acre) (1)	Output per acre (2)	No of farmers (3)
0 to 1	21.6	13
>1 to 2	22.15	15
>2 to 3	22.9	10
>3 to 5	23.7	14
above 5	24.1	15
	Total	67

Source: Field survey conducted by author in 2018-2019.

Figure 1 below shows that with rise in the area leased-in by the WEM owner, the per acre output or productivity rises. Thus consolidation of land holding within the catchment area of the machine leads to greater productivity.



Source: Field survey conducted by author in 2018-2019.

Figure 1.Relation Between Leased-in Area and Productivity in Boro Season.

One point to be noted here is that lease-in of land, although more welcome, depends not only on the WEM owner but also on the landowner whose land falls within the catchment area of the ESB owner's machine. We found several instances of providing incentives as well as coercion from the ESB owner to the landowner whose land falls within the vicinity of the catchment area of the WEM owner's machine, so that the land owner leases out his land to the ESB owner. Incentives include free provision of water or water at a high discount in the *kharif* season if water is required. One form of coercion we observed was that if the landowner is not willing to cultivate and wants to lease out his land, he must do so to the ESB owner in the vicinity. If he leases out his land to someone else, his land will not be provided with water. From Table 8 above, it is also clear that lease-in of land is a continuous phenomenon of the ESB owners. However, most of the landowners lease out only for one season (mainly Boro) to the ESB owners as they either cultivate during *kharif* season or they fear that land might be usurped by the ESB owner if land is leased-out annually.

IV

CONCLUSION

Field survey reveals an inter-linkage between land market and water market in that WEM owners lease-in land that falls within the catchment area of their machine to increase profit through positive economies of scale and optimal capacity utilisation of machine. Analysing the groundwater market structure we found the existence of a fragmented oligopoly type market where there is a captive segment and a contested segment in the groundwater market.

NOTE

1) A person who leases-out his land is called "lessor" and a person who leases-in other's property is known as lessee.

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Prospects of Agri Value Chain for Wheat in Haryana: Its Economics, Market Surplus and Linkage with Processors

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ABSTRACT

The paper is based on a survey done in Haryana to study the agri value chain of wheat which has surplus production is the state. The analysis brings out that wheat gives higher net income than other competing crops of the season which justifies the farmers' allocation of 90 per cent of their *rabi* area under this crop. The survey also revealed that farmers are growing wheat and selling it as usual in APMC markets since the 1970s. Most of the flour mills are owned by business families who have no linkage with farmers due to APMC Act and even otherwise to avoid politically pliable farmers. The state APMC Act is the biggest barrier in linkage as it does allow any purchase outside APMC market. Despite that 77 per cent millers were willing to purchase directly from the farmers because it will reduce their purchase price by 5 per cent in terms of arhatia fee, loading, unloading and transport expenses and losses. In turn, the processors may help in arranging good seeds and chemicals for the farmers to get quality wheat. But many farmers were apprehending price discrimination by millers after APMC becomes defunct in the long run while some big millers were also afraid to deal with politically pliable farmers.

Keywords: Agri value chain, Wheat processing units, Global markets, Exports, Haryana

JEL.: C83, Q13, Q17

I

INTRODUCTION

After the establishment of WTO in 1995 and the Trade Facilitation Agreement (TFA) entered into force on 22 February 2017, the world agricultural market has been heading towards a unit trading bloc (WTO, 2020). It offers enormous opportunities but also heightens competition with increasing freedom amongst market players. In the process, weaker market players will be 'pushed' out of mainstream and it may be a threat for small Indian farmers. Hence, India needs to promote Agri-Value Chain (AVC) to leverage its potentials in agriculture and enhance its export competitiveness. The global market is demanding high quality products, including ready availability, flavour, quality, freshness, convenience, environmental safety, and traceability. On the other hand, small farmers have little awareness about the quality parameters and even access to quality inputs. In order to bridge this gap, farmers are to be linked with AVC in which processors/ marketing intermediaries can provide the

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right information, capacity building and quality inputs. This integration may enable the Indian farmers to participate in the growing global agricultural market. To strengthen AVC, Agricultural Value Chain Finance (AVCF), can play an instrumental role in linking farmers and processors as well as enhancing productivity by application of modern inputs and technology (AFDB, 2012). Moreover, it offers an opportunity to the banks for expanding scope for agricultural credit by improving efficiency and ensuring repayments by consolidating linkages among participants in the value chain.

Convincing of Indian Farmers to Join AVCs

Firstly, the average size of holding is very small, i.e., 1.08 ha in 2015-16 (Government of India, 2018) which has decreased over time due to equal division among all heirs as per succession Act 1925. Of the total holding, about 69 per cent have average holding size of 0.38 ha. This smaller size is the constraint for investment in new technology and even accessing other than local markets. Secondly, in the increasing exports of agricultural commodities, the maximum benefits are cornered by the processors. If farmers are linked with the AVC, they will also get share in higher export prices and also support from processors in getting quality seeds, other inputs and capacity building.

Thirdly, now-a-days, even domestic consumers prefer buying of processed/semi-processed grains and vegetables. To illustrate, consumption of wheat in the form of daliya, loaf, cookies, rusks, muffins, noodles, pasta, custard, etc. is rapidly increasing even in rural areas. It is estimated that wheat and its processed products may be accounting for about one-third share of the consumer expenditure on food (Government of India, 2014). Value addition at farmers' level can give them additional income but it can happen if farmers are involved in some activity of processing by branded big food units. To dovetail the inflated theoretical benefits of AVC with ground situation, it was decided to study the status of AVC of wheat which affects the maximum farmers and consumers. In quest for identifying the existing AVCs and explore of the scope for AVC in future for the surplus wheat in Haryana, this study was sponsored by National Bank for Agriculture and Rural Development (NABARD).

Study Area

Among major wheat producing States of India are Uttar Pradesh (UP), Punjab, Madhya Pradesh (MP), Haryana, Rajasthan and Bihar which accounted for about 92 per cent of all India wheat production during the last 5 years (Government of India, 2020a). In terms of the contribution to Central pool, the situation is changing fast. In 2020-21, MP is at the top for the first time with 129 lakh tonnes followed of Punjab (127 lakh tonnes), Haryana (75 lakh tonnes), UP (36 lakh tonnes) and Rajasthan with

22 lakh tonnes (*op cit.*). Keeping in view the sizeable surplus and location near the mega consumption markets of Delhi and Gurugram, the state of Haryana was selected for the study.

Objectives of the Study

The main objective of the study was to find extant linkages if any and to ascertain the willingness of the wheat growers and its processors to link through with AVC and to evolve suggestions for their effective linkage. Specifically, it aims (i) To study the comparative economics of the wheat production and marketing channels used by surveying the farmers in a few district of Haryana. (ii) To ascertain extant status of linkage by approaching a few existing flour mills and bakeries to know their procedure for procurement of wheat and constraints, if any. (iii) To find out the willingness of the farmers and processors to link and bring out the risk and uncertainties perceived by them in joining the agri value chain of wheat and (iv) to assess the scope for wheat processing by wheat producers in the State with financial support from the banks.

Data Source

The paper is mainly based on primary data collected for the study (Sangwan and Gagandeep, 2015). However, secondary data from State Government (Government of Haryana, 2015; Agmarknet.nic.in, 2020) and other stakeholders has also been used to link with the macro environment. The primary data has been collected from the stakeholders in the AVC, viz., farmers, wheat flour mills and high value bakery units using products of wheat flour as the base (Figure 1).

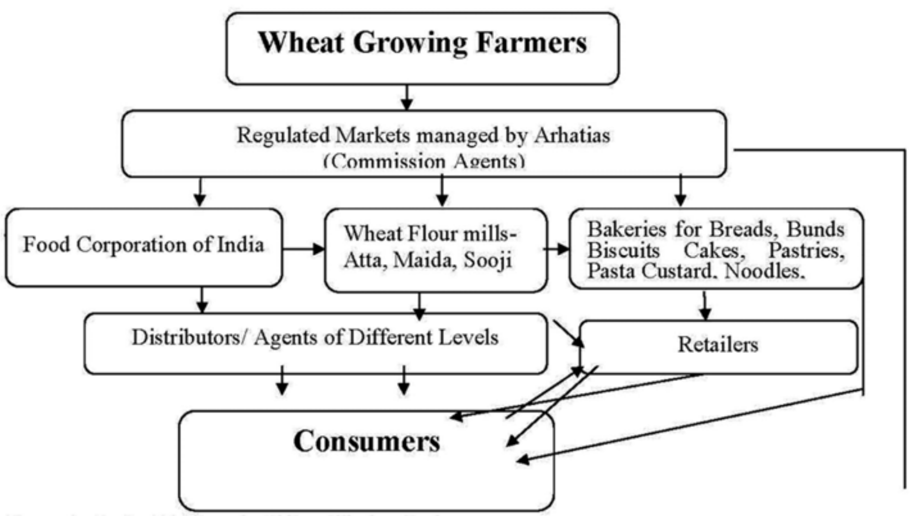

Figure1. Stake Holders in Value Chain of Wheat.

To select the sample farmers for interview in Haryana, its wheat surplus districts, blocks and villages were selected as under.

Selection of Sample Districts

The sample districts for survey were selected in view of availability of surplus wheat and per capita availability in the triennium ending 2013-14(Annexure-1). On this criterion and to represent different regions of the state; three districts of Hisar, Kaithal and Sonipat were selected. In each identified district, two or three sub-divisions (tehsils) were selected on the basis of more area under wheat. Five villages, from each of the identified tehsil were randomly taken from the alphabetical list of total villages. From each selected village, 5 to 11 farmers were interviewed. Thus, a total of 252 wheat growing farmers from 30 villages were interviewed in six selected blocks of three identified districts of Haryana. The details of sample are given in Table 1.

TABLE 1. DISTRICT/TEHSIL-WISE VILLAGES IDENTIFIED AND FARMERS INTERVIEWED

District (1)	Tehsil (2)	Villages Covered and farmers Interviewed in brackets (3)	Total (4)
Kaithal	Kaithal	Deewal (8), Jakholi (7), Kole Khan (8), Paharpur (9) and Siwan (7).	39
	Gulha- Chika	Bhunna (11), Harigarh Kingan (10), Khushal Majra (10), Paharpur Peedal (8) and Seon Majra (10).	49
Hisar	Hisar	Bichpari (8), Gaibipur (11), Kirori (5), Panihari (10) and Surewala (8).	42
	Hansi	Bass Akbarpur (7), Dhamian (8), Kajal (10), Madan Heri (7), Hansi Rural (9).	41
Sonipat	Sonipat	Bagru (7), Fatehpur (9), Karewari (9), Murthal Khas (8)and Salarpur Majra (8).	41
	Kharkhoda	Chhanauli (9), Jharauthi (8), Kundal (8), Nizampur Majra (8) and Saidpur (7).	40
Total	6	30	252

Source: Survey by CRRID Team for the study.

Agri Value Chain Experiences in India/Haryana

Sugar and milk are the two traditional value chains that have stabilised in different parts of India. Cotton, rubber and plantation crops such as coffee and tea have organised value chains in many locations where the relationships between the producer, aggregator, processor and marketer continue over a long time. Corporate-led AVC has originated after the policy of globalisation since the 1990s and it covers many crops such as cereals, pulses, spices, fresh vegetables and fruits and flowers. A few private companies like ITC, Hindustan Lever, Cargill India, Rallis, etc. have experimented with contract faming in food grains, though successful examples are limited (agmarketnet.nic.in).

Some value chains in India are oriented towards exports as their outputs find global markets. Basmati rice, guar gum, grapes, pomegranate, mango, vegetables, coffee, tea, spices, cashew are examples of value chains that have an export orientation. As compared to domestic markets, the export value chains have additional requirements relating to quality, certification of different types, specialised storage and transport which in turn need additional investment in sorting, grading, warehousing, processing, packing, specialised transport, etc. In Haryana, sales outside its APMCs are strictly prohibited as per the State Act except the apni mandi for fruits and vegetables till the recent ordinances in July 2020. Contract farming is allowed in the State as per section 43 of APMC Act 2018 and earlier 2006 but the Haryana Marketing Board has put strict conditions (www.hsamb.gov.in). After that Haryana State Cooperative Marketing Federation (Hafted) had started contract farming in few crops like wheat, basmati rice and barley at a limited scale. The United Breweries Group and SAB Miller had contacted for farming of malting barley in Rewari (Financial Express, 2008), though its success is not documented.

For encouraging the participation of private investors in food processing, Haryana Government has established food parks for food processing at Rai in Sonipat and Saha in Ambala. An International Horticulture market at Ganaur in Sonipat is coming up on about 493 acres with investment of 1200 crore (http://hortharyana.gov.in/). As per Model APMC Act, there is a provision to establish private markets by the companies dealing in contract farming but so far, none has come up due to strict conditions of APMC. The earlier studies of contract farming suggest bindings may be honoured by both contractors and farmers (Kumar and Kumar, 2008). The HSAMB has prepared a model agreement format for the registration of the contractor but the success stories of AVC in food grains are not reported in the state.

II

ECONOMICS OF WHEAT VERSUS OTHER CROPS

The economics of wheat and other crops was worked out on the basis of data of 252 sample farmers from the districts of Kaithal, Hisar and Sonipat in Haryana during the year 2015-16.

Social Status of Sample Farmers

Of the total 252 sample surveyed farmers, 73 per cent belonged to general category (GC), 20 per cent backward classes (BC) and 7 per cents cheduled castes (SC). Average members per family in all the three sample districts were 4.92 with 4.85 persons in GCs, 5.06 in BCs and 5.22 for SC families. This indicates the availability of labour within the families. Education-wise, 43 per cent were illiterate/primary, graduates and above were just 9 per cent while the remaining 48 per cent were 8th to 12th pass. It indicates that illiterate and the drop-outs from education have been sheltered in agriculture. That may be the reason that about 11 per cent adult farmers were unmarried too.

Economic Conditions of Sample Farmers

Of the surveyed 252 farmers, 31 per cent of sample farmers were marginal, 32 per cent small, 23 per cent medium (5 to 10 acres) and 15 per cent were big farmers

(> 10 acres) with average owned land of 6.14 acres. The farmers were augmenting their holdings by leasing in land which increased their average operated holding to 9.52 acres. Out of this, 38 per cent was leased in land. The land was leased in by all the categories of farmers, but it was the maximum by SFs which is contrary to the neighbouring Punjab. But owing to exorbitant increase in lease rent upto Rs. 44000 per acre, it was reported that MFs and SFs were decreasing their leased in land in recent years due to decreases in price of basmati paddy. Just 10 per cent of the family members of the sample respondents were having other occupations such as service including private, trade, transport, etc. as their main occupation. Allied activities especially dairy was the subsidiary occupation of about 92 per cent of sample farmers.

Cropping Pattern

Out of total operated area of 2399 acres by 252 surveyed farmers, 93 per cent was sown under *kharif* crops and 99 per cent in *rabi* crops as given in column 8 of Table 2. Area was less in *kharif* because a few farmers leave some parcels of their land fallow to sow early *rabi* crops. In *kharif* season, paddy was sown on 80 per cent area, cotton 11 per cent, fodder 5 per cent and 2 per cent each under vegetables and maize. In *rabi* season, 90 per cent area was under wheat, 4 per cent under fodder and oilseeds each and 2 per cent under vegetables (column 9).

Across the districts; in Kaithal, paddy in *kharif* and wheat in *rabi* were occupying as much as 97 and 95 per cent of the area (column 3). In Hisar, cotton in *kharif* and oilseeds in *rabi* were other important crops (column 5). In Sonipat, fodder and vegetables occupy more area in both seasons (column 7) which may be due to nearness to Delhi market. Overall paddy and wheat occupied 85 per cent of gross cropped area (GCA). Cropping intensity of three districts was 192 per cent with the highest 197 in Kaithal and 188 in Hisar and Sonipat.

Gross Value of Crops Per Acre

Gross value per acre (GV/A) is presented for all crops of sample farmers in Table 2 at 2015-16 prices. The GV/A of paddy and wheat was Rs. 34070 and Rs. 29136, respectively (column 14). In Hisar and Sonipat, cotton and maize are also grown in Kharif and their GV/A was Rs. 22118 and Rs. 5737 respectively (columns 11 to 13). GV/A from vegetables in *rabi* season was about Rs.42000 but marred with risk due to wide variations in their prices. Sugarcane is competing with paddy and wheat in GV/A in Hisar but the constraints of irrigation and delayed payments to cane growers from sugar mills resulted in shifting its acreage to paddy-wheat rotation. Moreover, both these crops are 100 per cent procured by the Government at their MSPs. In total GV of a farmer, wheat and paddy accounted for 93 per cent of with 85 per cent acreage. It substantiates that the farmers are rational in adopting the cropping pattern dominated by paddy and wheat.

TABLE 2. CROPPING PATTERN AND CROP WISE GROSS VALUE OF PRODUCE IN SAMPLE DISTRICTS

Season/ Crop	Cropping pattern in sample districts						Total	Crop area as per cent of		Gross value of produce per acre (in Rs.)			
	Kaithal		Hisar		Sonipat								
	Area	Per cent	Area	Per cent	Area	Per cent	Area	Season	GCA	Kaithal	Hisar	Sonipat	Average
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Paddy	1118.50	97.43	278.20	47.28	377.55	76.69	1774.25	79.61	38.44	36521	27462	31678	34070
Cotton	0.00	0.00	229.00	38.92	12.50	2.54	241.50	10.84	5.23	0	22118	5920	21280
Maize	0.00	0.00	29.00	4.93	19.00	3.86	48.00	2.15	1.04	0	5207	5737	5417
Vegetables	0.00	0.00	11.50	1.95	38.50	7.82	50.00	2.24	1.08	0	16435	26909	24500
Fodder	29.50	2.57	40.75	6.92	44.75	9.09	115.00	5.16	2.49	11458	11755	11128	11435
Kharif Total	1148.00	100.00	588.45	100.00	492.30	100.00	2228.75	100.00	48.29	35877	22982	27782	30684
Wheat*	1118.75	94.46	553.25	85.20	471.50	86.98	2143.50	90.22	46.44	30034	28266	27633	29136
Mustard	0.00	0.00	40.50	6.24	6.00	1.11	46.50	1.96	1.01	0	16494	15000	16301
Barley	0.00	0.00	7.00	1.08	0.00	0.00	7.00	0.29	0.15	0	8143	0	8143
Oilseeds	0.00	0.00	16.00	2.46	16.00	2.95	32.00	1.35	0.69	0	16063	16375	16219
Vegetables	12.00	1.01	9.10	1.40	25.30	4.67	46.40	1.95	1.01	45833	22857	46443	41659
Fodder	53.60	4.53	23.50	3.62	23.30	4.30	100.40	4.23	2.18	30747	28809	22403	28448
Rabi Total	1184.35	100.00	649.35	100.00	542.10	100.00	2375.80	100.00	51.47	25613	22462	23712	24316
Sugarcane-perennial	0.00	0.00	3.00	100.00	8.00	100.00	11.00	100.00	0.24	0	90667	52625	63000
GCA	2332.35	100.00	1240.80	100.00	1042.40	100.00	4615.55	100.00	100.00				
NSA	1186.50		659.75		553.00		2399.25	100.00	-				
Cropping intensity (per cent)	197		188		188		192	-	-				

Source: Field Survey by CRRID Team during June 2015;

Notes: GCA= Gross cropped Area, NSA Net sown Area, * Wheat value includes its residue too.

Some Features of Wheat Production

As per survey, the main varieties of wheat sown in Haryana were HD-2967 in 66 per cent area, WH-1142 in 13 per cent, HD-2851 in 9 per cent, WH-711 in 8 per cent and RAJ-1114 in 2 per cent and other varieties in the remaining 2 per cent area. The wheat seed sown per acre varied from 30 to 50 kg with average of 46.40 kg. Per acre yield of main varieties ranged from 15q to 18q, depending upon quality of land and irrigation. It is totally irrigation crop. Sources of irrigation were reported as pump sets both electric and diesel by 95 per cent and canal by 47 per cent. Thus, 42 per cent were using both as supplementary. Canal irrigation was the highest 76 per cent in Hisar.

Item-wise Cost of Cultivation

District-wise cost of cultivation (COC) per acre for wheat is given in Table 3.

TABLE 3. DISTRICT-WISE PER ACRE COST OF CULTIVATION IN SAMPLE DISTRICTS

	Kaithal		Hisar		Sonipat		Average	
Item	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ploughing (Times)	4.20	1440 (14.14)	4.50	1474 (14.64)	4.88	1981 (18.36)	4.53	1632 (15.77)
Seed (kg)	46.61	1080 (10.60)	44.52	997 (9.91)	48.12	1000 (9.27)	46.42	1026 (9.91)
Compost (Trolleys)	1.36	750 (7.36)	0.74	368 (3.66)	1.23	651 (6.04)	1.11	590 (5.70)
DAP (kg)	52.73	1202 (11.80)	50.00	1140 (11.33)	49.38	1126 (10.44)	50.70	1156 (11.17)
Urea (kg)	157.04	879 (8.63)	128.23	718 (7.13)	120.63	670 (6.21)	135.30	756 (7.30)
Weedicides (ltrs.)	0.98	592 (5.81)	0.95	412 (4.09)	0.99	535 (4.96)	0.97	513 (4.96)
Pesticides (ltrs.)	1.00	373 (3.66)	0.96	116 (1.15)	1.00	285 (2.64)	0.99	258 (2.49)
Irrigation charges (Times)	3.8	547 (5.37)	4.2	1246 (12.38)	4.00	884 (8.20)	4.00	892 (8.63)
Maintenance cost of P'Set (Times)	1.24	333 (3.27)	0.63	183 (1.82)	0.94	279 (2.59)	0.94	265 (2.56)
Harvesting process	Per acre	1014 (9.95)	1.00	1688 (16.77)	1.00	1464 (13.57)	1.00	1389 (13.42)
Transporting to market/ home	Per acre	305 (2.99)	1.00	275 (2.73)	1.00	268 (2.48)	1.00	283 (2.73)
Family labour	3	650 (6.38)	3	525 (5.22)	3	640 (5.93)	3	605 (5.85)
Hired labour	3	820 (8.05)	3	740 (7.35)	3	810 (7.51)	3	790 (7.64)
Others/ Misc.	-	201 (1.97)	-	183 (1.82)	-	192 (1.78)	-	192 (1.86)
Total	-	10186 (100.00)	-	10065 (100.00)	-	10785 (100.00)	-	10345 (100.00)
Average yield (q)	18.17	16.16	16.16	17.21				
Residue Net (Rs.)	3692	4830	4224	4189				

Source: Field Survey by CRRID team during June 2015.

The cost covers all material inputs, use of machinery and labour, etc. In the case of use of own machinery, i.e., tractor and pump-set etc., the operational cost was taken. Interest on capital investment was not taken into consideration. Actual charges paid were taken for hiring, for ploughing, irrigation and transportation. Thus, charges for machinery consisted of a mix of owned and hired equipment. The average per acre cost of wheat cultivation was Rs.10345 in 2015-16.

Item-wise ploughing cost was 16 per cent, seed costs 10 per cent, cost of manure and fertilisers 24 per cent and that of weedicides and pesticides 7 per cent. Expenditure for Irrigation including maintenance of equipment and harvesting and transporting accounted for 11 per cent 16 respectively. The component and labour, both family and hired was about 14 per cent. Other/ miscellaneous expenses were 2 per cent.

Across the districts, labour and seed cost showed least variations while the ploughing, harvesting and transportation costs to market cost varied depending upon own or hired machinery. Inputs were used more in Kaithal district due to better land and canal irrigation; hence its yield was also higher. Irrigation cost was higher, if use of diesel pump is more.

Across farm size, transportation cost per quintal worked out higher for SFs and MFs. But no difference was reported in other marketing charges which were levied per quintal, e.g., cleaning cost @ Rs.12.20 per qtl is charged from the farmers while other costs like commission @ Rs.2.5 per cent, market fee and rural development cess @4 per cent, VAT @5 per cent, auctioning @0.08 per cent are realised from the buyers whether government agencies or private persons, flour mills, etc.

Net Income Per Acre

District-wise per acre gross sale value, cost of cultivation (COC) and net income (NI) is presented in Table 4 by taking the same from earlier Tables. Average per acre NI is Rs. 18791 after deducting COC of Rs. 10345 from gross sale value of Rs. 29136.

TABLE 4. AVERAGE NET INCOME PER ACRE OF WHEAT IN SAMPLE DISTRICTS

District (1)	Yield in qtl. (2)	Value of wheat @ (3)	Net value of residue (Rs) (4)	Gross sale Value (Rs.) (5)	Cost of production (6)	Net income (7)
Kaithal	18.167	26342	3692	30034	10186	19848
Hisar	16.163	23436	4830	28266	10065	18201
Sonipat	16.144	23409	4224	27633	10785	16848
Average	17.205	24947	4189	29136	10345	18791

Source: Taking yield and residue from Table 3.11 and actual price realised by farmers @ 1450 per qtl in 2015.
Note: Gross sale value of wheat includes wheat residue too.

Across the districts, net income (NI) per acre in Kaithal was the highest at Rs.19848 after deducting COC of Rs. 10186 from gross sale value of Rs. 30034. Similarly in Hisar district, the NI is Rs.18201 with lower gross sale and COC than that of Kaithal. The NI per acre is the lowest Rs. 16848 in Sonipat due to lower gross sale value and higher COC than Kaithal and Hisar. It may be due to smaller holdings, lack of irrigation and more use of hired machinery by most of the farmers in Sonipat.

Extent of Marketed Surplus

The quantity of wheat sold through different channels, retained for seed and domestic consumption for human and animals was directly asked from the farmers. It is to be noted that all the sample farmers were selling in the market. The quantity of wheat surplus and marketing through different channels are worked in each district (Table5). Of the total production of 36879qtl by sample farmers; 83 per cent was sold in APMC through *arhatias*, 7 per cent retained for human and animal consumption each and 3 per cent was retained for seeds. Direct sale to consumers was negligible. About one-third seed was replaced by new seeds every year.

TABLE 5. DISTRICT-WISE MARKETING AND CONSUMPTION OF WHEAT IN QUINTALS AND PER CENT SHARE

	Kaithal		Hisar		Sonipat		Total	
Sale through/and retention for (1)	Quantity (2)	Per cent share (3)	Quantity (4)	Per cent share (5)	Quantity (6)	Per cent share (7)	Quantity (8)	Per cent share (9)
Sale in APMC	17968	88.40	6767	75.67	5878	77.22	30613	83.01
Direct to consumers	0	0.00	0	0.00	25	0.33	25	0.07
Retained for seed	593	2.92	132	1.48	273	3.59	998	2.71
Retained for human consumption	794	3.91	937	10.48	750	9.85	2481	6.73
Retained for animals	970	4.77	1106	12.37	686	9.01	2762	7.49
Total	20325	100.00	8942	100.00	7612	100.00	36879	100.00

Source: Field Survey by CRRID team during June 2015, APMC- Agricultural Produce Marketing Committee.

Across the districts, the maximum 88 per cent of wheat produced was sold in Kaithal, 76 per cent in Hisar and 77 per cent in Sonipat. Sale outside APMC was reported by one farmer in Sonipat district to an atta chakki. Quantity retained for consumption by both human and animals was 9 per cent in Kaithal, 23 per cent in Hisar and 19 per cent in Sonipat. Variations may be due to smaller holding size and more allied activities in Hisar and Sonipat.

Farm-Size Wise Marketed Surplus

It may be interesting to see the farm size wise marketed surplus as worked out in Table 6. As expected, the wheat production marketed was the minimum 69 per cent by marginal farmers, 81 per cent by small farmers and 87 per cent by other farmers. Retention for human and animal consumption in percentage terms was almost double by marginal farmers as compared to small and other farmers. Wheat saved for seeds was 2.71 per cent which was less than normal requirement of 3 per cent. It was because of seed-saving by just 20 per cent MFs, by 50 per cent SFs and by 40 per cent other farmers. Overall, 37 farmers saved for seeds. The remaining seed required was purchased from the market for replacing the old seed.

TABLE 6. FARM SIZE WISE MARKETING AND CONSUMPTION OF WHEAT

Sale through/and retention for	Marginal farmers		Small farmers		Other farmers		Total	
	No. of farmers	Wheat qty. (in q)	No. of farmers	Wheat qty. (in q)	No. of farmers	Wheat qty. (in q)	No. of farmers	Wheat qty. (in q)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
APMC	77	3021	80	8117	95	19474	252	30612
	(100.00)	(68.33)	(100.00)	(81.46)	(100.00)	(86.58)	(100.00)	(83.01)
Direct Sale	1	25	0	0	0	0	1	25
	(1.30)	(0.57)	(0.00)	(0.00)	(0.000	(0.00)	(0.40)	(0.07)
Seed	15	116	40	392	37	490	92	998
	(19.48)	(2.62)	(50.00)	(3.93)	(38.95)	(2.18)	(36.51)	(2.71)
Human	77	651	80	705	95	1125	252	2481
	(100.00)	(14.73)	(100.00)	(7.08)	(100.00)	(5.00)	(100.00)	(6.73)
Animals	68	608	76	750	93	1404	237	2762
	(88.31)	(13.75)	(95.00)	(7.53)	(97.89)	(6.24)	(94.05)	(7.49)
Total	77	4421	8	9964	95	22493	252	36878
		(100.00)	(100.00)	(100.00)	(100.00)		(100.00)	(100.00)

Source: Field survey by CRRID team during June 2015; Figures in brackets are percentage to the respective totals under each farm size.

Role of Commissions Agents (Arahtias)

Arhatias do not find specific mention in the circular of State Government but in practice, they are fulcrum of all transactions in the APMCs. The wheat arrived in APMC is unloaded in front of their shops by the dealing farmers. The number of dealing farmers with an arhatia varied depending upon the loans advanced and dealings. The number was from 40 to 100 farmers in APMC of Kaithal City. The arhatia is responsible for the quality of wheat and he arranges equipment like, separators (Jharana), fanning machine and labour, etc. for cleaning. The bags are supplied by the purchasing agencies but filling, stitching and loading are arranged by arhatias. The labour cost was reported Rs.10 per bag of 50 kg. Out of that the arhatia was charging Rs 6.10 from farmer and Rs.3.90 from the purchasing agency.

The staffs of purchasing agencies would come sometimes after a gap of three days or more for certifying the quality. The wheat lifting by the contracted transporters of the purchasing agencies is frequently delayed and the arhatias are responsible during the period. He is paid commission @2.5 per cent for providing space and facilitates in the APMC. He also helps APMC in realising market fee and rural development cess @ 2 per cent each from the purchasing agencies and others. He acts as billing and payments agent too and paid Rs 0.15 per bag for this service by government procurement agencies (GPAs). It was revealed that GPAs are more dependent on arhatias to enforce quality norms and to ensure quantity till the wheat reaches the godown. He makes payments on behalf of the agencies to the farmers.

Summing up Economics of Wheat Production

The discussion in the above sections reveals that farmers are growing wheat and selling it as usual in APMC markets since 1970s. Almost no direct sale was reported to consumers and the millers. Wheat is grown in 90 per cent of *rabi* area as there is no competing crop (s) to fetch higher net value to the farmers. One notable observation was almost the total replacement of manual labour in operations like weeding, spraying of pesticides, harvesting, preparation of dry fodder, etc. In this way, all the COC of wheat has become paid out cost for the farmers. It has serious repercussion on the farmers in case of decrease in yield as has happened in March 2015 when wheat was damaged due to unseasonal rains.

III

FARMERS LINKAGE WITH PROCESSORS

Extant Linkage with Flour Mills

To ascertain the linkage of farmers with first stage processers, 9 wheat flour mills consisting of 6 roller flour mills and 3 atta-chakkies were surveyed in May and June, 2015. The chakki-units were located in Sonipat district and owned by individuals. Of the rollers mills, 3 units were from Rai food Park in Sonipat, one each from Panchkula, Ambala and Hisar. Out of total 6 sample roller mills, five were registered under Private Companies Act and one under Partnership Act. Though, survey included many aspects of their working, capacity utilisation and economics but in this paper, only the information regarding procurement of raw material is used to ascertain their linkage with farmers.

Procurement of Raw Material

All mill owners reported that bulk of their wheat requirement is purchased from APMC grain market during harvesting months of May and June. After marketing season; millers reported purchase from Food Corporation of India (FCI) which releases from its warehouses. FCI fixes the price including all cesses, taxes, and transportation and storage charges. Direct purchase from the farmers is not allowed as per APMC Act of Haryana. The purchaser in Haryana whether Government of private has to pay commission @2.5 per cent to the arhatia, market fee and development cess @4 per cent, VAT and other expenses about 7 per cent. These total charges vary from state to state. In Haryana, millers were paying about 13.5 per cent over the MSP in 2015. Some mills bordering UP were purchasing through agents who supply below Rs.150 per quintal than the price of Haryana with all proper receipts. It was due to less market price than MSP and lower other taxes in UP.

In terms of ownership, no farmers' families were found to have the flour mills. Most of the flour mills are owned by business families who have other linkages too. They were concerned about the procurement price whether the wheat is produced by farmers of Haryana or other states. Even some second stage processors i.e. 9 bakery units located in Sonipat (1), Ambala (1), Panchkula (3) and Chandigarh reported no links with famers. The bigger MNC units like Nik Bakers, Polka, and Capital were not ready to share any information. These MNCs have rendered many old oven based bakeries in Chandigarh non-competitive since April 1997 when biscuits, pastry were taken out of reserved category for MSMEs.

Farmers' Awareness about Wheat Processing

Wheat flour is universally known but the second stage bakery products were not known to all farmers. As per multiple responses of sample farmers, about 73, 48 and 46, 17 and 12 per cent farmers were having knowledge of bread making, bunds, and biscuits, noodles and other items like cakes, rusks, custard, etc. (Table 7).

TABLE 7. AWARENESS OF WHEAT PROCESSED PRODUCTS IN SAMPLE DISTRICTS (ITEM-WISE MULTIPLE RESPONSES)

	Kaithal		Hisar		Sonipat		Total	
Product	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flour	87	100.00	84	100.00	81	100.00	252	100.00
Noodle	21	24.14	6	7.14	16	19.75	43	17.06
Bread	62	71.29	63	75.00	59	72.84	184	73.02
Bund	52	59.77	27	32.14	42	51.85	121	48.02
Biscuit	34	39.08	45	53.57	38	46.91	117	46.43
Others	4	4.60	10	11.90	16	19.75	30	11.90
Total	87	100.00	84	100.00	81	100.00	252	100.00

Source: Field survey by CRRID team during June 2015.

Across the districts, the situation was almost the same. Among the districts, awareness of these products was higher in Sonipat than Kaithal and Hisar. It may be due to proximity of Sonipat to mega consumption centre of Delhi and location of Rai Food Park in this district.

Farmers' Involvement in Wheat Processing Units

Most of the farmers were aware of wheat processing units like flour mills and bakeries, though all their products were not known to them. Out of total 252 sample farmers, most of them have installed small chakki for their home use but the common facilities were reportedly vanishing. A big farmer and MLA in Kaithal have set up a floor mill which has become defunct and it has become a bad example for farmers.

Farmers' Willingness to Link with Processing

Of the total sample farmers, 46 per cent expressed willingness to link with wheat processing units. Such farmers are 55 per cent in Hisar, 44 per cent in Kaithal and 41 per cent in Sonipat as shown in Table 8.

TABLE 8.WILLINGNESS OF FARMERS TO LINK WITH WHEAT PROCESSING UNITS

	Kaithal		Hisar		Sonipat		Total	
Willing or not	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Yes	38	43.68	46	54.76	33	40.74	117	46.43
No	49	56.32	38	45.24	48	59.26	135	53.57
Total	87	100.00	84	100.00	81	100.00	252	100.00

Source: Field survey by CRRID team during June 2015.

The concern of willing farmers are summarised in Table 9. Of the 117 willing farmers, 91 per cent would like to link with wheat processing units, if prices offered are higher, 19 per cent would consider if convenient to market and 11 per cent if time saving and 4 per cent if transport cost is reduced. Among districts, the higher price was the consideration by 95 per cent farmers in Kaithal. Convenience and time saving were the concern of 39 per cent farmers in Hisar and 27 per cent in Sonipat.

TABLE 9. REASONS FOR WILLINGNESS TO LINK WITH WHEAT PROCESSING UNITS (MULTIPLE RESPONSES)

Consideration for	Kaithal		Hisar		Sonipat		Total	
Linking	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Higher Prices	36	94.73	41	89.13	29	87.87	106	90.60
Convenient	3	7.89	10	21.73	9	27.27	22	18.80
Time Saving	5	13.16	8	17.39	0	0.00	13	11.11
Transport saving	3	7.89	0	0.00	1	3.03	4	3.41
Total	38		46		33		117	

Source: Field Survey by CRRID team during June 2015.

Farmers' Risk Perception about Linkage

Risk apprehensions of 54 per cent of sample farmers' who are unwilling to link with the wheat processing units are summarised in Table 10.

TABLE 10. APPREHENSION FOR NOT WILLING TO LINK WITH WHEAT PROCESSING UNITS

Reasons	Kaithal		Hisar		Sonipat		Total	
	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Not interested	23	45.10	11	29.73	25	53.19	59	43.71
Commission Agent the Best	9	17.65	9	24.32	9	19.15	27	20.00
Less rate in open market	2	3.92	0	0.00	0	0.00	2	1.48
Millers will discriminate	17	33.33	17	45.95	13	27.66	47	34.81
Total	51	100.00	37	100.00	47	100.00	135	100.00

Source: Field survey by CRRID team during June 2015.

Of the unwilling farmers, 44 per cent expressed apathy to link and 20 per cent preferred the *arhatia* due to old links. About 37 per cent apprehended less price and discrimination by the millers. Less price and discrimination in long run by millers was the apprehension of 46 per cent in Hisar, 33 per cent in Kaithal and 28 per cent in Sonipat. In fact, experience of linkage with processing units was not available with the farmers to think about its benefits. During 2014-15, the author conducted a study of rice mills in Haryana too and no paddy grower was found linked with the mills (Sangwan and Gagan Deep, 2014).

Other Reasons for not Linking

Other reasons for not selling direct to the processors are given in Table11. Of the total sample, 70 per cent reported that wheat processors have never contacted them, 22 per cent knew that direct sale is not allowed and 6 per cent apprehending lesser price from the processors. The remaining two per cent farmers never thought of direct selling to the processors. Across the districts, apprehension of lesser price is the maximum in Kaithal (16 per cent).

TABLE 11. DISTRICT-WISE PROBLEMS IN DIRECT SELLING OF WHEAT TO PROCESSORS

	Kaithal		Hisar		Sonipat		Total	
Reasons	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Not contacted by processor	53	60.92	57	67.86	66	81.48	176	69.84
Did not try for direct sale	1	1.15	1	1.19	3	3.70	5	1.98
Less rate than MSP	14	16.09	0	0.00	1	1.23	15	5.95
Not allowed	19	21.84	26	30.95	11	13.58	56	22.22
Total	87	100.00	84	100.00	81	100.00	252	100.00

Source: Field Survey by CRRID team during June 2015

Millers Response about Direct Purchase from Farmers

The responses of 9 sample millers are summarised in Table 12. About 78 per cent millers expressed their willingness for direct purchase. They argued that even after paying the market fee, cess and vat (now GST), the purchases at their mill compound @ MSP will cheaper by about 5per cent due to saving in arhatia's commission, transport, loading and unloading, loss in transit, etc.

TABLE 12. WILLINGNESS OF SAMPLE FLOUR MILLS TO PURCHASE WHEAT FROM FARMERS

Interest↓/ Unit→	Shagun flour mills	Aahar consumer products	Gee gee flour mill	Supreme flour mill	Vidya dal and flour mill	Rattan flour Mill	Jyoti flour mill	Malhotra atta chakki	Pawan atta chakki
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Interested in direct purchase	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Reasons for no direct purchase		not allowed		Not interested to deal with Political farmers				Not allowed	

The biggest barrier for no linkage between farmers and processors is the state government itself. Its APMC Act Section 8(1) bars direct purchase from farmers by millers and any other. To quote *"From the date of issue of notification under section 6 or from such later date as may be specified therein, no person, unless exempted by rules made under this Act, shall, either for himself or on behalf of another person or the State Government, within the notified market area, set up, establish or continue or allow to be continued any place for the purchase, sale, storage and processing of the agricultural produce or purchase, sell, store or process such agricultural produce except under a license granted in accordance with the provisions of this Act, the rules and bye-laws made there under and the conditions specified in the license."* It applies for flour mills even after amendment till 1 July 2020. Though, despite ban by APMC, a few atta-chakki were purchasing in small lots covertly on agreed prices with the farmers.

Further, millers were apprehending problems in dealing with politically pliable farmers who will be supported by politicians despite written agreements.

Willingness to Set up Wheat Processing Units

The responses of the farmers to set up wheat processing units are given in Table 13.

TABLE 13. WILLINGNESS TO SET UP WHEAT PROCESSING UNITS

	Kaithal		Hisar		Sonipat		Total	
	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Yes	31	35.63	6	7.14	11	13.58	48	19.05
No	56	64.37	76	93.86	70	86.42	204	80.95
Total	87	100.00	84	100.00	81	100.00	252	100.00
Who identified type of unit	31	100.00	6	100.00	12	100.00	49	100.00
Flour mill	25	80.65	4	60.00	7	58.33	36	73.47
Biscuit/bread/bund units	5	16.13	2	40.00	5	41.67	12	24.49
Noodle, etc	1	3.22	0	0.00	0		1	2.04

Source: Field survey by CRRID team during June 2015. Percentage in 5 to 7th line is from those identified the units. In 4th line percentage of all who identified type of unit.

Of the sample, only 19 per cent farmers were willing to set up some type of wheat processing units. District-wise, 36 per cent farmers in Kaithal, 14 per cent in Sonipat and only 7 per cent in Hisar were willing to set up any wheat processing unit. The types of processing units identified are shown in Table 13. About 73 per cent of willing farmers showed willingness for flour mills, 25 per cent for biscuit/bread/ bund units 2 per cent for noodle and other units. Across the districts, flour mills were expressed as choice by 81 per cent farmers in Kaithal, by 60 per cent in Hisar and 58 per cent in Sonipat. Willingness for setting biscuit/bund/bread units was 16 per cent in Kaithal, 40 per cent in Hisar and 42 per cent in Sonipat.

Farmers' Apprehensions to Set up Processing Units

The problems apprehended by some the sample farmers to set up wheat processing units are presented in Table 14.

TABLE 14. PROBLEMS IN SETTING UP WHEAT PROCESSING UNITS (MULTIPLE RESPONSES)

	Kaithal		Hisar		Sonipat		Total	
Type of unit	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent	Nos.	Per cent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Availability of loan	4	8.33	2	66.67	3	30.00	9	14.75
Availability of subsidy	19	39.58	1	33.33	2	20.00	22	36.07
Training required	17	35.42	0	0.00	3	30.00	20	32.79
Availability of land	6	12.50	0	0.00	1	10.00	7	11.48
Any other	2	4.17	0	0.00	1	10.00	3	4.92
Total	48	100.00	3	100.00	10	100.00	61	100.00

Source: Field Survey by CRRID team during June 2015.

Of the 61 respondent farmers, 15 per cent apprehended non-availability of big loan for setting up a flour mill and 36 per cent wanted that Government should give some subsidy for setting up the wheat processing units. Owing to lack of any family experience, training was suggested by 33 per cent farmers to create interest and impart know-how for establishment of processing units. About 11 per cent reported non-availability of suitable land in industrial estates and as a unit outside the estates will not get uninterrupted supply of electricity. Rest of the farmers could not even think of starting their own processing units owning to no experience of their family. Across the districts, farmers of Hisar were more specific in loan requirement and subsidy.

IV

CONCLUSIONS AND SUGGESTIONS

1) Wheat is grown in 90 per cent *rabi* area in most of districts of Haryana as it gives higher net income than other competing crops of the season. The other notable finding was replacement of manual labour in all wheat operations by machinery, thus making its entire COC as paid out cost. It has increased the risk concern of farmers in terms of decrease in yield or prices or both.
2) The survey analysis revealed that farmers are growing wheat and selling it as usual in APMC markets since 1970s. No farmers' families were found to have the flour mills. Most of the flour mills are owned by business families who have no linkage with farmers due to APMC Act and even otherwise to avoid politically pliable farmers.
3) In Haryana, millers were purchasing wheat by paying about 13.50 per cent taxes over MSP as compared to 8.5 per cent in the neighbouring States of UP over its market price which is usually less than MSP by Rs. 200 per qtl. After accounting for all costs, the millers of Haryana were paying Rs.150 less per quintal on the

wheat purchased from UP. So millers have no special attraction for farmers of the state.

4) Despite that 77 per cent millers were willing to purchase direct from farmers because it will reduce their purchases price by 5 per cent in terms of arhatia fee, loading, unloading and transport expenses and losses. In turn, the processors may help in arranging good seeds and chemicals for the farmers to get quality wheat. This can be a win-win situation for the farmers, processors and the State government.
5) Farmers were apprehending price discrimination by millers during purchases at their mills while some big millers were also afraid to deal with politically pliable farmers.
6) To set up flour mills and other processing units; the individual farmers reported lack of capabilities and unsure about big loans at scale of mills. Hence, farmers' producers organisations (FPOs) for wheat as well as paddy may be promoted on the lines of the FPOs being promoted for vegetables and fruit growers. The Agriculture department of States may be entrusted FPOs like horticulture department.
7) The willing farmers and FPOs of wheat may be imparted technical knowledge of flour mills and bakeries. Industry department, Hafed, NABARD and bankers can associate in training for project preparation, providing guidance for bank credit and other incentives from State and Central governments.
8) State government may consider equity participation for the wheat processing units by FPOs at par with those given by government of Maharashtra to sugar mills and later on for cotton ginning units. Even interest subsidy may be considered for the units of the FPOs on the loans provided by banks.
9) The flour mills and bakery units were also found profitable by the study and there is a scope for new units in the surplus wheat state of Haryana. Government of Haryana may consider setting more food parks in southern Haryana along the railway lines to Bhiwani and Hisar where land will be cheaper.
10) The AVC in wheat can be possible if propelled by the State Government to create employment and income for rural youth. Hafed may be persuaded by State Government to buy the product of flour mills of FPOs to market under its brand at the initial stage.
11) The FCI price policy should be favourable to the surplus wheat producing States through all India auction at the place of storage/release of the wheat. Minimum quantity of wheat release may reduce from 100 tonnes to truck load, i.e., 10 tonnes for purchase by smaller units.

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ANNEXURE 1. RANKING OF HARYANA DISTRICTS AS PER WHEAT SURPLUS DURING TRIENNIUM ENDING 2013-14

Districts name (1)	Average production (000 t) (2)	Population in 2011 (3)	Annual consumption requirement (000 t)* (4)	Surplus production (000 t) (2-4) (5)	Per capita availability in kg/ year (2/3) (6)	Rank in per capita availability (7)	Rank in Surplus (8)
Ambala	378.33	1136784	58.52	319.48	332.52	14	15
Panchkula	52.67	558890	28.77	23.93	94.29	20	21
Y.Nagar	397.33	1214162	62.51	334.49	326.97	15	14
Kurukshetra	555.00	964231	49.64	505.36	575.59	6	9
Kaithal	872.00	1072861	55.23	816.77	812.78	3	4
Karnal	860.00	1506323	77.55	782.45	570.93	7	5
Panipat	434.33	1202811	61.92	372.08	360.82	13	13
Sonipat	742.67	1480080	76.19	666.51	501.80	8	7
Rohtak	458.67	1058683	54.50	404.20	433.27	11	12
Jhajjar	459.33	956907	49.26	410.04	479.98	9	11
Faridabad	145.00	1798954	92.61	52.39	80.60	21	20
Palwal	465.67	1040493	53.56	412.14	447.58	10	10
Gurgaon	237.67	1514085	77.95	159.75	156.99	19	19
Mewat	312.00	1089406	56.08	255.92	286.39	16	16
Rewari	235.00	896129	46.13	188.87	262.24	17	17
M/Garh	211.00	921680	47.45	163.55	228.93	18	18
Bhiwani	688.67	1629109	83.87	604.83	422.75	12	8
Jind	801.67	1332042	68.57	733.13	601.86	5	6
Hisar	1082.00	1742815	89.72	992.28	620.83	4	2
Fatehabad	996.33	941522	48.47	947.83	1058.18	2	3
Sirsa	1538.00	1295114	66.67	1471.33	1187.54	1	1
Entire State	11923.33	25353081	1305.17	10617.33	470.26	-	-

Source: Government of Haryana (2014), *Statistical Abstract of Haryana 2013-14* and various issues.
Note: *Normal per capita consumption @ 51.48 kg per year.

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Impact of Microfinance on Farm Income of Small and Marginal Farmers in Western Tamil Nadu

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ABSTRACT

The small and marginal farmers were more dependent on the private credit sources with higher interest rate for their family needs and timely agricultural practices. Drought, pest and disease incidence, higher input cost, less product price and non-timely availability of credit were the major reasons for indebtedness of the small and marginal farmers. In this context, microcredit through bank linkage self-help groups (SHGs) served as the credit source to the small and marginal farmers. A study was conducted on the tribal and non-tribal SHG and non-SHG members in western Tamil Nadu in order to study the impact of microfinance on income of members and non-members of self-help groups on the selected tribal and non-tribal women in the study area. In the case of tribal SHG members, income from agricultural source was Rs. 48772 compared with Rs. 29900 of non-members. The average annual income of SHG members in before operation period was Rs. 11944 and it was Rs. 21415 in after implementation period and the difference was Rs. 9471. The non-tribal SHG member's average annual income difference between the two periods before and after implementation period was Rs. 17332.Non-follow up practices from government officials was the main problem faced by SHG members in tribal sample farmers.

Keywords: Micro credit, Self-help groups, Indebtedness, Uncertainty, Tamil Nadu

JEL.: C33, Q14, Q15

I

INTRODUCTION

In India, the marginal, small and semi-medium farmers are contributing 95 per cent of the total farmers (Agriculture Census, 2011-12). The average size of holdings of the small and marginal farmers is about 0.38 ha when compared to 17.37 ha for large farmers, which cannot generate adequate employment and income from crop cultivation (Dev, 2017). Agricultural development requires timely and adequate supplies of essential farm inputs. But the investment capacity of majority of the Indian farmers is quite low as they are poor and they cannot afford to meet the increasing demand for the purchase of improved seeds, recommended dosage of fertilisers, hiring costly farm machinery etc. So, lack of finance and its accessibility are one of the main reasons for low productivity of Indian agriculture. Furthermore, the absence of adequate farm and non-farm employment opportunities lead them to perpetuate in poverty trap.

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In India, the share of formal sources varies from 22.6 per cent to 58 per cent for small and marginal farmers. In states like Tamil Nadu, Punjab and Andhra Pradesh, the dependency of small and marginal farmers on informal sources is higher. According to NSSO (70th round) around 52 per cent of the farm households remained indebted in India as a whole of which the state of Andhra Pradesh had the highest share of indebted agricultural households in the country (92.9 per cent) and Tamil Nadu (82.5 per cent).

Tenant farmers and marginal farmers were more dependent on the informal sources for their credit needs in farm inputs as well as their family needs as compared to the medium and large farmers. A higher percentage of investment is carried out through informal sources of borrowings such as moneylenders, traders and input dealers by the landless (40.6 per cent), marginal (52.1per cent) and small farmers (30.8 per cent) (Kumar *et al*., 2017).

The indebtedness through formal sources is lower for scheduled tribes as compared to others across social groups, because they do not have any collateral security to get the loan from informal sources.

Microcredit can play an important role in agricultural development in the small, marginal and tenant farmers. One element of an effective strategy for poverty reduction is to promote the effective use of farm inputs. This can be done by creating opportunities for raising agricultural productivity among small and marginal farmers. Many microfinance institution loans are used for agricultural production, trading, processing and transport, resulting in an increase in the use of agricultural inputs and increased output of agricultural production (Zohir and Matin, 2004). Self-Help Group (SHGs) plays a significant role in reaching out and connecting with rural poor women. These groups enable its members to gain their identity as individuals, while realising and utilising the immense power of mutual aid (Mohammad and Mohammed, 2007).

Pandit *et al*. (2007) in his study on financing agriculture, a study of Bihar and West Bengal potato cultivation has identified that in Bihar only about 15 per cent farmers opted for institutional loans, whereas, it was more than 34 per cent in case of non-institutional loans. Input traders, fellow farmers, money lenders were the important non-institutional sources in Bihar.

Ashaolu *et al*. (2011) conducted a study in Nigeria which revealed that the total cost per hectare of microcredit user farmers is higher ($266.87) than that of non-credit user farmers ($209.40), indicating misallocation of resources by credit-user farmers. Again, profit per hectare of microcredit user's farmer is greater ($285.04) than that of non-credit users ($178.41), suggesting that access to credit could improve farmers' productivity and higher income in the form of revenue and profit.

Ibrahim and Siegfried (2013) conducted research in Sudan and the results showed that, farm profits for all categories were $161.97. The microcredit users were found to be better off with a profit of $168.13 compared to $ 155.28 for microcredit non-users. Results obtained from a probit model showed that savings, value of assets and incomes are the significant variables determining the credit constrained conditions.

Puhazhendhi (2000) in his study in Tamil Nadu observed that 38 per cent of the members were able to sign during the pre-linkage period but as a result of SHGs group formation the literate members increased considerably and 85 per cent of them learnt to sign after the group formation. About 27 per cent of the members had educated their children up to the school level during the post linkage with SHGs period. The study revealed that the members regularly started eating wheat and rice, after group activities which were earlier consumed by them only during festivals.

In this background, an attempt is made to study the impact of microfinance on income of members and non-members of self-help group on the selected tribal and non-tribal women in the study area.

II

METHODOLOGY

Ashenfelter and Card (1985), the use of difference-in-differences methods has become very widespread. For the present study, the information was collected for the pre and post-program period and compared with the control group as well (Wing *et al.* 2018; Palanisami *et al.*, 2014).

For each observation 'i' let us define a variable as if the observation is from the control group and if it is from the SHG group. Similarly for each observation *i* define a variable as if the observation belongs to time t = 0, that is before the SHG program and if the observation belongs to time t = 1, that is, after the SHG program. Now form the regression equation,

$$y_i = a + b\delta_i + cT_i + d\delta_i T_i \quad \text{....(1)}$$

The following results can be easily checked:

Observation belonging to	$\boldsymbol{\delta}$	T	y_i
Non-SHG before the program	0	0	$\bar{y}_{c0} = a$
Non-SHG after the program	0	1	$\bar{y}_{c1} = a + c$
SHG before the program	1	0	$\bar{y}_{T0} = a + b$
SHG after the program	1	1	$\bar{y}_{T1} = a + b + c + d$

So using Equation (4)
Impact of the program

$$= \big((a + b + c + d) - (a + b)\big) - \big((a + b) - a\big) = d \quad \text{....(2)}$$

TABLE 1. DOUBLE DIFFERENCE METHOD OF IMPACT ASSESSMENT OF TRIBAL AND NON-TRIBAL SHG MEMBERS PROGRAMME

Particulars (1)	SHG farm women participants (2)	Non-SHG participants of farm women (3)	Difference across groups (4)
After SHG programme	D1	C1	D1 - C1
Before SHG programme	D0	C0	D0 - C0
Difference across time	D1-D0	C1-C0	Double difference (D1 - C1)-(D0 - C0)

Farm level data were collected from both tribal and non-tribal farm women, i.e., who have participated in the SHG programme and who have not participated and calculated separately. This enables the use of the double difference method to study the impact of the SHG programme.

The resulting measures can be interpreted as the expected effect of implementing the SHG programme both in tribal and non-tribal farm women households. The columns distinguish between groups with and without the programme and the rows distinguish between before and after the programme. Before the SHG programme, one would expect the annual family income to be similar for the two groups, so that the quantity (D0 - C0) would be close to zero. Once the SHG programme has been implemented, however, one would expect differences between the groups as a result of the improvement in knowledge of the farmers about the farming technique and communication skills due to the SHG programme provide training to them. The impact of the programme, however, would be better assessed considering any pre-existing observable or unobservable differences between the two randomly assigned groups,i.e.,the double-difference estimate, which is obtained by subtracting the pre-existing differences between the groups, (D0 - C0), from the difference after the programme has been implemented, (D1 - C1).

Double in Difference (DID) methodology is becoming a popular tool for studying the impact analysis as it has the advantage to control the time-invariant characteristics of the farmers when comparing the members and non-members of a SHG programme.

Garrett Ranking Technique

The constraints in the adoption of soil conservation technologies were analysed based on Garrett's scoring technique. Garrett ranking was applied to rank a set of factors as perceived by the sample respondents based on certain criteria (Garrett and Woodworth (1997).

$$\text{Per cent position} = \frac{100(R_{ij} - 0.5)}{N_j} * 100$$

where,

R_{ij}= the rank of the i-th item by j-th individual and

N_j=the number of items ranked by the j-th individual

III

DATA AND VARIABLES

The two time periods were classified as before implementation of SHG programme upto the year 2012 and after implementation in the year 2018 and control group which is non-SHG programme before as well as after period collected data as panel data. Hence an approach that considered with and without as well as before and after situations is significant.

A total of 120 women farm households were selected comprising 40 women farm households from tribal villages in Coimbatore district and 40 women farm households from non-tribal in Erode district by employing stratified random sampling procedure to study the impact of the SHG during January, 2018. In order to make a comparative study, 20 women farmers in these villages, of which each ten farm women households from tribal and non-tribal of who have not participated in SHG programme were selected as control. Thus, a sample of 80 farmers was covered for the impact study. The required information from the respondents was gathered by personally administering the interview schedule. The primary information collected from the women farm households' annual net income. In addition, the details of the trainings attended and subject matter learnt during the training programme were collected from the respondents. The base line data collected in 2012 was also used for cross checking the annual net income of the farmers prior to SHG training programme.

IV

RESULTS AND DISCUSSION

From Table 2, the average age of the women farmers were assessed to be 39 years in tribal SHG members and 40 years in non-tribal SHG member's households. Education was lower in tribal farms as compared with non-tribal farms. Experiences in farming activities were high in non-tribal SHG members and non-members in the selected sample farmers.

TABLE 2. DEMOGRAPHIC PARTICULARS OF MEMBERS AND NON-MEMBERS OF SELF-HELP GROUP OF TRIBAL FARMERS OF SELECTED STUDY AREA

Particulars (1)	Tribal SHG members (2)	Tribal Non-SHG members (3)	Non-Tribal SHG members (4)	Non-Tribal Non-SHG members (5)
Age (years)	39.30	47.70	40.10	55.70
Education (years)	5.35	3.70	9.27	6.10
Experience (years)	11.97	16.90	15.03	28.00
Family size (numbers)	4.70	4.10	4.63	4.60

From the Table 3, the average farm size of sample farm indicates less than one hectare to 1.90 hectare of land holdings. The farmer's income from agricultural source was in members of SHGs of Rs.48772 compared with Rs.29900 of non-members of tribal farmers. In members of non-tribal farmers agricultural income was as high as Rs. 95600 as compared with non-members as well as tribal SHG member farmers. In non-tribal farmers, members of SHGs successfully operated in their groups with more than ten years and also repayment rate was also greater as compared with tribal SHG members.

TABLE 3. AVERAGE FARM SIZE AND INCOME PARTICULARS OF MEMBERS AND NON-MEMBERS OF SELF HELP GROUP OF SELECTED STUDY AREA

Particulars (1)	Tribal SHG members (2)	Non-SHG members (3)	Non-Tribal SHG members (4)	Non-Tribal Non-SHG members (5)
Farm size	1.65	1.90	1.39	0.96
Agricultural net income	48772.33	29900.00	81300.00	33000.00
Total net income	52639.00	36300.00	95600.00	55400.00

In non-tribal farm women members in Erode district cultivated flower crops like jasmine and chrysanthemum and milk yielding cows as their main income source. So, the need for credit was frequent and adequate for their farm requirements like plant protection, plant growth supplements and other farm operations from microcredit through nationalised banks and PACBs.

Tribal SHG members in Coimbatore district were mainly cultivating paddy, maize, sorghum and vegetable crops like tomato, chillies and chrysanthemum. The agricultural lands were adjoining the protected areas and therefore wildlife disturbances in the cultivation area seem to be a major problem. Farmers used protective measures like fences, trenches and cultivated non-eating agricultural crops. Losses due to wildlife were compensated but not appropriate. In tribal farmers 43 per cent were tenant farmers and also paid their profit as land rent to the land holders. Thus, their net profit is reduced further other than the cost of production.

The SHG members of tribal and non-tribal women farmer's agricultural income as well as their total net income were larger compared with the non-members of sample farm households.

From the Table 4, it is evident microfinance borrowing was higher in non-tribal SHG members of Rs.45,000 because, they utilise microfinance loans for their financial needs of both agricultural and household purposes and repay regularly. Therefore, they again got the higher loan from the bank. Revenue from flower cultivation was on a regular basis that encouraging the repayment of loan from microcredit. The credit amount was increased based on their regular repayment to banks of the sample non-tribal SHG members.

TABLE 4. MICROFINANCE LOAN PARTICULARS OF MEMBERS AND NON-MEMBERS OF SELF HELP GROUP OF SELECTED STUDY AREA

(Rs.)

Particulars (1)	Tribal SHG members (2)	Non-Tribal SHG members (3)
SHG loan amount (Average)	25000	45000
Interest rate	12 per cent	12 per cent

Tribal SHG members also repaid regularly but some of the members could not repay on a regular basis due to non-regular income sources, crop failure and other family expenditures, therefore the other members were also affected due to these challenges in tribal SHG members, however the members earned higher income as compared with non- SHG members.

The details of private borrowing by these members are given in Table 5. Private borrowing was higher in non-SHG members of both the categories of which 76 per cent in tribal non-SHG members and 62 per cent in non-tribal members and it was nil in non-Tribal SHG members, because, they used microfinance loans for their financial purposes of both agricultural and household needs. Among the sample farmers30 per cent of members borrowed private loan for their spontaneous need of credit. The average private loan amount ranged from Rs.29000 to Rs.37500 higher in both non-members tribal and non-tribal farmers of tribal SHG members and 62 per cent non-tribal farmers borrowed from private lending sources. Interest rate was higher at 36 per cent to 41 per cent of borrowings in all categories of farmers.

TABLE 5. LOAN PARTICULARS OF MEMBERS AND NON-MEMBERS OF SELF HELP GROUP OF SELECTED STUDY AREA

Particulars (1)	Tribal SHG members (Rs.) (2)	Tribal Non-SHG members (Rs.) (3)	Non-Tribal SHG members (Rs.) (4)	Non-Tribal Non-SHG members (Rs.) (5)
Private loan	3620.7	29000	-	37500
Interest rate	41 per cent	36 per cent	-	39 per cent
Private borrowing	30 per cent	76 per cent	-	62 per cent

From the Table 6 and Figure 1, the data reveal that monthly expenditure was higher in non-tribal SHG members as compared with the tribal SHG members and non-members in the sample farmers. Also the total average annual average savings was higher by Rs.17000 in the case of non-tribal SHG members. The tribal SHG members also saved but they distributed among themselves for their requirements. Non-members used their income mostly for their private loan repayment and higher interest rate.

TABLE 6. EXPENDITURE AND SAVING PARTICULARS OF MEMBERS AND NON-MEMBERS OF SELF HELP GROUP OF SELECTED STUDY AREA

Particulars (1)	Tribal SHG members (Rs.) (2)	Tribal Non –SHG members (Rs.) (3)	Non-Tribal SHG members (Rs.) (4)	Non-Tribal Non –SHG members (Rs.) (5)
Monthly expenditure /head	5561	6065	8408.333	5903.3
Total Savings	5033.33	0	17000	0

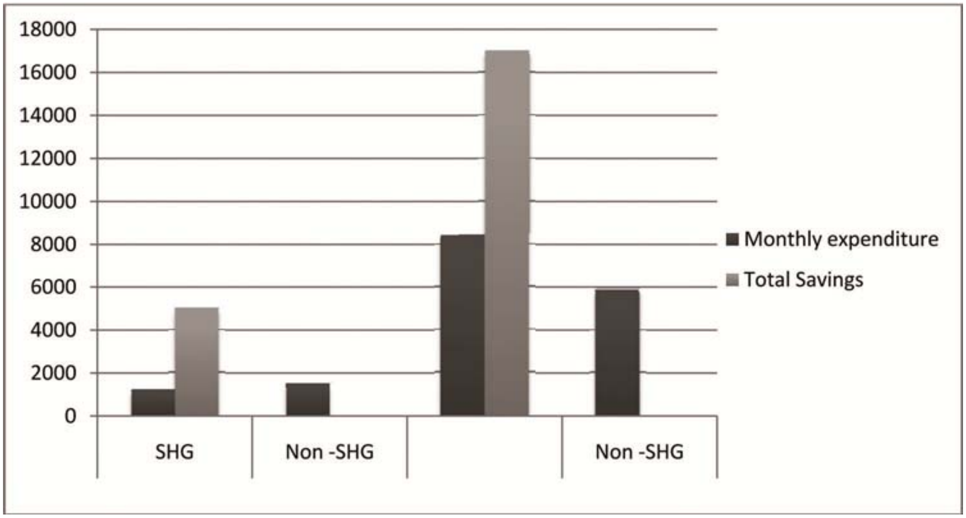

Figure 1. Expenditure and Saving Particulars of Members and Non-Members of SHGs.

Differences in Difference (DID) Analysis of SHG Members and Non-Members of Tribal Women Sample Farmers

In the analysis of DID given in Table 7, the tribal SHG members were found to be more dependent on microfinance for their agricultural operations and family needs. The well-timed credit was distributed at 12 per cent interest rate among the members. The training on agricultural technology imparted on the members increased the productivity of crops. The average annual income of SHG members in before operation period was Rs. 11944 and it almost doubled in after operation period toRs. 21415 and the difference was Rs. 9471.

TABLE 7. DIFFERENCES IN DIFFERENCE METHOD FOR PARTICULARS OF INCOME IN MEMBERS AND NON-MEMBERS OF SELF-HELP GROUP OF TRIBAL FARMERS OF SELECTED STUDY AREA

Particulars (1)	Pre – SHG members (Rs.) (2)	Post – SHG members (Rs.) (3)	Final Difference (Rs.) (4)
Members	11944.00	21415.00	9471.00
Non members	9222.00	14520.00	5297.00
Double Difference			4173.00

The non-member SHG tribal farmers seem less aware of agricultural technologies as compared with member farmers. They were dependent on private credit sources for their credit needs with higher interest rate. Thus, the average annual income difference of non-members between two periods was lower by Rs.5297 as compared to SHG members. The double difference between members and non-members and before and after implementation programme was Rs.4173 of the SHG of tribal farmers. The inflation rate effect was compressed by both values taken as 2012 base year value. The significance of the model indicates the p value of 9.39E-09.

RESULTS OF DIFFERENCES IN DIFFERENCE MODEL OF TRIBAL FARMERS

	Coefficients	Standard Error	t Stat	P-value
Intercept	9222.222	1429.99	6.449151	9.39E-09
d1	2722.222	1651.21	1.648622	0.103353
d2	5297.778	2022.311	2.619665	0.010622
B	4173.378	2335.164	1.787188	0.077894

Differences in Difference (DID) Analysis of SHG Members and Non-Members of Non-Tribal Farmers of the Selected Study Area

The results of Table 8 indicate that the non-tribal SHG member’s average annual income difference between the two periods as before and after implementation of period was Rs.17332. Since their credit needs were satisfied by microfinance through bank linkage SHGs at 12 per cent interest rate their purchasing power increased and well-timed investment on agricultural operation also increased. Thus the income from agriculture depicted an increase. So, the repayment rate was higher in non-tribal SHG farmers, therefore higher loans were accomplished from banks thus, SHGs were successfully operated with enhanced savings from members.

TABLE 8. DIFFERENCE IN DIFFERENCE METHOD FOR PARTICULARS OF INCOME IN MEMBERS AND NON-MEMBERS OF SELF HELP GROUP OF NON-TRIBAL FARMERS OF SELECTED STUDY AREA

Particulars (1)	Pre – SHG members (Rs.) (2)	Post – SHG members (Rs.) (3)	Final Difference(Rs.) (4)
Members	23027.00	40360.00	17332.00
Non members	20777.00	28056.00	7278.00
Double Difference			10054.00

There was very less difference of Rs. 7278 in non-members because of their dependency on private money lenders for their credit needs with higher interest rate. The non-SHG sample members largely owned less than one hectare land. Therefore, their investment on agricultural operation required less investment, hence, the net return were also less. The major part of their income was used to repay higher interest rate to private credit sources which reduced their investment on protective measures like children education, food, investment in agricultural operation. The significance of the model indicates in the p value of 4.89E-10.

RESULTS OF DIFFERENCES IN DIFFERENCE MODEL OF NON-TRIBAL FARMERS

	Coefficients	Standard Error	t Stat	P-value
Intercept	20777.78	2912.291	7.134512	4.89E-10
d1	2249.715	3362.824	0.668996	0.505525
d2	7278.222	4118.602	1.767158	0.081216
B	10054.28	4755.752	2.114132	0.037784

Constraints

Among constraints in microfinance operations highlighted in Table 9, non-follow up practices from government officials was reported to be the major problem faced by SHG members in tribal sample farmers followed by the need for easy repayment operation (mobile banking) training to group members, micro insurance for their crops, training of agricultural and allied programmes to members, subsidy of agricultural inputs and group members conflicts in the study area.

TABLE 9. CONSTRAINTS IN MICROFINANCE OPERATIONS FALLOW- UP PRACTICES BY SHG MEMBERS

Constraints (1)	Garret's score (2)	Rank (3)
Non-follow up practices from government officials	81.62	1
Need easy repayment operation (mobile banking) training to group members	72.16	2
Micro insurance for their crops	63.65	3
Training of agricultural and allied programs to members and price and price forecast information distribution	55.12	4
Subsidy of agricultural inputs	50.07	5
Group members conflicts	45.85	6

V

CONCLUSION

The income progression was higher in both tribal and non-tribal members of SHGs from the before and after implementation of this programme as compared with non-SHG members of sample farmers in the study area. In tribal farms, non-diversified and non-regular income were the main reasons for less income and repayment rate compared with non-tribal SHG member farmers. Hence, the government should formulate strategies and programmes to extend technical and financial interventions and promote this programme for more benefits of the tribal and the non-tribal marginal, small and tenant farmers.

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Startups with Open Innovation: Accelerating Technological Change and Food Value Chain Flows in India

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ABSTRACT

Entrepreneurial new firms can bring in radical innovations better with a risk-taking approach. startups have been proliferating in all sectors of the economy including agriculture in developing countries in recent years. This paper harnesses a large database of start-ups in India and examines the nature of innovations of the start-ups employing open innovation framework. Several types of startups have come up in the last decade that are filling the gaps in the food value chains in infrastructure deficit regions of the country and introducing innovations by mobilising 8 billion USD investments. This fast-expanding knowledge flows have brought several innovations that could not be imagined just a few years back. Significantly, open innovation has taken root in Indian agriculture with the rise of startups and this has several positive implications. Open innovation is required at the present stage as Indian agriculture is in transition and moving towards a higher level of technologies with better and faster linkages among various food chain actors. There are concerns that need to be addressed about this innovation, bypassing the smallholders, as companies can only plan for their own innovations and marketing. The government needs to develop a policy framework to create the necessary enabling environment for the development of the startup ecosystem and to internalise and mainstream this open innovation into agricultural development strategies keeping the twin goals of growth and equity.

Keywords: Startups, Technological Change, Food Value Chain, Innovation

JEL.:L26, O36, Q13, Q16

I

INTRODUCTION

The debate on large versus small firms as the drivers of innovation has been veering towards the latter in development discourse in recent period that is nearer to the initial hypothesis of Schumpeter (Baumol, 2004; Dolfsma and van der Velde, 2014). Concomitantly, entrepreneurship has been rising simultaneously in most parts of the world as countries transition from managed economies to entrepreneurial economies triggering a shift in government policies away from constraining the freedom of business to contract through regulation, public ownership and antitrust towards a new set of enabling policies which foster the creation and commercialisation of new knowledge (Acs *et al*., 2004; Audretsch, 2009). While spillovers in knowledge generated in public and private sectors are hypothesised to lead to entrepreneurial new firms by Acs and Audretsch (Acs*et al*., 1994),

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Chesbrough (2003) postulated that innovations in the new millennium are to be jointly achieved. In this background, startups have been proliferating across the countries not only the developed, but also in developing countries in Asia, Africa and Latin America both in hi-tech sectors and traditional sectors like agriculture (Nanda and Rhodes-Kropf, 2013; Fabricio *et al.*, 2015; De Bernardi and Azucar, 2020). Notwithstanding the proliferation of startups and a flurry of innovations in various segments of the value chain, the extant literature does not analyse these developments in developing country context empirically to mainstream these developments in the overall growth process. This paper endeavours to address this research gap.

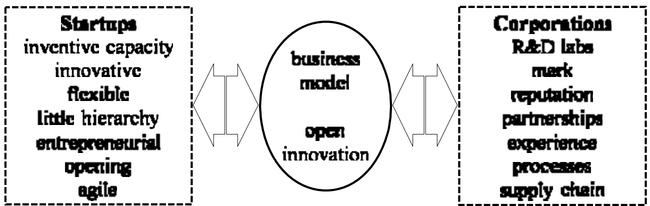
This paper is organised as follows. The following Section expounds the conceptual framework and data source and methods. The third Section examines the nature of innovations of startups in regard to their functioning at various nodes of the value chain. The fourth Section brings out the discussion on open innovation knowledge flows leading to open innovation. The last Section concludes with policy suggestions.

II

CONCEPTUAL FRAMEWORK

Open innovation has been permeating every field of economic activity all over the world in the last two decades. More consciously and as a planned development process, after the word 'open innovation' was coined and formalised as a new paradigm of creating and profiting from technology by Chesbrough (2003) in his celebrated book. Initially, he called it the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2006). As the learning curve moved up with intensive debates and extensive applications over a period of the first decade, more details are added to say that open innovation is 'a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation's business model' (Chesbrough and Bogers, 2014). To start with, this kind of organisation of innovation is only possible in the economic activities as the level of sophistication is high and the processes are complex. However, the evolving experience in disparate industries showed that this can have traction in relatively conventional industries too (Chesbrough and Crowther, 2006; Medeiros *et al.*, 2016). The ramping up of technology with newer innovations has been spurring transitions in the food industry, especially as the mid-stream and downstream of food value chains reached two-thirds magnitude in most of the world (Reardon *et al.*, 2019) including India (Reardon *et al.*, 2020). Research has shown that diverse actors in the long chains with heterogeneous needs (Sarkar and Costa, 2008) and an assortment of technologies required to produce the changing consumer demands (Bigliardi and Galati, 2013) all lead to open innovation paradigm for faster technology development and diffusion. The convergence of findings can also be seen in studies in agricultural economics showing the diffusion of innovation across all the actors in the entire chain when the processing firms bring in new technologies (Zilberman *et al.*, 2019). However, the new paradigm involves disparate actors in both development and diffusion of innovations.

The knowledge flows can be outside in or outbound depending on the needs of innovation and the business models of the respective actors. While initial evidence showed that primarily the large companies initiate and move the process forward, subsequent experience proved that small and medium sized companies including startups, non-profit foundations, collective community actions and individual consumers can also catalyse significant transformations (Figure 1). Startups specifically need external knowledge sources in view of scarcity of internal resources and competencies (Di Pietro *et al.*, 2018). The food system is ideally suited to combine the knowledge specificities of many actors including startups in open innovation framework (De Bernardi and Azucar, 2020, p 109-110).



Source: Fabricio*et al.*, (2015).

Figure 1.Startups and Large Companies Relationship.

This paper employs open innovation framework to understand the operations of large number of agri-tech startups in India across various activities to fully make sense of their activities in totality. Being an exploratory study on this evolving ecosystem, this paper confines to broad delineation of the functions and interoperability mechanisms without going deeper into the technological products and associated marketing strategies. It classifies the startups working in food value chains based on the main purpose of each of its functioning, though there can be several interventions at different nodes of the value chain and overlap of functions. Then, it analyses the innovations and brings out salient features including the level of investments. It harnesses a large database of startups from Traxcn and also collates with other published as well as news items in business dailies.

III

NATURE OF INNOVATIONS IN FOOD VALUE CHAINS WITH STARTUPS AND IMPLICATIONS

There are several types of startups that have come in the last decade that are filling the gaps in the food value chains in infrastructure deficit regions of the country. Farmers in developing countries face multiple risks on several fronts

(Komarek *et al*., 2020) and these startups endeavour to address them using new generation IT tools such as internet of things (IoT), big data analytics, blockchain technology and so on. Many of these startups in India operate in tandem with various other related companies in downstream with the supermarkets, retailers, hoteliers, in the mid-stream with the processors, wholesalers and logistic firms, and in the upstream with the input companies and so on. It is here the open innovation framework is employed to discern the nature of emerging innovations and their diffusion through inbound and outbound as well as bi-directional knowledge flows as shown by Bogers *et al*., (2018).An effort is made to classify them based on their main line of activity, though they can have other initiatives too, so that the nature of arising startup initiatives can be analysed to unravel the mechanisms of knowledge flows for innovation. The six broad categories of startup innovations identified are- those providing output market linkages; facilitating input supply; enabling mechanisation, irrigation control and financial support; helping in quality maintenance, monitoring, traceability and output predictions (SaaS); post-harvest management and farming as a service (FaaS); and those supporting animal husbandry farmers. All these groups are discussed below with more details and analysis with interconnections. Finally, the nature of knowledge flows leading to the complicated web of open innovation network is examined.

3.1. *Output Market Linkages*

Accumulated evidence shows that reducing the chain of intermediaries between the farmer-producer and consumer can benefit the former through higher price realisation (Chand, 2017; Nuthalapati *et al*., 2020; Pingali *et al*., 2019). A large number of startups focus on innovations for linking the farmers in far-flung areas with the buyers of their produce (Table 1). The important players among them include- *Udaan, BigBasket, Swiggy, Zomato,GrofersNinjacart, WayCool, ZopNow, ShopKirana, Jumbotail, DeHaat, AgriBazaar, Bijak, Farmpal, and MilkBasket*. The first four of these start-ups are unicorns involved in direct procurement from farmers and selling to other supermarket chains and other downstream actors. *Udaan* is a fastest growing B2B full stack platform dealing in several items like electronics, garments, footwear, kitchen and home appliances along with staples and fruit and vegetables (Poojary, 2019). Despite being the direct sellers of food, the other three unicorns, viz., *BigBasket*, *Swiggy* and *Zomato* engage directly with farming community and procure through viz., like direct sellers of food. By September 2020, large investments are attracted by these startups to the tune of 6.96 billion USD, which is invested in building the long neglected modernisation of the value chains as well as for innovations. Significant investments are in *Swiggy* (1.6 billion), *Zomato* (972 million), *BigBasket* (1.02 billion), and *Udaan* (900 million). Some of the other startups raising considerable investments include *Grofers* (535 million USD), *Ninjacart* (164 million), *WayCool* (65 million), *Jumbotail* (25 mn), and *Bijak* (15 mn).

TABLE 1. STARTUPS CONNECTING FARMERS WITH OUTPUT MARKETS

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Bigbasket (Unicorn)	Online marketplace of grocery products	2011	Bangalore	Yes	7.88E+08	Series F	366077300
Zomato (Unicorn)	Online platform enabling food ordering and delivery	2008	Gurgaon	Yes	9.75E+08	Series J	169140273
Swiggy (Unicorn)	Online platform for food ordering and delivery	2014	Bangalore	Yes	1.62E+09	Series I	159331500
Udaan	Online B2B marketplace for multi-category products	2016	Bangalore	Yes	900000000	Series D	77,60,117
Grofers (Soonicorn)	Online retail store offering groceries	2013	Gurgaon	Yes	5.48E+08	Series F	11121000
Ninjacart (Soonicorn)	App-based B2B platform offering vegetables and fruits	2015	Bangalore	Yes	1.63E+08	Series C	17109500
WayCool	E-distributor of farm	2015	Chennai	Yes	65736870	Series C	22692800
ZopNow (Soonicorn)	Online grocery platform with a three-hour delivery promise (Acquired by More and Amazon)	2011	Bangalore	Yes	12045360	Series A	2942600
Agrevolution (DeHaat)	Provider of end-to-end farming services to the farming communities	2012	Patna	Yes	16507907	Series A	5417400
Bijak	Online B2B marketplace to trade agriculture commodities	2019	Gurgaon	Yes	14591780	Series A	na
Jumbo tail	Online B2B platform for packaged food, fruits and vegetables	2015	Bangalore	Yes	25361400	Series B	29233300
Shop Kirana	Mobile-based B2B marketplace for groceries	2015	Indore	Yes	12472215	Series B	3011000
Otipy	App-based platform offering fruits and vegetables	2019	Delhi	Yes	2500000	Seed	
Kisan Network	B2B marketplace for farmers, bulk buyers	2015	Delhi	Yes	3493115	Seed	866700
Crofarm	Digital supply chain of fruits and vegetables from farm to business	2016	Gurgaon	Yes	5866696	Seed	1476300
Aibono	Services for farm data collection & analytics and mobile application for farm management	2013	Bangalore	Yes	6488656	Seed	244200
Clover Ventures	Provider of supply chain solution for fruits and vegetables	2017	Bangalore	Yes	6930813	Series A	148400
Teabox	Online retailer of tea	2012	Bangalore	Yes	19000000	Series B	2689100
Satvacart	Online platform offering multi-category grocery products	2014	Gurgaon	Yes	2324241	Seed	183700
Tokri	Online platform to buy fresh produce and groceries	2014	Pune	Yes	2500000	Seed	55500

(Contd..)

TABLE 1.(CONCLD.)

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Milkbasket	Subscription based daily need items delivery (Milk and F&V)	2015	Gurgaon	Yes	40575340	Series B	10348500
Farmpal	Online platform delivering farm produce to businesses	2017	Pune	Yes	136390	Seed	179463
MeraKisan	Online marketplace that connects consumers with local farmers	2014	Pune	Yes	1000000	Seed	819100
VnF	Online platform to purchase fruits and vegetables	2018	Mumbai	Yes	2000000	Seed	422900
InI Farms	Provider of farming services to horticulture industries	2009	Mumbai	Yes	14634837	Series A	14404300
FarmTaaza	Manages supply chain of fruits and vegetables from farm to business (Acquired by WayCool)	2015	Bangalore	Yes	10693115	Series A	na
Daily Ninja	Hyper-local subscription based delivery service (Acquired by BigBasket)	2015	Bangalore	Yes	10744109	Acquired	413969
Smerkato	Online B2B platform offering multi-category grocery products	2016	Bangalore	Yes	na	Funded	na
GeeCom	Online E-commerce platform offering agricultural products and supplies	2018	Indore	No	na	Unfunded	na
Farmley	Online platform linking farmers with customers (Earlier called TechnifyBiz)	2016	Delhi	Yes	na	Funded	1683221.35
Kirana Monk	App-based B2B marketplace offering farm produce	2018	Sonipat	No	na	Unfunded	na
Atomaday	App-based video shopping platform offering fruits and vegetables	2017	Bangalore	No	na	Unfunded	na
Green-N Good	Online retailer of organic products	2012	Jaipur	Yes	na	Funded	na
Organo fresh Solutions	B2B wholesaler of fruits and vegetables	2017	Chandigarh	No	na	Unfunded	874200
Farmcon	Online B2B marketplace for agriculture products	2017	Pune	No	na	Unfunded	na
LivLush	B2B platform to procure fresh fruits and Vegetables (Sabziwala and LivLush merged as Kamatan)	2016	Bangalore	Yes	na	Series A	5530600
Brown soil	Online B2B platform offering farm produce	2018	Bangalore	No	na	Unfunded	

Source: Compiled from Traxcn database as of February 2020.

While *BigBasket* has been procuring directly from the farmers since the last several years (Nuthalapati *et al*., 2017), several startups embarked on direct procurement in recent years and the quantities are significant and increasing. For example, *Udaan* is procuring fruits and vegetables in Delhi and Karnataka and dealing with a quantity of 500 tonnes per day, apart from 5000 tonnes of staples (Poojary, 2019). *Ninjacart* supplies fresh produce to *Flipkart* for its *Flipkart Quick* and deals with 1500 tonnes a day (Velayanikal, 2020). *Zomato* acquired Bangalore-based *WOTU* in 2018 and renamed as 'Hyperpure' for starting direct procurement from farmers through operations in B2B foodtech space (Kashyap, 2019, 2020), while *Swiggy* entered hyperlocal grocery delivery recently and also procured from farmers directly (Garg, 2020). Leveraging e-*mandi* model, *Agribazaar* works with 200,000 farmers and connects them with procurement agencies and food processing companies like Britannia, *AgroPure* and others at no cost, though it collects transaction fee from the buyers (Mitter, 2020). *DeHaat*, based on the franchise model connects farmers with traders, institutional financers and buyers like *Reliance Fresh*, *Zomato*, *Udaan*, etc., on one platform in 20 regional hubs in eastern India and serves 210,000 farmers (Singh, 2020a). It is noteworthy that several of the active startups work in the states with poor agricultural marketing infrastructure in central and north India. Further, they provide several related services to which we return towards the end of this Section. While several startups fail to survive or make it to the bigger leagues, some are acquired by bigger companies. For example, *ZopNow* was acquired by More and later Amazon; *FarmTaaza* by *WayCool;* and *DailyNinja* by *BigBasket*. Pivoting from B2C to B2B, as has been done by *Ninjacart*, *WayCool*, has been a trend recently and B2B startups seem to get higher funding chances relatively (Sheth *et al*., 2020).

3.2 *Startups Facilitating Input Supply*

Several studies showed that availability and quality of inputs to the farmers is a serious problem impinging productivity and profitability of farmers, where flyby night operators make quick money by selling spurious seeds, fertilisers and pesticides (Parthasarathy and Shameem,1998). The transformation of input industries and delivery systems are critical in this regard (Pray and Nagarajan, 2014). Several startups have been offering solutions to optimise the use and enable delivery of assured quality inputs to farmers (Table 2). These online services have been of help in the times of pandemic to follow social distancing and purchase inputs from home using smartphone. *Agrostar* is the largest startup in input supply to farmers and is expected to be unicorn soon. It has mobilised 47 million USD in funding and reached Series C funding so far. It has been serving farmers in Gujarat, Maharashtra and Rajasthan with 400, 000 active users and one million downloads of its app. By partnering with leading national and multinational companies to sell their products through *AgroStar*, it enables farmers in buying seeds, nutrients, crop protection, as well as hardware products from its platform and app (Apoorva, 2019). Similar services are provided by *BigHaat*, *Khetinext*, *Gramophone*, and several others. Many of them combine input provision with agri-advisory and other services.

TABLE 2. STARTUPS ENABLING ONLINE PROCURING OF QUALITY INPUTS

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Agrostar (Soonicorn)	Online platform offering agri-inputs, content, and advice	2008	Pune	Yes	47182672	Series C	11618100
Khethinext	Mobile app that enables procurement of farm inputs and provides information	2017	Hyderabad	Yes	5386498	Series A	na
Gramophone	App-based platform providing farm input products and information to the farmers	2016	Indore	Yes	8062080	Series A	578400
Marut Drones	Provides drone-based precision agriculture services	2019	Guwahati	Yes	100085	Seed	na
LeanAgri	Technology solutions providers for farmers	2017	Pune	Yes	567108	Seed	93300
BharatAgri	Platform that provides crop management solutions for farmers	2017	Pune	Yes	1291537	Seed	93300
BigHaat	Online marketplace offering farm inputs	2015	Bangalore	Yes	2569628	Seed	103894
A-One Seed Wholesale	Online B2B marketplace of seeds	2019	Hisar	No	na	Unfunded	na
Terra Agro biotech	Manufacturer and supplier of biological farm inputs	2016	Jaipur	No	na	Unfunded	na
AgriApp	Online marketplace for agriculture farm inputs	2016	Bangalore	Yes	na	Funded	na
SmartFarms	Online B2B distributor of agricultural input products	2019	Gurgaon	Yes	na	Seed	na
FarmGuru	Online platform for group buying of farm inputs	2015	Pune	No	na	Unfunded	na
BehtarZindagi	Online marketplace for agricultural supplies	2016	Delhi	No	na	Unfunded	na
Unnati	Unnati	2016	Noida	Yes	452321	Seed	1,01,28,605

Source: Compiled from Traxcn database as of February 2020.

3.3 Startups *for Mechanisation, Irrigation and Financial Services*

Farming in the Indian context is becoming difficult for lack of suitable equipment especially for small farmers, enormous drudgery in irrigation fields and waste of water and lack of financial services. Startups have been finding these gaps and operating efficient services across the length and breadth of the country (Table 3). Some of them focus on accurate and timely assessment of soil moisture and developing data-driven controlled irrigation models. *Kisan Raja* is an innovative device allows farmers to remotely control the agricultural motor using their mobile or landline and used by 34200 farmers in India (Gogoi, 2019), apart from being

TABLE 3. STARTUPS HELPING IN EFFICIENT MECHANISATION, IRRIGATION AND FINANCIAL SERVICES

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Mechanisation							
FarMart	Web and mobile-based application for renting farm equipment	2015	Gurgaon	Yes	739765	Seed	35000
EM3 Agri Services	Provider of farming services to the farming communities	2013	Noida	Yes	17022002	Series B	1173648
RAVGO	Digital farm and construction equipment rentals marketplace	2015	Gurgaon	No	na	Unfunded	na
JFarm Services	Online marketplace platform for equipment rental	2017	Chennai	No	na	Unfunded	na
Trringo	Mobile based app offering farming equipment on rent	2016	Mumbai	No	na	Unfunded	240000
Irrigation							
FlyBird Innovations	Manufactures irrigation controllers	2013	Bangalore	Yes	223330	Seed	66400
Intech Harness	Provider of an IoT-based automated water pump controller	2018	Pune	Yes	na	Funded	na
Sense It Out (F6s)	IoT controller for greenhouse management deployed as a service	2015	Pune	Yes	na	Funded	na
KisanRaja	Technology Solutions for Agriculture	2006	Bangalore	No	na	Unfunded	na
Satyukt	Data and analytics solutions for earth observations	2018	Bangalore	No	na	Unfunded	na
Kritsnam Technologies	IOT-based solutions for water monitoring and management	2015	Kanpur	Yes	70119	Seed	na
Financial services							
Jai Kisan	Online supply chain platform for farmers	2017	Mumbai	Yes	6014060	Seed	97900
SG Agtech Innovations	Online platform for providing digital and financial solutions to farmers	2018	Chennai	No	na	Unfunded	na
SafalFasal	Online marketplace for agricultural products	2019	Mumbai	No	na	Unfunded	na
Jai Kisan	Online supply chain platform for farmers	2017	Mumbai	Yes	6014060	Seed	97,900
Niruthi technology	Location-specific crop monitoring and yield prediction solution provider	2005	Hyderabad	No	na	Unfunded	3,40,900
Gramcover	Insurance marketplace focused on rural areas	2015	Noida	Yes	1181090	Seed	3,17,500
SatSure	Data services for crop health monitoring and assessment	2016	Bangalore	Yes	na	Funded	30,400
PayAgri	Online platform to bring cashless ecosystem in Agriculture	2017	Chennai	Yes	348442	Seed	9,775
Farmguide	Digitizing agri supply chain and services	2014	Gurgaon	Yes	1570818	Seed	1,57,200
AgRisk Tech	Core banking, payments, transaction banking, and financial inclusion solution provider	2009	Mumbai	No	na	Unfunded	na

Source: Compiled from Traxcn database as of February 2020.

harnessed by the World Bank for a project on saving water in rice. Bangalore-based *FlyBird* installs censors in the soil to detect moisture content and controls irrigation at a low cost to the farmers and this can be of use especially for high value crops (Ayyar and Desikan, 2016). There are others like *Intech Harness* that provides solutions for water pump controller and *Sense It Out, Kritssnam, Agrirain, Manna Irrigation.*

Several startups focus on mechanisation of farming activities through renting easy to use machines or aggregating companies that can rent machines. FarMart, EM3 Agri Services, *M.I.T.R.A* and others have been providing these services at lower cost and some of them are finding good traction among farmers (Singh, 2017). Sickle innovations, Distinct Horizon, TractorJunction, Khetibadi and J Farm service are some of the other startups in mechanisation services. *KamlKisan* develops farm equipment for small farm owners to reduce labour dependence and has rental services in Karnataka, Jharkhand and Andhra Pradesh (Ravi, 2017).

As we move from traditional marketing services to the modern marketing channels, lack of support structures to provide handholding through credit is a handicap for the farmers. Some of the start-ups resolve this issue through making credit available in a transparent online procedure at lower rates of interest, along with other services. Apart from *Jai Kisan*, *SGAgtech* and *SafalFasal* shown in Table 3, there are others like *Samunnati, FarMart*, *PayAgri, Kissht*, *SatSure, Farmguide, Niruthi* and so on. *GramCover* acts an insurtech platform too. Some of the startups with market linkage also provide loans. For example, there are the startups like *Udaan, Bijak* and *Clover*.

3.4 *Startups for Quality Maintenance, Monitoring, Traceability and Output Predictions*

Several innovative products have been developed and popularised by startups in this area for quality assaying, quality maintenance through advisories, traceability, and yield predictions through mobile imagery, digitisation and advanced software (Table 4). One of the most popular startup in this category seems to be *CropIn* that has clients in 30 countries and chosen by the World Bank as a project on sustainable livelihoods and adaptation to climate change. Basically a farm-to-fork traceability business model, it collects information from various sources like weather, satellite and ground data and delivers targeted solutions to the agribusinesses on a B2B model and at the same time has a unique farmer application for the companies to interact directly with the farmers (Anand and Raj, 2019). The Government of India has also roped in *CropIn* to streamline crop cutting experiments and their accuracy.

SaaS start-ups such as *Intellolabs, Agricxlab and QZense* and *RaavTechlabs* focus on quality assessment of agri-commodities. *Intellolabs* developed an app to test, grade, and analyse the visual quality parameters of agri-commodities to enable better price for the farming community and had been working with the Government of Rajasthan to grade grains in *mandis* (Prasad, 2018). *Agricxlab* harnessed deep

TABLE 4. STARTUPS FOR QUALITY MONITORING AND MAINTENANCE AND PREDICTIONS OF CROP HEALTH AND OUTPUT

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
CropIn	Provider of saas-based farming solutions to agribusinesses	2010	Bangalore	Yes	15623458	Series B	1622700
Intello Labs	Image recognition based solutions for multiple industries	2016	Bangalore	Yes	8750809	Series A	157400
FarmERP	Software suite for control over farm operations and traceability	2005	Pune	Yes	1438880	Series A	311600
Jivabhumi	Connecting consumers to farmer groups/cooperatives. Uses Block chain technology for traceability	2015	Bangalore	Yes	na	Funded	316400
Agricx	Provider of AI-based stack solutions for grading	2016	Thane	Yes	774776	Seed	40700
qZense Labs	Provider of an IoT device for food quality check for grading	2019	Bangalore	Yes	253386	Seed	na
AgNext	Platform for monitoring and improving agricultural food quality for grading	2016	Mohali	Yes	4336741	Seed	97000
RAAV Techlabs	Provider of AI-powered food quality analysers	2018	Delhi	Yes	na	Funded	9200
OneWater	Soil and groundwater sensing and analytics product	2015	Ahmedabad	No	na	Unfunded	na
AmviCube	Developer of paddy quality tester for rice mills	2014	Raichur	Yes	na	Funded	na
Amnex	Provider of precision agriculture solutions	2008	Ahmedabad	Yes	na	Funded	18783400
AS Agri Systems	Develops integrated hardware and software platform for precision agriculture	2017	Bangalore	No	na	Unfunded	na
BKC Aggregator	Precision agriculture solutions provider	2018	Delhi	No	na	Unfunded	na
NEERx Technovation	Provides smart agriculture solutions	2019	Gandhinagar	Yes	na	Funded	na
RML Agtech	Online portal for agriculture information sharing	2007	Mumbai	Yes	4000000	Series A	779068
FarmBee	Online platform providing data-driven agricultural solutions	2006	Pune	Yes	9099055	Seed	760200
MyCrop Technologies	Provider of information, expertise, and resources for agriculture sector	2016	Ahmedabad	Yes	na	Funded	na
Agrojay	Online information dissemination platform for agriculture farmers	2019	Nashik	No	na	Unfunded	na
Namma-Uzhavan	Online agriculture information dissemination platform for farmers	2018	Coimbatore	No	na	Unfunded	na
Nebulaa's Matt	Crop quality assessment system	2016	Jaipur	Yes	294730	Seed	141400
TartanSense	Analysing health of plants using drones	2015	Bangalore	Yes	2139340	Seed	1800

(Contd).

TABLE 4.CONCLD.

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Yuktix	Technology sensor products for remote monitoring and control of devices	2013	Bangalore	Yes	133229	Seed	76500
Fasal	AI-powered IoT platform for precision agriculture	2018	Bangalore	Yes	1720000	Seed	na
Blooom	Online mobile-based platform for agriculture risk prediction and mitigation	2009	Delhi	No	na	Unfunded	na
Skymet Weather	Crop insurance and weather forecasting data services	2003	Noida	Yes	11768115	Series C	5827100

Source: Compiled from Traxcn database as of February 2020.

learning technology to grade agri-commodity and certify in 30 seconds and acts as a bridge between cold storages and procurement companies (Patil, 2018). On the other hand, women entrepreneurs founded *QZense* employs a unique combination of near-infrared spectral sensors and olfactory sensors for analysis of internal spoilage, ripeness, sweetness, and shelf life that can be used at any stage of the supply chain though initially deployed by retailers to gauge and maintain quality for driving down inventory losses and spur margins (Balakrishnan, 2020). Soil and groundwater sensing and analytics products is brought out by *OneWater*, while an innovative paddy quality tester for rice mills came out from *AmviCube*. Another useful innovation is by *Krishitantra*from Udupi, Karnataka for rapid soil testing in 35 minutes and that can be shared in cloud and sms with advisory. *Cheruvu* also enables soil testing facilities and advisory along with comparisons to neighbour’s field. *TartanSense* developed technologies to assess health of plants drone imageries.

Precision agriculture using advanced analytics and prediction platforms are supposed to be the game changing technologies and exclusive preserve of top six companies and likely to be bypassed for the developing world (Lianos*et al*., 2016). However, startups enter this segment of value chain and make them possible through their innovations in a cost-effective manner for the smallholder farmers in developing country context such as in India. Precision agriculture solutions are provided by software platforms of *Amnex, AS Agri Systems, BKC Aggregator* and *NeerXTechnovation*. Agricultural information sharing has few startups attending and they include *RML Agtech, FArmBee, MyCrop Technologies, Agrojay* and *NammaUzhavan*. Crop yield predictions are facilitated by *Fasal, Yuktix, Bloom* and *Skymet*. Many of these startups leverage satellite images to geotag farms, assess crop health and estimate output. *Fasal* captures real-time data on growing conditions from on-farm sensors and delivers farm-specific, crop-specific actionable advisories to farmers via mobile in vernacular languages. Likely to be unicorn soon is *SourceTrace* that operates in 26 countries with a digital platform that helps capture information regarding agriculture, financial services and retail through existing mobile and wireless networks in developing economies and also a two-way interactive digital platform (NASSCOM, 2019).

3.5 *Startups for Post-Harvest Management and Farming-as-a Service*

As the value chains became elongated with nearly two-thirds of food being consumed in urban areas in India (Reardon *et al*., 2020), the requirements for processing, logistics, wholesaling and associated services have been increasing over the past few decades. Startups have been crucial in the segment of logistics with several of them acting as third party logistic partners for other startups as well as established food companies like Britannia and several others. Apart from that, few startups made innovative products for cold storage and saving the produce from post-harvest damage before being transported. Table 5 examines the startups in mid-stream of the value chain.

The solar-powered small-size cold storage unit of *Ecozen Solutions*; and low-cost storage cum transportation solution called *Sabjikothi*, developed by *Saptakrishi*, for extending shelf-life of vegetables from 7-30 days have tremendous potential to cover the shortcomings for smallholder farmers. Another area many startups have been playing considerable role is storage of agri-produce. In a country where it is estimated that there is storage gap of around 35 per cent, their role can play crucial role in reducing food damage. *A2Z Godaam* of *Arya Collateral* is foremost among them. It is a digital platform for search, discovery and fulfilment of warehousing for farmers, FPOs, corporate and other stakeholders. It goes beyond storage by integrating with other services like financial and market linkages (Kashyap, 2020a). Similar post-harvest services are provided by another startup called *Origo* with 3.5 million tonnes of storage capacity in 500 warehouses across 15 states.

Farming as a service (FaaS) has been growing with several urban people wishing to engage in cultivation of fruits and vegetables often in organic modes on the one hand and on the other several smallholders wishing to have support in several related services to make their farming profitable. Several startups have been testing this area and seem getting good response. *Farmizen*, and *Hoshachiguru* provide min-farms to be rented by prospective cultivators and can also opt to take services from them for technically sound and cost effective cultivation (Hariharan, 2018). These startups collect rent and also fee for their services. On the other hand, startups like *Vegrow* and *EMB* partners with smallholders for profitable cultivation that might also lead to aggregation of fragmented farms for achieving economies of scale (Sangwan, 2020).Rooftop gardening by *Khetify*, indoor hydroponics by *Agro2o* and end to end farm enabling services for greenhouses by *Kheyti* represent the other emerging areas for startup ventures.

TABLE 5. STARTUPS HELPING IN POST-HARVEST MANAGEMENT, FARMING AS A SERVICE (FAAS)

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Post-harvest management							
Ecozen Solutions	Manufactures and supplies solar-powered irrigation pump controllers	2009	Pune	Yes	10590520	Series A	9799600
SaptaKrishi (Sabjikothi)	Provider of a micro-climate storage solution for farmers	2018	Kanpur	Yes	na	Funded	na
New Leaf Dynamic Technologies	Off-grid refrigeration	2012	Delhi	Yes	na	Funded	na
AgriGator	Provider of agricultural logistics platform connecting grain shippers and carriers	2019	Bhopal	Yes	na	Funded	na
Star Agriware-housing and Collateral Management	Agricultural warehousing and post-harvest supply chain solutions	2006	Mumbai	Yes	72000000	Series C	109300000
Arya Collateral Warehousing Services	Warehousing and collateral management services for agri commodities	1982	Noida	Yes	9333310	Series A	11955900
Farming- as-a-service (FaaS)							
Farmizen	Develops and operates digital application for community supported farming	2017	Bangalore	Yes	296585	Seed	47300
Triton Foodworks	Integrated business for soil-less cultivation of fruits & vegetables and supply of produce	2014	Delhi	Yes	na	Seed	na
Agro2o	Manufacturer and supplier of indoor hydroponics system	2017	Delhi	Yes	na	Seed	na
Kheyti	Greenhouse and end-to-end farm enabling services	2015	Hyderabad	Yes	na	Seed	105300
Khetify	DIY rooftop farming and gardening kits	2016	Delhi	No	na	Unfunded	na
Farmizen	Develops and operates digital application for community supported farming	2017	Bangalore	Yes	296585	Seed	47,300
HosaChiguru	Agri Infrastructure and developer	2006	Bangalore	No	na	Unfunded	na
Vegrow	Provider of tech-enabled farming services to farmers	2020	Hyderabad	Yes	2500000	Seed	na

Source: Compiled from Traxcn database as of February 2020.

3.6 *Startups for Farmers in Animal Husbandry*

Animal husbandry sector, with one-third of gross value added in agriculture, does attract startup ventures though not in proportion to its contribution to value added and support to smallholder cultivators (Table 6). The leaders in this segment are *Licious* and *FreshtoHome* that engage in farm-to-fork model and supply to the consumers directly. They received funding to the tune of 95 million (Series E funding) and 47

TABLE 6. STARTUPS IN ANIMAL HUSBANDRY

Company Name (1)	Overview (2)	Founded year (3)	City (4)	Funding (5)	Total funding USD (6)	Company stage (7)	Annual revenue USD (8)
Licious (Soonicorn)	Online platform for delivery of meat and seafood	2015	Bangalore	Yes	94500000	Series E	9133000
Fresh to home (Soonicorn)	Manages supply chain of meat and seafood from farm / fishermen to home	2012	Bangalore	Yes	47200000	Series B	929567
ZappFresh	Online fresh meat delivery service	2015	Delhi	Yes	9059375	Series A	4087400
Caprabook	Software for goat farm management	2015	Satara	No	na	Unfunded	na
Eggoz	Full-stack egg producer using advanced technology, IoT based poultry farming techniques	2017	Bihar Sharif	Yes	751549	Seed	362900
PoultryMon	Hatchery management solutions for poultry farms	2018	Hyderabad	Yes	na	Funded	na
Aquaconnect	Developer of products for data-driven farming in shrimp ecosystem	2017	Chennai	Yes	1101687	Seed	204300
INCEVE	Provider of SONARs for catching fishes	2016	Bangalore	Yes	na	Funded	na
Stellapps	Provider of farm optimization and monitoring support for milk	2011	Bangalore	Yes	19009146	Series B	6895700
Country Delight	Online retailer of dairy products	2015	Gurgaon	Yes	19636337	Series B	7964500
Prompt AMCS	Automatic milk collection system for dairy industry	2011	Ahmedabad	No	na	Unfunded	na
Meri Dairy	Provider of dairy management software for milk collection centers	2008	Jaipur	No	na	Unfunded	na
Farmery	Production, marketing and delivery of raw cow milk	2015	Delhi	No	na	Unfunded	765800
Eruvaka	Provider of IoT based on-farm diagnostic equipment. Animal nutrition and aqua feed	2012	Vijayawada	Yes	6780764	Series B	1360200
Krimanshi	Developer & supplier of sustainable feed for livestock animals	2018	Bangalore	Yes	na	Seed	na
Tropical Animal Genetics (TAG)	Developer of in-vitro animal breeding platform	2014	Gurgaon	Yes	na	Seed	262000
Aquaconnect	Developer of products for data-driven farming in shrimp ecosystem	2017	Chennai	Yes	1101687	Seed	2,04,300

Source: Compiled from Traxcn database as of February 2020.

Million (Series B funding) respectively. Apart from them, large ticket investments are in dairy sector start-ups *CountryDelight* (20 million) and *Stellaps* (19 million) and fishery startup*Aquaconnect* (11 million). Both *Licious* and *FreshtoHome* procure directly from farmers. While *Caprabook* is for goat farm management, *PoultryMon* is for hatchery management solutions. Dairy sector has few startups in *Stellaps*, *Country Delight*, *Prompt AMCS*, *Meri Dairy and Farmery*. *Eruvaka* and *Krimanshi* deal with sustainable feed solutions, while *Eruvaka* has developed AI based on-farm diagnostic equipment.

Listed as one of the 100 Technology Pioneers of 2020 by the World Economic Forum 2020, Stellaps digitises farm-to-consumer chain and enables dairy ecosystem partnerships including facilitating digital payments and hassle-free credit and insurance to marginal dairy farmers, apart from better milk quality and traceability (Kashyap, 2020b). It works with its innovative software solutions for dairies to enable contactless procurement, and for adhering to sanitary guidelines. It has been managing 10 million litres of milk per day and covers two million farmers in 30000 villages.

IV

OPEN INNOVATION KNOWLEDGE FLOWS

The foreging analysis reveals that open innovation as explained by Chesbrough (2003) has been taking root in Indian agriculture by joint development and diffusion of innovations by startups and other actors in the food value chain. The entry of startups has accelerated flows between food chain actors in regard to making and diffusing innovations to the end users, as the foregoing analysis shows.The knowledge flows are both outbound from the startups to the companies and other actors and sometimes in the opposite direction as well as bi-directional, as brought out in the cases above. Some of the companies have founded their own startups for various knowledge generation and use. For example, *Godrej Agrovet* instituted a venture capital fund in the name of Omnivore as an anchor investor for investing in startups. It is a leading agribusiness company in poultry feed, dairy products, vegetable oil and processed foods (Joint venture with Tyson Foods of USA for processed foods). This company has so far completed two funds with 40 million and 97 million and about to start the third one (Putrevu, 2020). Among its investments are startups working in various segments of food value chain and include *DeHaat* (Full-stack market place), *Stellaps* (Dairy platform), *GramCover* (Rural fintech and farm finance), *Bijak* (B2B agricultural commodity platform. The company has also acquired two startups for digital supply chain solutions for farm business (Chaudhari, 2012).

One of the largest processing company ITC has upgraded its *eChoupal* to more collaborative mobile platform in the name of *eChoupal* 4.0 and other companies like Bayer is harnessing the same (Anand, 2020).ITC has invested in alternative investment funds (AIF) that fund startups and is also investing directly in startups to aid in improving the business (Naik, 2019).Reliance, that started JioMart ecommerce company recently, has backed or acquired startups like *Grab A Grub* (Last-mile logistics company), *C-Square Info Solutions* (Software for managing logistics of distribution and retail operations), *Fynd* (e-commerce company), Reverie Language Technologies (language localisation technology platform), *Haptik* (AI-backed B2B chatbot maker), and *Netradyne* (Driver and commercial vehicle safety). Reliance continues to scout for many more startups as partners in innovations for food chain (Soni, 2020). Walmart-owned *Flipkart* launched a venture fund with 100 million to support early-stage startups and also a startup accelerator called *Flipkart Leap* for deep engagement with B2C and B2B startups with supply chain solutions (Poojary, 2020). It has also been leveraging supply solutions of *Ninjacart* for its grocery delivery initiative ‘Flipkart Quick’ to procure directly from farmers and committed to invest 50 million to strengthen Ninjacart (Velayanikal, 2020). Similarly, Amazon acquired the ecommerce grocery startup *ZopNow* in 2018.On the other hand, a startup by name *StarAgri* floated its own initiative for market linkages in the form of *Agrobazaar*.

The interconnections between startups themselves and their business partnerships with input companies, processors, aggregators, traders, hotels and restaurants, supermarkets, ecommerce companies, research organisations, various governments (federal as well as provincial), international institutions like the World Bank, various crop associations like tea growers association, constitute a complex web. This fast expanding knowledge flows has brought several innovations which could not be imagined just few years back. The vibrancy of the food value chains in India during the pandemic can be attributed to some extent to the activities of the startups (Medhi, 2020; Mitter, 2020; Narain, 2020).The ecosystem has been bringing to the ready access of farming community several innovative products including online marketing of farmers produce, precision agriculture solutions for crop and animal husbandry, traceability solutions, storage solutions, online financing, innovative field level cold storages, irrigation control, customised mechanisation solutions on rent, rapid quality assessment and grading, third party logistic solutions. Most of the innovations explained above are innovations flowing from the startups to other actors in the value chain, which itself has been accelerated and invigorated with missing links covered up. It needs to be highlighted here the fact that innovations in value chain organisation can accelerate technology adoption by the farming community (Swinnen and Kujipers, 2019).

V

SUMMARY AND CONCLUSIONS

Entrepreneurial new firms can bring in radical innovations better with risk-taking approach. Startups have been proliferating in all sectors of the economy including agriculture in developing countries in recent years. Their demand for capital that can support risky innovative ventures catapulted a venture capital industry in the country in the new millennium and enhanced flow of capital. This paper harnesses a large database of startup data in India and examines the nature of innovations in the startups working in agriculture in open innovation framework, analyses startups according to their roles in the value chain, funding and investment and revenue.

There are several types of startups that have come up in the last decade that are filling the gaps in the food value chains in infrastructure deficit regions of the country and introducing innovations. Our estimates show that they mobilised investments to the tune of 8 billion USD into food and agriculture sector producing four unicorns and three soonicorns by the end of 2020. Most of these startups operate in tandem with various other related companies in downstream with the supermarkets, retailers, hoteliers, in the midstream with the processors, wholesalers and logistic firms, and in the upstream with the input companies and so on. The entry of startups has accelerated flows between food chain actors in regard to making and diffusing innovations to the end users. The knowledge flows are both outbound from the startups to the companies and other actors and sometimes in the opposite direction as well as bi-directional.

The interconnections between startups themselves and their business partnerships with input companies, processors, aggregators, traders, hotels and restaurants, supermarkets, ecommerce companies, research organisations, various governments (federal as well as provincial), international institutions like the World Bank, various crop associations like tea growers association, constitute a complex web. These fast expanding knowledge flows have brought several innovations which could not be imagined just few years back in developing countries. The ecosystem has been bringing to the ready access of farming community several innovative products including online marketing of farmers produce, precision agriculture solutions for crop and animal husbandry, traceability solutions, storage solutions, online financing, innovative field level cold storages, irrigation control, customised mechanisation solutions on rent, rapid quality assessment and grading, third party logistic solutions. These innovations are from the startups to other actors in the value chain, which itself has been accelerated and invigorated with missing links covered up.

The accelerated and intensified knowledge flows across disparate actors in the food value chains, leading to emergence and faster diffusion of innovations, are the essence of innovation system (World Bank, 2012).The emergence of open innovation in agriculture augurs well to flows and to harness higher level of technologies. The factors leading to open innovation, termed erosion factors by Chesbrough and Bogers (2014), significantly influence the evolution of this innovation system. Most of these erosion factors including startups getting venture capital, rise of internet with 800 million internet users, widespread use of social media, universities becoming innovation hubs, and mobility of employees, are present in India and they combine to create this open innovation system. Venture capital has grown over the years and India has become one of the favoured destinations (Dossani and Kenney, 2002; Nuthalapati and Singh, 2019). After a long period of stagnation and ‘technology fatigue’ (Narayanmoorthy, 2007), Indian agriculture is in transition and moving towards higher level of technologies with better and faster linkages among various food chain actors. As experience in other countries demonstrated, open innovation is required during the transition stage to higher level of technologies and the innovations will be less radical without knowledge flows (Medeiros *et al*., 2016). The government needs to develop policy framework to create necessary enabling environment for development of the startup ecosystem that include venture capital industry, and associated policy changes. It is worth mentioning few key measures like early stage support through seed fund, encouragement to angel investors, mass incubators, level playing field for non-technical startups.

The nascent stage of development of this open innovation needs dispassionate research on these developments from the purview of equity and the possibility of scaling up these ventures. Also required is research focus on the type of business models, collaboration and licensing agreements between companies, universities and governmental agencies. The limited and available evidence points to the startup innovations accessible more to the larger farmers (Singh, 2016; Hennessy *et al.*, 2016). Food chain actors resisting these open flows will be worse off in terms of net welfare gains and this will be much more problematic if the farming community are bypassed by these innovations.

Policymakers in Europe have internalised the three core principles of open innovation (Open science, open innovation and open to the world) in its Mission-oriented Innovation Policy (MIP) as the core of the *Horizon Europe* progamme. Preliminary studies in the Netherlands show that corporate startup collaborations can improve innovation performance and enhance competitive advantage and at the same time mediating and moderating factors are important to be kept in mind (van der Boezem *et al*., 2015). This is warranted as startups and chain actors interact with others keeping their own interests rather than the wider interests and therefore this innovation has to be internalised and mainstreamed into the agricultural development planning, mindful of the twin objectives of growth and equity (Lele and Goswami, 2017; Korreck, 2019; Singh, 2020). The entry of open innovation in food value chain actor bodes well for the agricultural sector and it calls for wider engagement by economists in research related to the factors leading to this innovation in terms of business mechanisms, socio-economic contexts, technological drivers and both supply and demand side factors.

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Summaries

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Strategies for Linking of Joint Liability Groups of Farmers with Farmer Producer Organisations for Transforming Agricultural Activities into Livelihood-cum-Business Enterprise

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The study attempts to explore the strategies to transform the agricultural activities of Joint Liability Groups (JLG) farmers by linking with FPOs with the following objectives (i) To find out the major challenges / constraints faced by JLG farmers and its possible remedies through linkages with FPOs and (ii) To recommend for the adoption of different strategies by FPOs of JLG farmers for improving the livelihood and agribusiness activities of its members. The study is based on data collected from NSS reports, *Agricultural Statistics at a Glance*, Agricultural Census Reports, published documents of NABARD and other published sources. The study initially highlight the major challenges / constraints faced by JLG farmers based on which it could explore the strategies to improve the existing agricultural activities of JLG farmers at pan-India level by linking with FPOs. The study concludes that JLG farmers are the disadvantaged section of farming population. They face several constraints in their agricultural production activities like uneconomic holdings which result in inadequate marketable surplus and low bargaining power and cannot realise better price for their produce. In order to overcome the problems it is imperative for JLG farmers to form collectives i.e., FPC. The FPC will motivate the farmers to grow vegetables, rear milch animals and adopt poultry farming as backyard poultry. These type of activities are labour intensive and generate regular flow of income. FPC as agri-value chains operates with backward and forward integration. Thus FPC will help the farmers to realise better price of their produce and improve their income and in turn their quality of life and pattern of livelihood. Gradually the FPC can explore ways for expanding and strengthening of its business activities and achieve viability and sustainability.

Efficient Supply Chain for Paddy Seed in Jashpur District of Chhattisgarh

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The present study seeks to analyse the present status of supply chain marketing pattern and market structure in rice seed at dealer's level in Jashpur district of

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Chhattisgarh, farmers' preferences in rice seed purchase and promotional measures adopted by seed compaines. Out of eight blocks of the study district, Kunkuri and Bagicha blocks were selected on the basis of more number of rice seed growers and retailers. Four villages were randomly selected for each in north, south, east, west and central part of district and from each sample village, 80 hybrid/rice growers were interviewed through a pre-designed questionnaire. The results of study indicated the different supply chains involved in the marketing of rice seed in the study area. Besides most of the respondents belonged to Scheduled Tribe (ST) and scheduled caste (SC) are school educated having large size of land holding and they mostly performed rain fed agriculture. In the study the value of Gini coefficient was found to be 0.84, which clearly indicated that there was intense competition among dealers and market structure was uniformly distributed. In terms of the ranking of factors influencing the preferences of rice seed purchase the farmers ranked higher yield as first followed by good germination, good dealers availability of credit, dealers guidance, neighbors or family opinion, and finally the brand and price . The study envisaged that farmers were growing more hybrid seed rather than high-yielding varieties (HYV) seeds for their rice cultivation, with nearly 20 per cent farmers were using hybrid seed and 80 per cent farmers used higher yield HYV seeds. With regard to preference of a particular brand, 48 per cent farmers believed higher yield, 20 per cent farmers believes on disease and pest resistance, 6 percent farmers believed for timely availability of seed, 8 per cent believed longer viability of seed. The study also revealed that most of the farmers were unaware about the promotion measures used in rice seed marketing such as field demonstration, sample distribution in dealers shop, farmers visit to research plots, slide show, and television. All in all the study concluded that the important factors which influencing to preference of farmers to rice seed purchase were higher yield, good germination and availability of credit to the farmers.

Creating an Ecosystem of Agri-Innovators for Agricultural Development

Deepak Pal and Laveena Sharma*

The Business Planning and Development (BPD) unit of Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh is providing incubation services and capacity building programs on various agri-managerial aspects, along with showcasing of technologies for commercialisation. Keeping in view the above the study attempts to analyse the performance and impact of BPD Unit as institutional initiative for creating an ecosystem of agri-innovators for agricultural development. Since the inception, it has played a vital role in the development of agripreneurship and commercialising transferable technology through incubator, protection through

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IPR, licensing, commercialisation, market linkages, quality assurance system and human resource development. It is a unique ecosystem of mentors brought together to advise, share, and collaborate. Through its capacity building programmes and transfer of technology about 850 (approx) participants have been trained on different issues of agriculture and allied subjects for agripreneurship development. This project has been supporting the doubling the farmers income by 2022 campaign along with the states priority of 'Farm as Enterprises' promotion and the impact of this has been clearly visible on the society.

Agricultural Marketing Reforms in Madhya Pradesh – Status and Potential

Pooja Pastore Shukla and Kanhaiya Ahuja†

The objectives of the paper are (i) to perform a qualitative assessment of the current status of agricultural marketing in the state of Madhya Pradesh and (ii) to study the policy frameworks which have influenced the structure, conduct and performance of its agricultural markets and identify the potential areas for further improvement. Despite undergoing multiple reforms, the agricultural marketing in Madhya Pradesh still employs practices which cannot be called inclusive. The prevailing marketing system in Madhya Pradesh is a mix of traditional and local practices and over a period of time, many of these markets have lost momentum despite the best intentions and efforts of the government. Over the last decade or so, newer needs such as increasing volumes of output, greater horticultural production, price disparity across markets are compelling a thorough review of the mandi system in its entirety. The very objective of introducing these reforms of preventing farmers from distress selling, though fulfilled to some extent, are yet to be fully realised. The five-year development plans and the economic reforms of 1990s have completely transformed the Indian economy and market dynamics, impacting its transactions both locally and globally. These should have been followed with some corresponding structural and functional reforms in the agricultural marketing considering it as a complex, diverse and rapidly changing phenomena, with a mix of organised and unorganised sectoral practices. The agricultural marketing system in the state is in dire need of a paradigm shift from its production-oriented approach to a focus on the demand side, which in turn will make it more sustainable and growth oriented. Therein lies immense potential in the areas of agro processing, marketing, branding, value addition, organic farming and domestic and global exports. An entirely differentiated set of marketing practices, specialised agricultural markets and supporting infrastructure are essential to tackle the prevailing distress among the farmers, which is possible only with adequate and timely government intervention.

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Role of Institutional Interventions in Custard Apple Value Chain Development

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Custard apple is a perishable fruit grown wildly in the forest areas of Southern Rajasthan. This area is mostly a tribal area and custard apple plays an important role as an income generation activity for the tribal population during its fruiting period. In order to reduce huge post-harvest losses and development of value chain in custard apple, Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur (Rajasthan) introduced browning free technology and pulp extraction machine. The present study outlines the role of MPUAT, Udaipur in custard apple value chain development. It also analyses the two alternative value chains, viz., private processing unit and farmer-producer company involved in custard apple processing. A sample of 50 tribals selling custard apple to each processing units was randomly selected from the records of each processing unit. Acharya's method was deployed to evaluate the marketing efficiency of value chains. The study revealed that by using the technology, problem of browning in custard apple pulp processing was resolved. The value chain with private processing unit as an actor had more operational efficiency as well as marketing efficiency but the employment and entrepreneurship development of tribal women was better in case of farmer producer company. The value added through adopted value chain in rupee terms was Rs. 57.27 per kg in private processing unit and Rs. 50.28 per kg in farmer producer company. The study emphasised the need of market development, demand creation and value chain development for income and employment generation of tribals of Southern Rajasthan.

Institutional Arrangement and Constraints in Surface Irrigation Water Management: A Micro Level Study of Northern India

Subhash Chand and R.C. Srivastava†

The Warabandi is an age old irrigation system in the canal command areas practiced in India. Innovation in technology, diesel and electricity led to the emergence of groundwater exploitation. In this context this study aimed to understand intuitional arrangement in Warabandi areas, its functioning and constraints of declined canal irrigation system in North India. This study was conducted in two states Haryana and Uttar Pradesh and one district with four villages of two blocks from each state which falls under canal command areas was randomly

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selected. A total of 604 respondents were intensively surveyed using structured and pretested schedule and the study pertained to the agricultural year 2015-16. The data were collected on socio-economic status, input use in farm production system and types of irrigation management institutions, reasons of why warabandi system least preferred by the farmer than ground water supply. The results of the study indicated that the concentration of groundwater extraction was increasing in both the areas; cultivated land/tube well ratio was 1.31(ha):1 (per tubewell), 8.4(ha.):1 (per tubewell) for UP and HR, respectively. The socio-economic characteristics indicated that there was a significant difference in both the states. In both the states PRI was playing a greater role in channel maintenance, conflict resolution, management of common water as expressed by 78 per cent households. The study indicates that Warabandi system is slowly fading away due to encroachment and demolition of field channels, decreased water supply, and dependency on groundwater extraction etc. and they were of the opinion that irrigation department fail to release the water in time followed by non-availability of staff at office, non-cooperation by irrigation department and farmer's fellow, frequent droughts and heavy rains, price fluctuation and market failures etc. to sustain canal irrigation system and to minimise the exploitation of groundwater.

Economic Analysis of Marketing Cost, Marketing Margin and Price Spread under Different Marketing Channels of Bhendi in Tirunelveli District of Tamil Nadu

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The study attempts an economic analysis of marketing costs, marketing margin and price spread under different marketing channels of bhendi vegetable in Tirunelveli district of Tamil Nadu. The marketing efficiency in case of Bhendi vegetable has been estimated for different three marketing channels. The major Bhendi growing blocks in Tirunelveli district, viz., Sankarankovil and Vasudevanallur blocks account for 38 per cent of total production of bhendi and these blocks were selected purposively for the present study. Six villages from each block were selected randomly and ten farmers were selected from each selected villages with a total sample size of 120 farmers and 40 intermediaries, namely, commission agent, wholesaler and retailers were selected. The study revealed that marketing efficiency of bhendi vegetable was much higher in channel III than that of channel II and Channel I. There was no involvement of any intermediaries in sale of produce in Channel III. On the other hand the higher marketing margins were taken away by the market intermediaries in the channel I and channel II resulting in the poor efficiency in the marketing of bhendi in the study area.

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Study on Role of Agribusiness Startups in Agriculture Development: A Case Study of Jawahar R-ABI

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Agritech Startups are providing relevant and innovative solutions to a number of challenges faced all across the agricultural and allied sectors. An effort was made by – RAFTAAR - Remunerative Approaches for Agriculture and Allied sector Rejuvenation, Ministry of Agriculture and Farmers' Welfare, New Delhi with the establishment of 24 Agri Business Incubators (R-ABIs) in the facilitation of five knowledge partners across the country in 2017-18. Apart from RKVY-RAFTAAR multiple policies have been implemented to support agri start-ups, their early take off and successful operations. Jawahar R-ABI, Jawaharlal Nehru Agricultural University is one of them and generators of agricultural technologies, having large pool networks of technical and business experts, industry, government partners, financial partners, experts from agri-sector, and extensive mentors to support the startups ecosystem. This paper highlights the role played by agribusiness startups in agriculture development in the facilitation of Agribusiness Incubation center (Jawahar R-ABI) in developing, supporting and promoting agri entrepreneurs in the country. Within a short span of time that is less than 1 year, 24 startups have been graduated from Jawahar R-ABI and apart from this Jawahar R-ABI startups providing employment to many others and play a very significant role in agriculture development. Thus for long term sustainability, and make the dream of a self-reliant India come true it might be necessary to build up more functional and financial autonomy to accelerate incubation and entrepreneurship in the agribusiness ecosystem.

Strengthening the Supply Chain through Institutional Intervention – A Case Study in Uttar Pradesh

Shubhi Patel, Rakesh Singh, O.P. Singh and Vaishnavi Singh*

The role of institutions is undeniable in controlling the uninterrupted flow of agricultural produce from farm to the consumers basket. This study deals with the institutional dimensions in agriculture supply chain and documents a case study of an NGO IRADA that has organised 2000 farmers into Farmers Producers Organisation (FPO) for supply chain management. The study reveals that institutions play a crucial role in removing the disruptions of the supply chain through timely reforms and

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interventions. One such intervention of direct selling through FPOs has come up with a solution to improve the marketing efficiency and reduce the price spread of fruits and vegetables. The case study reveals that direct selling of fruits and vegetables through FPO fetched higher returns to the farmers and share in consumer rupees. The transaction cost is negligible and profit is shared with the farmers after selling. The recent reform of direct marketing increased the business of FPO by two fold. Additional benefits of institutional linkage received are subsidies, trainings, technical knowhow that further improves their farming. Thus it can be said that the institutional intervention has benefitted the farmers as well as the consumers who pay low price for quality produce. Such interventions should be promoted and replicated in other areas in order to improve the supply chain.

Price Behaviour of Grapes in Maharashtra: A Temporal Divergence Analysis at Wholesale and Retail Level

Deepak Shah†

Horticultural crops like grape are subjected to high price volatility due to lack of storage, transportation and processing facilities, aside from weather and institutional risks. Further, though the demand for various fruit crops shows a rising trend, the supply chain of these high value commodities is fraught with several issues like lack of transparency in prices to farmers, weak supply chain links, predominance of intermediaries, which ultimately leads to revenue loss to farmers and higher price of crop produce at consumers end. There are also wide fluctuations in monthly prices of grape, which lead to seasonality and which cause a perpetual concern to producers. Fluctuations in annual prices, which are generally cyclical in nature, also affect the export performance as well as domestic marketing of produce. In the light of this background, the present study seeks to examine the price movement of grape in the state of Maharashtra with focus on nature of price fluctuations at wholesale and retail levels. The study clearly underscored the fact that the cyclical fluctuations in annual and monthly prices of grape led to a cause of perpetual concern to producers since their share in consumer's price still remained at lower ebb. The computation of typical seasonal indices of wholesale and retail prices clearly exhibited a trend of peak wholesale and retail prices of grape in the month of December and May with lowest prices in this respect being observed in the months of March. One of the major factors responsible for lower share of producer in retail prices of onion was traced in higher cumulative marketing margins cornered by various market functionaries within the channel. It is to be noted that due to inadequate infrastructure facilities most of the farmers prefer to dispose of their produce immediately after harvest, which results in low prices on offer. This obviously necessitates developing adequate

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post-harvest infrastructure facilities like storage, transportation, pre-cooling units, cold storages, refrigerated vans for the transportation of highly perishable fruit crops vegetables, etc., especially to protect the farmers from undue low prices on offer. The study also favoured exercising various regulative measures to check practices of various functionaries involved in the marketing of high value crops.

Role of Institutions in Coffee Production: A Case Study of Kodagu

Gana Shruthy M.K. and Parmod Kumar*

Taking into account land tenure as an institution in coffee agro-forestry system, the paper deals with two major land tenures in Kodagu, viz., redeemed and unredeemed land tenures. The paper attempts to understand the role of land tenure on coffee productivity and agro-forestry systems and shift taking place from Arabica to Robusta variety of coffee. The paper also looks into the role of major institutions in controlling the problem of Coffee Leaf Rust and Coffee Berry Borer. The study uses primary survey data collected from 120 coffee growers (60 Arabica and 60 Robusta growers) in Kodagu district of Karnataka state during the reference period 2015-16. The results indicate that the land tenure system had a considerable impact on productivity and coffee agro-forestry system of Kodagu. Interestingly, the impact of land tenure system was diametrically opposite among the two varieties of coffee. Though, the institutions played a vital role in controlling the major pests and diseases, however, the paper calls for re-dressal for re-designing policy outlook particularly to improve the livelihoods of marginal and small growers.

Economics and Institutional Aspects of Protected Cultivation of Rose and Its Supply Chain in Maharashtra: An Empirical Analysis

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In India, the government provides subsidies for adoption of efficient farm technology to enhance farm productivity. However, adoption rate of technologies varied significantly and some technologies negligibly adopted without subsidy support. Protected cultivation has a better input use efficiency, enabling the farmers to produce more output per unit area. In this context the paper analyses the economics of cultivation of rose under polyhouse condition in Maharashtra and discusses their practical implications for the promotion of this technology. It is thus important to assess the status of protected cultivation in India, the role of various

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institutions involved in its promotion, to evaluate the economic feasibility of polyhouse cultivation of rose and to assess supply chain and marketing of rose in Pune and Nasik districts of Maharashtra. Specifically it assesses the role of various institutions involved in its promotion and estimates the profitability of rose cultivation under polyhouse along with its price spread in market. The results of the analysis indicate that the cost of establishment of rose under polyhouse was very high, but offers increased returns. The feasibility analysis shows that rose cultivation under polyhouse are feasible under both with and without subsidy support. However, it is more profitable to farmers with subsidy support which have lesser payback period. Five types of marketing channels are being followed in Maharashtra for marketing of rose. Government subsidy support will serve as demonstration effect for higher adoption of efficient technology like polyhouse. Thus, it is suggested that protected cultivation of rose under polyhouse should be promoted among the farming community for its larger adoption as it will have a positive impact on farm income and profitability. Also, Farmers Producers Organization (FPOs) should be encouraged in helping farmers to look for better inputs and to access better markets.

Institutional Arrangement for Efficient Supply Chains in Agriculture

D.V. Subba Rao*

Institutions integrate various market functions under networks. Efficient supply chains play a pivotal role to address market imperfections stemming from backward and forward linkages in input supply for production as well in commodity processing and product marketing. The aim of the study is to explore an institutional framework for most profitable, scalable and sustainable innovative production and supply models for substantial improvement in net income and employment. Data collected from 63 farmers during the agricultural year 2018-19 are used for the study. Majority of the farmers are small with an average farm size of 1.02 ha. The important crops are flowers, mostly Jasmine, Artimesia anisofolia (line leaf), green chillies as well paddy. Technological and institutional interventions showed that biological control measures such as application of Trichoderma in Jasmine, erecting yellow sticky traps within the chilli fields to control leaf curl virus, and training in vermi-composting have yielded higher returns at reduced cost. The adoption of climate resilient practices reduced the cost of cultivation while improving sustainability of agriculture with continuous flow of income throughout the year. It is suggested to encourage farmers to extend line leaf cultivation as it is significantly contributing to income. Increase the farm size which facilitates to increase income of the farmer. As there is huge livestock population in the village, these activities need to be integrated for additional income. All the interventions are made possible at the instance of Parimala FPO

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supported by NABARD. It has improved the traditional supply chain in providing agri-inputs and arranging output marketing and helps in enabling institutional integration.

Tenancy and Institutional Barriers in Rural Andhra Pradesh: Observations from NSSO Data

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The study is concerned with institutional barriers, particularly in credit and product markets, faced by tenant farmers in rural Andhra Pradesh. Using NSSO data, there are three distinct findings on the relation between lease market institutions are found. First, in 2012-13, small tenant farmers constituted the major category among tenant farmers in rural Andhra Pradesh. The land scarcity among the lower rung of peasantry, otherwise known as land hunger impels large tenant farmers to lease in land. There are evidences of leasing out of land by small land owners in rural Andhra Pradesh as well. The increased prevalence of tenancy suggests that, during the decade 2003 to 2013, small farmers leased land in and paid higher rent per hectares in order to sustain mere economic size of their farms. The second finding suggests that fixed rent paid in cash prevailed in coastal regions of rural Andhra Pradesh, however the tenant households with marginal operational holdings, still continue to engage with share produce rents in the market. Thirdly, there are two institutional barriers faced by the landless and marginal tenant farmers in the State. An exorbitant amount of rent (particularly when seen as a share of the gross value of output) often reinforces the existing inequality and the socio-economic differentiation of peasantry in rural Andhra Pradesh. Due to this, the dependence on informal credit then exacerbates the economic plight to a further extent.

A Study on Institutional Credit and Its Effect on Farm Investment in Mango Production in Krishnagiri District of Tamil Nadu

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The present study has been attempted to assess the various financial institutions and its role in farm investment in mango production in Krishnagiri district with the sample of 180 mango farmers comprising 90 borrowing and 90 non-borrowing mango farmers. The study was conducted in the three blocks, namely, Bargur, Kaveripattinam and Mathur blocks which have the highest acreage and production under mango. The study has revealed that majority of the borrowers depended on co-

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operative banks to meet their credit requirements which is similar to that of state level agricultural credit disbursement. It was followed by commercial banks, micro finance, relatives and friends and the mango processors. The returns from investment were higher in case of the borrower farms than that of the non-borrowers due to access of credit form the financial institutions. In returns to investment function of borrowers, all four variables viz., farm investment, institutional credit or owned capital, labour usage and non-farm income were contributing positively whereas in non-borrowers farms, returns to investment was influenced by labour usage and non-farm income at less significant level. Thus the institutional credit plays a vital role in the farm profitability which resulted in economic and social development of the farmers in the study area. Due to the prevailing dependence on local money lenders there is an urge to strengthen the institutional credit system for agriculture and allied activities.

Diversification of Agriculture towards High-Value Crops: A District-wise Study of Himachal Pradesh

Jyoti Chaudhary† and H.P. Singh‡

During the last few decades, the agricultural diversification in Himachal Pradesh towards high-value crops, i.e., fruits and vegetables including off-season vegetables has increased at a fast rate. The process of diversification has started in the late sixties and picked up pace in the eighties after that the state has made reasonable progress. This paper has studied the growth in the area, production, and productivity of all foodgrains and non-foodgrains for over three decades. The data for all the 12 districts of the state namely Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Lahaul& Spiti, Mandi, Shimla, Sirmaur, Solan and Una have been collected for the years 1991-92 to 2017-18. The extent of crop diversification has been studied by analysing temporal changes in the cropping pattern, the area under fruit and vegetable crops. The analysis brings out a shift in the cropping pattern of agricultural commodities as the area under foodgrains declined and increase in the area under high-value commodities in the state. Agriculture has diversified from the cereal crops towards high-value commodities; thus, the horticulture sector also registered a significant increase in terms of vegetables including off-season crops (pea, cauliflower, cabbage, etc.) and fruits production. Considerably better performance of the agriculture sector in the state became possible because of the flourishing horticultural sector. The crop diversification was most prominent in the districts which have favourable agroclimatic conditions for the cultivation of these crops as the shift can be seen in the gross cropped area under high-value commodities in these districts. Since high-value crops generate better returns and land productivity also

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increases with the increased diversification, thus this would help to boost the economy of the state.

Economic Analysis of Rice Value Chains in Western Odisha: Problems and Prospects

Suvangi Rath, Pujalipta Behera and Sarba N. Mishra*

A study was conducted on the value chain analysis of rice in Sambalpur and Bargarh districts of Odisha. The objective was to study the gaps of rice production, value chain and problems and prospects in the value chain of rice in Sambalpur and Bargarh. Data for this study was obtained from field level household surveys across 3 blocks of Sambalpur and Bargarh district. A total of 81 farmers were interviewed, 41 from Sambalpur and 40 farmers from Bargarh. In Sambalpur district, the survey was done in major rice growing area viz. Kuntara, Pandaripathar, Chandanimal, Daleswar, Gochara, Tihadipali and Bagadhi villages of Kuchinda block. In Bargarh district, the survey was done in Balijudi, Patrapali, Nuagarh, Jandal, Badmal, Bagartipali, Balijhari villages of Bheden and Bhatli block. There were two different types of farmers, one being high yielding variety (HYV) growers and the other being hybrid growers. In case of millers the survey was conducted in Burla area of Sambalpur district and Bhatli area in Bargarh district. The millers were again of two types one who process the common raw rice and other who process the parboiled rice. Many categories of rice value chain exist in the State. Parboiled rice, flaked rice, puffed rice, rice bran oil and many more can be derived from this value chain. In Sambalpur mostly flaked rice, puffed rice value chains are followed for consumption. The study concluded that the cost of one quintal of common rice was Rs 2637.10 and that of parboiled rice was Rs 2591.41. Illiteracy of the farmers and lack of adequate and timely supply of seeds were found to be the major issues that prevent the farmers from reaping better economic benefits.

Farmer Producer Company in India: Its Structure, Performance and Scaling up Potential

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Farmer Producer Company (FPC) is a formal farmer collective, which is a hybrid of professionally managed company and co-operative in terms of ensuring

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inclusiveness of small holders. Of over 7000 FPCs, many are defunct and many are struggling to survive which call for a relook at the organisation. This study has synthesised the evolution of farmer collectives, business potential of FPCs, and features of FPCs and challenges faced by them. This article also used four FPC cases established in Tamil Nadu about 4-6 years ago. The study showed that FPC is structurally different and superior to other institutional innovations such as cooperative, contract farming and other groups such as FIG, CIG, farmers' association and farmer clubs. The analysis of minimum business potential showed that there is a huge gap between present status and minimum business potential. FPCs were facing several challenges, which were limiting their survival and scaling up potential, such as low level of participation by the members, wide and faster expansion in non-core businesses and shortage of funds. The study also proposed various strategies to make FPCs sustainable and inclusive to the small holders.

Does Institutional Innovation in Groundwater Sharing Stimulate Market-led Farming Systems? A Case Study from Odisha

Surajit Haldar*, **Debdutt Behura****, **Smita Susovita**** **and**
Sk Mahidur Rahaman***

Water user association (WUA) is known for its manifold socio-cultural-economic benefits irrespective of its place of formation and scale of operation. The study has been attempted to answer how such a sharing arrangement shifted smallholders and land use pattern decision especially when the market is favourable. A mixed method of survey was adopted to collect primary data from 20 WUA from 12 villages of the two adjoining districts, viz., Cuttack and Jagatsinghpur of Odisha state. At first, focus group discussions were conducted to collect information on the land use and land cover change (LULCC), irrigation provision and market accessibility by the WUA farmers. Based on these three parameters, surveyed villages were clustered into four different groups, namely, highly diversified irrigated agriculture for direct market supply (HDIAM), moderately diversified limited irrigated agriculture for direct market supply (MDLIAM), moderately diversified limited irrigated agriculture for indirect and limited market supply (MDLIAIM) and least diversified mostly irrigated agriculture for direct market supply (LDMIAM). HDIAM and MDLIAM farmers were diversifying their land use mostly to off-season vegetables that fetch a remunerative price. MDLIAIM farmers though shifted to vegetables and sold that at the farm gate price to the traders but also specialised to sugarcane cultivation taking the existing facility of contract farming with the sugar mill. Their market accessibility was limited by a distant secondary market and poor transportation and communication facility. For LDMIAM, rainy season rice area was reduced to half of

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the gross cropped area and is replaced by sugarcane after WUA formation. Hence, an irrigation provision through WUA enhanced farm economics while the market determined land use pattern and land cover change.

Contribution of Institutions during Covid 19 Pandemic: A Qualitative Analysis

Rooba Hasan†

Lockdown announced due to Covid 19 pandemic has impacted livelihood activities and disrupted the food markets. It has become a threat for vulnerable sections. At this time of rough livelihood shocks in all the sectors of the economy and government failure due to covid 19 pandemic the non-government Institutions became decisive in briefing the gaps formed by institutional failure. In the light of this, the present paper attempts to analyse the problems faced by the households from different walks of life and tries to critically examine the contribution of non-government institutions in providing livelihood support, supply chain support and food security during covid 19 pandemic. It has been observed from the results that coordination of government and non-government institutions played a significant role in solving problem of food and livelihood insecurity of migrants and other households. The collective work of government and non-government Institutions played an immense role in determining the vulnerable sections of the society and supporting them. the non-government Institutions has played a vital role in arranging inputs for production especially during the supply chain disruptions due to lockdown and in linking producers with the markets through different initiatives. The training provided by them helped women in arranging alternative livelihood and financial security. Thus they have been able to give boost to employment opportunities other than those based on factory model of production. The role of these non-government institutions is crucial for households in linking market and accessing government support. They also used funds provided by private and government for their activities. This model can also be disseminated to avoid failure of government schemes and market failure.

Improved Agriculture and High-Value Farming through Corporate Social Responsibility: A Case of CybageAsha in Pune

Anushka Awasthi, Khushi Mishra, Millena Mohanty and Varun Miglani*

Cybage CSR team took a step forward in reaching out to the farmers of villages in Pune district, through partnership with BAIF Development Research Foundation in implementing Integrated Livelihood program (ILP) in 2017-18. The paper evaluates

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the income and yield changes due to adoption of package of practices (PoP) in paddy cultivation and the perception of the farmers towards the CSR initiative. Before/after design is adopted to evaluate the changes and data was collected using the pre-tested interview schedules from 54 farmers and 89 per cent of the sample farmers were small and marginal farmers indicating the initiative were inclusive. The farm extension services and improved quality seeds yielded higher production and income. Farmers training and financial support helped the farmers to diversify their cropping pattern and increase cropping intensity from 128.6 per cent to143.1 percent with the increased area under vegetables. Agricultural and household assets of farmers have also seen increase from 2017 to 2020. Farmers were satisfied with the work started by BISLD and with the sincerity of the team members. Farmers have suggested the need for support in accessing farm machinery, lift irrigation scheme, land-levelling methods and road development. After assessment and interpretation of the parameters taken into consideration, the study concludes that this programme has been beneficial and gives a sustainable solution to the farmers for their source of livelihood. The strategic partnership between BISLD and Cybage has resulted in the holistic development of the participants involved.

A Study on Modern Reforms in Indian Agriculture by Adopting Seven-Point Strategy

Vijayachandra Reddy S. and Vasudeva Naik K.†

Farmer's income can be doubled by adopting the seven point programme strategies. Among seven strategies, the most important strategies have been highlighted. The first and foremost strategy is improve the irrigation efficiency by adopting Pradhan Mantri Krishi Sinchai Yojana, which added total value of ₹ 23 lakh crore to the gross domestic product (GDP), assuming that an investment of ₹ 251,665 crore is made by the central and state governments in the form of incentives. In addition to direct economic benefits to farmers and the government, the additional production would ensure food security as well as profitability to farmers. Most importantly, through enhanced water and land-use efficiency, sustainable development could be achieved, while creating millions of jobs such as water technicians, farmer facilitators, protected vegetable cultivation technicians and value chain experts. This will also strengthen agriculture related industry development, while marketing and processing will generate growth and tax revenue to the government. Government introduced Soil Health Card Scheme to inform farmers about nutrients status of the soils. This would help in reducing the cultivation cost of the farmers. With the decrease in cost of cultivation and increase in yields, net incomes of the farmers increased between 30 and 40 per cent after the SHC scheme.

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To protect farmers from losses, the government is focusing on storage facilities and integrated cold chains in rural areas. "Pradhan Mantri Kisan Sampada Yojana (PMKSY)" It is an umbrella scheme incorporating ongoing schemes of the Ministry like Mega Food Parks, Integrated Cold Chain and Value Addition Infrastructure, Food Safety and Quality Assurance Infrastructure, etc. and also new schemes like Infrastructure for Agro-processing Clusters, Creation of Backward and Forward Linkages, Creation / Expansion of Food Processing & amp; Preservation Capacities. In this scheme, food-processing capabilities would be developed by working on the forward and backward linkage of agro-processing cluster, which would benefit 20 lakh farmers and create employment opportunities for about five lakh persons.

Agricultural Value Systems and Monetisation of Agri- Produce

Ashok Dalwai*

Agriculture is in need of a new mandate, which goes beyond securing food, fodder and feed requirements of humans and livestock, and includes generation of productive jobs and incomes for the farmers as equally important. This seeks a paradigm shift in perception of agriculture as a default occupation, and purely a production activity into an enterprise that operates on the principles of agri-business. This implies, practising agriculture as profit-centric vocation that necessitates demand and; market-led operations all along the agricultural value chain, that comprises pre-production, production and; post-production activities. In essence, it calls for looking at agriculture as an eco-system, with due emphasis on realising higher productivity at efficient cost of production, and producing in response to market demand. The paper postulates that agricultural value systems built on robust supply chains are a way forward to practice of agriculture as an agri-business. Further, it elaborates upon the constraints that impaired such a possibility so far, and the new policy and reform framework that opens up huge opportunity for promoting both domestic and global supply chains, which will serve the interests of farmer-producers and consumers. When agriculture, a biologically driven production system is operated efficiently, resource use becomes rational and food loss is minimised, aiding ecology at large.

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Institutions and Efficient Supply-Chains for Agriculture Development with Reference to Farmers' Producer Companies in India

Arifa Sultana†

Institutions like Farmers' Producer Companies have evolved due to failure in co-operative system in India. The supply chain of these FPCs are very crucial for the agricultural development as it involves millions of small and marginal farmers who are dependent upon them and hope to increase their incomes by reducing the transaction costs at every step of supply chain. Transaction cost and social capital approaches from the new institutional economics theory explains how benefits can be obtained from the supply chain. The various issues and challenges in the supply chain for FPCs are forecasting demand and supply, keeping up the quality and maintaining relations with suppliers, appointment and retention of chief executive officer, and information and communication for decision making that results in increase in income. The supply chain model of Chetna Organic Farmers Producer Company Limited shows that the company's supply chain has proved to be sustainable and increased the incomes of the members.

Augmenting Farm Income through Supply Chain Management – Few Case Studies in Telangana State

Rajani Adikarla*

There has been a disconnect between agricultural growth and farmers' well-being, in past two decades. This has been due to the failure of existing marketing system in providing remunerative prices for the agricultural produce supplied by farmers. Hence, efficient agricultural markets are important for the farmers, more so for small and marginal farmers wellbeing. This study makes an attempt to examine the contribution of supply chains of agro products to farm incomes of farmers in Telangana State through a 'Case Study' method. It is evident from the case studies that the cropping patterns are more diversified under ZBNF compared Non-ZBNF. The ZBNF farmers obtained higher yields, lower cost of production higher incomes apart from soil fertility improvements. The farmers' collectives -Primary Agricultural Cooperative societies (PACS) are found to be highly beneficial for Non-ZBNF farmers and for specific crops like paddy. Case studies as they are isolated reflect the micro situation, but scaling up of beneficial supply chains to farmers producing through innovative methods is the challenge to the policy makers.

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SUBJECT II
AGRICULTURAL LABOUR, SKILL DEVELOPMENT, LABOUR PRODUCTIVITY AND EMPLOYMENT

Factors Affecting Migration of Labourers from Domestic Agriculture and Its Impact on Household Crop Income in Assam

Bodrul Islam and Pradyut Guha*

ABSTRACT

With the foundation of new economics of labour migration (NELM) theory the study has made an attempt to examine the influence of migration of labourers from domestic agriculture on household crop income using primary data collected from 224 farm (cultivator) households in Nagaon and Morigaon districts of Assam. Three stage least squares estimation technique was applied for jointly determining the factors influencing migration, remittances and their impact on crop income. The analysis of the data reveals that though outmigration of labourers from domestic agriculture significantly reduced household crop income, the inflow of remittance has helped in stimulating the earnings from the cultivation of crop. The migration in the study area is considerably influenced by household size, total value of assets holding, networking influence, proximity to commercial bank and flood proneness of the village while the number of migrants, dependents, and age of migrants emerge to be strong predictor of inflow of remittances. The findings of present study offer evidence in support of NELM theory.

Keywords: New economics of labour migration, Three stage least squares, Crop income, Labour migration, Remittances, Assam

JEL.: J43, J60,Q19

I

INTRODUCTION

Agriculture and allied activities are one of the largest sources of labour employment in Indian economy, providing livelihood for 54.60 per cent of the country's total workforce (Government of India, 2018). There are many issues and challenges faced by Indian agriculture over the years, but one of the major challenges faced by the sector in recent years is the scarcity of labour (FICCI, 2015). The share of agricultural labour in India has maintained declining trend over the years while the corresponding ratio in non-farm sectors has been opposite (Government of India, 1991; 2001; 2011). The employment shares in secondary and tertiary sectors have gradually increased with continuous outmigration of labourers from agriculture (FICCI, 2015).

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One of the predominantly agrarian states of North East India is Assam where agricultural sector contributed 19.34 per cent to Gross State Domestic Product during 2016-17 (Government of Assam, 2018) and provided employment and livelihood support to 50 per cent workforce as farmers and agricultural labourer, (Government of India, 2011). The share of agricultural workforce in Assam has declined from 67.32 per cent in 1991 census to 52.49 per cent in 2001 census and further to 49.45 per cent in 2011 census (Government of India, 1991; 2001; 2011). Though, the share of agricultural labourers has increased within agricultural workforce across the districts of Assam during last three censuses but the share of cultivator has rapidly decreased during reference period (Appendix Table A1).

The problem of outmigration of labourer from agriculture has been a subject of interest in the works of various scholars. Kuznets (1957) provided evidence in support of continuous decline of labour force engaged in agriculture eventually with increased share of labour force in the non-farm sector. The works of Lewis (1954), Chenery and Syrquin (1975), Ravallion and Datt (1996), Mundlak*et al.* (1997), Lanjouw and Lanjouw (2001), Bdul (2012) also claimed about outmigration labourers from agriculture. The decision to migrate from household agriculture is urged by higher wages in non-farm local job opportunity, low earnings, high unemployment rate, lack of employment security, poor job satisfaction, lengthy working hours, poor working conditions, seasonal nature of work, debt settlement issues, employment opportunity from MGNREGA[1], financing farm activities (Paris *et al*., 2005; Korra, 2011; FICCI, 2015). The available literature came up with mixed findings on the impact of labour migration from agriculture on crop income. Taylor and Wyatt (1996) found that inflow remittances from family migrants helped in stimulating household farm income indirectly by relieving credit and risk constraints on household-farm production. In this line Rozelle *et al*. (1999), Taylor *et al*. (2003), Tuladhar *et al*. (2014) established that migration negatively influenced agricultural output, though its effect on crop yields being non-negative with remittances partially offset some of these losses.

A study on farmer's income generation through cultivation of crops has important policy implications. The decision to migrate from domestic agriculture eased with prior knowledge about implications of family members quitting household agriculture on their crop production or income from crop cultivation. The novelty of present study is its preliminary attempt in jointly determining the factors influencing migration, remittances and their impact on crop income of farm households in Assam which has not been investigated so far in the works of earlier scholars.

II

THEORETICAL FOUNDATION

While migration affects crop income through the induced shortage of labour, remittances tend to relax household's credit and risk constraints, which affect agricultural productivity in the long run (Lucas, 1987). The new economics of labour migration (NELM) theory states that wage differential alone does not determine an individual's decision to migrate rather it is a collective decision made by households and not by individuals (Stark, 1991). Hence, migration and remittances are endogenous to household income and yield (Rozelle *et al*., 1999; Taylor *et al*., 2003). The NELM theory asserts that household crop income (Y) is influenced by three factors, viz., migration (M), remittance (R) and household characteristics (X_Y) as specified in the following functional form;

$$Y = f(M, R, X_Y) \qquad \text{.... (1)}$$

The data on crop income for this study has been estimated using Farm Business Income (FBI) generated by a household. The role of family migrants is to contribute in farm production by relaxing the credit constraint through remittances for the household facing investment constraint in high productive activity say agriculture at commercial basis. Let agriculture at commercial basis be high productive activity with FBI defined as;

$$FBI = [TR \text{ earned from crops production} - CC \text{ of the Crop}] \qquad \text{.... (2)}$$

The cost of cultivation (CC) in agriculture has been well defined by the Commission for Agricultural Cost and Prices (CACP) in 1979. There are nine different types of cost for agriculture as identified by CACP, viz., A1, A2, A2+FL[2], B1, B2, C1, C2, C2*, C3. With regional differences in farming the CACP cost concept being used in works of Narayanmoorthy (2013), Goswami (2016), and Sharma and Guha (2018). With the various forms of cost, the estimation of FBI needs differentiating the figures of revenue from cost. The total revenue (TR) figures of farming household have been obtained by taking the product of average market price of a crop (rice season-specific in the present case) with the total rice output produced by the sample households. The present study considered specific market price for specific type of rice (ahu, sali and boro) whichever a farm household had produced during the preceding farming season of the survey period. In addition, many households produced multiple varieties of rice, therefore, we have used variety-specific market price of the preceding farming season. Since, the market prices are different across geographical locations, for normalisation and better comparability the study has considered the variety-specific average market price of the sampled locations of the study. The reason for considering the market price is two-fold, viz. it is unrealistic to assume perfect competition in the market for agricultural products; secondly, prices are expected to vary across geographical locations. Though there are variations in price of a specific variety of rice across locations of Assam, however, such variations are not likely to be so high to substantially overstate or understate the value of rice in the study area. Also, it is expected that the regions where the price of rice is slightly higher, the rental rates of the services of capital goods, wage rate of labour, cost of seeds, fertiliser are likely to be higher. This actually cancels out the price effect. Nevertheless, in this study, we have considered the average of prices and rental rates at the village level to minimise the effects of variations in prices and rental rates on FBI, if not to eliminate it. The farmers in the study area failed to provide the information on interest value of owned capital assets (excluding land). Therefore, present study has used only three cost concepts, viz.,A1[3], A2[4] and A2+FL while measuring FBI. The FBI in the present study has been considered as income from crop cultivation.

III

STUDY AREA, DATA AND THE SAMPLE

The present study is carried with primary data collected using multi stage random sampling method during May-October, 2019. In the first stage two districts, namely, Nagaon and Morigaon of Assam were selected for their relative importance in terms of percentage share of cropped area out of the total land utilised area in the state.[5] In the second stage seven non-contiguous community development (CD) blocks were purposively selected from each district. In the third stage from each CD block minimum of two villages were selected. Finally, from each of the sampled village eight household were selected with a break up of 4 farm households experiencing migration[6] of unskilled labourer from household agriculture and another four household with no reported case of outmigration of unskilled[7] labourer from indigenous agriculture. In this way, a sample of 224 farm (cultivator) households from 28 villages was selected for conducting field survey. The primary survey gathered information on household characteristics, farm characteristics, migrant's characteristics, village characteristics and enabling factors from the paddy farming households. Paddy being a dominant crop in terms of share in gross cropped area in both the sampled districts[8] was the reason for selection of the crop in the study.

The summary statistics of the variables of the study being reported in Table 1, it is evident that, mean years of schooling of household head is seven years with average family size of seven members. The household head in the study area are middle-aged adults with average age of 49 years. Average land holding of the households was 1.45 hectare with 1.27 hectare being devoted for paddy farming. The

TABLE 1. SUMMARY STATISTICS

Variables (1)	Units (2)	Mean (3)	Std. Dev (4)	Min (5)	Max (6)
Years of schooling household head	Year	7	4	0	15
Household size	Number	7	3	2	20
Age of household head	Year	49	10	21	68
Land holding per household	ha	1.45	0.80	0.54	7.63
Area under paddy	ha	1.27	0.78	0.33	7.36
Migrant	Number	1.34	0.65	1	5
Crop income[9]	INR	51,033	44,800	3,060	4,11,500
Remittances received	INR	78,840	92,982	0	6,00,000
N = 224					

Source: Authors estimation based on Field Survey Data, 2019.

average crop income of the sampled farm household in the study area was INR 51,033. On an average 1.34 person reported to migrate from the sampled households with remittances received from them was INR 78,840 during the previous farming season.

IV

ECONOMETRIC MODEL AND ESTIMATION STRATEGY

With the thrust of the study being to jointly determine the factors influencing migration, remittances and their impact on income from crop output, the following set of simultaneous equations were formulated;

$$\ln Y_i = \lambda_0 + \lambda_1 \ln M_i + \lambda_2 \ln R_i + \lambda_3 \ln Z_i + \lambda_4 \ln F_i + \lambda_5 V_j + \varepsilon_Y \quad ....(3)$$

$$\ln M_i = \delta_0 + \delta_1 \ln Z_i + \delta_2 V_j + \delta_3 \ln T_q + \delta_4 D + \varepsilon_M \quad .... (4)$$

$$\ln R_i = \gamma_0 + \gamma_1 \ln M_i + \gamma_2 \ln Z_i + \gamma_3 V_j + \gamma_4 \ln T_q + \varepsilon_R \quad ....(5)$$

With ε being the well-behaved error term in crop income, migration and remittances equations respectively; 1, 2… 224 ϵ i-th farm households; 1, 2…... 28 ϵ j-th village; 1, 2………………112 ϵ q-th farm household with reported migration outside domestic agriculture during six or more than six months preceding to survey period. The description of the variables used in the study and their anticipated relationship is reported in Table 2.

TABLE 2. DESCRIPTION OF THE VARIABLES

Variable (1)	Description (2)	Anticipated Relationship (3)
Y_i	Crop income	
M_i	Number of migrants	+/-
R_i	Remittances received	+
Z_i	Vector of household characteristics	+/-
F_i	Vector of farm characteristics	+/-
V_j	Vector of characteristics of the village	+/-
T_q	Vector of socio demographic characteristics migrants	+/-
D	Network influence encouraging migration	+/-

There are several standard estimation techniques available for simultaneous equation models; some are called single equation methods[10] while there are other system equation methods[11]. After successive rounds of simulation and diagnostic tests of the primary data, it was decided to use Three Stage Least Square (3SLS) estimation technique as proposed by Zellner and Theil (1962) in the present study. The suitability of 3SLS for present study is two-fold firstly, the fitted set of simultaneous equations (3-5) qualified the over identification status via order and rank conditions (refer Appendix Table A2). Secondly, the simultaneity behaviour of migration, remittance, and crop income makes the disturbances term across the equations as interrelated, therefore, to deal such endogeneity problem 3SLS has preferred over 2SLS (Rozelle *et al*., 1999; Taylor *et al*., 2003; Tuladhar *et al*., 2014). The endogeneity in present case was tested via Wu-Hausman test (Hausman, 1976) as reported in Appendix Table A3. Usually, 3SLS gives consistent estimates with greater asymptotic efficiency than 2SLS (Kmenta, 1997).

V

RESULTS AND DISCUSSION

The 3SLS estimates of fitted set of simultaneous equations (3-5) have been reported in Table 3. The estimated result reveals that except number of migrants, the coefficient of the household characteristics such as remittances, household size, land per capita, and total value of assets holding have turned out as significant with positive elasticity in crop income equation. Farm inputs such as seeds, insecticides and pesticides also have shown positive and significant relationship with crop income. Hence, an incremental use of these inputs helped in enhancing the income of the sampled farm households in the study area.

TABLE 3. DETERMINANTS OF MIGRATION AND REMITTANCES AND THEIR EFFECTS ON HOUSEHOLD CROP INCOME

Variables/Constant/others (1)	Crop Income (2)	Migration (3)	Remittances (4)
Farm characteristics and enabling factors			
Number of migrants (Number)	-0.68(.28)**		4.06(.79)***
Remittances received (INR)	0.02(.007)**		
Household size (Number)	1.10(.17)***	0.24(.07)***	-0.38(.52)
Number of dependent (Number)	-0.15(.09)	-0.05(.04)	0.71(.33)**
Square of age of household head (Years)	0.01 (.084)		
Year of schooling of household head (Years)	-0.01 (.06)	-0.01(.03)	-0.03(.18)
Land per capita (ha)	0.75(.11)***	0.06(.05)	0.43(.30)
Total value of assets holding of household (INR)	0.09(.04)**	0.11(.02) ***	-0.34(.12)***
Family income (INR)		-0.18(.02)***	
Year of schooling of migrant (Year)		0.001(.06)	0.22(.45)
Age of migrant (Year)		0.01(.04)	2.96(.33)***
Migration network (=1 if yes)		0.14(.04)***	
Distance to pucca road from village (km)		0.05(.03)	
Distance to bus stand from village (km)		-0.02(.03)	
Distance to weekly market from village (km)		-0.04(.03)	
Distance to bank from village (km)		0.06(.03)*	
Distance to fertiliser store from village (km)	0.57(.42)		
Distance to farm fuel store from village (km)	-0.37(.41)		
Wage rate in village (INR)	0.18(.14)		
Exposure of flood (=1 if yes)	-0.01(.07)	0.07(.04)*	0.25(.22)
Farm inputs			
Cost of hired labour (INR)	-0.04 (.009)***		
Maintenance cost of own machinery (INR)	-0.08(.012)***		
Cost of hired machinery (INR)	0.01(.02)		

Contd.

TABLE 3.CONCLD.

Variables/Constant/others (1)	Crop Income (2)	Migration (3)	Remittances (4)
Cost incurred in seeds (INR)	0.36(.07)***		
Cost of insecticides and pesticide (INR)	0.17(.08)**		
Cost of fertiliser (INR)	-0.07 (.023)**		
Irrigation charges (INR)	-0.09 (.02)***		
Land revenue (INR)	-0.003(.02)		
Rent paid for leased land (INR)	0.02 (.01)		
Others expenses incurred in farming (INR)	-0.07(.03)**		
Constant	6.13(1.26)***	0.53(.26)**	4.39(1.47)***
Number of observations =224			
R-squared	0.675	0.402	0.914
Chi^2	514.73	151.91	2477.08
(p-value)	(0.00)	(0.00)	(0.00)

Source: Same as Table 1.
Notes: *** $p < 0.01$; ** $p < 0.05$, *$p < 0.10$. Figures in parentheses are the standard error.

The negative significant coefficient of number of migrants in crop income equation implies that migration of an unskilled labourer from domestic agriculture lowered the income of the farm household by 0.68 percentage points. Possible explanation of such result may be the fact that absence of household labourer in domestic agriculture insists the farm household to depend on hired labourer for continuation of farming activity thereby raising the total production cost. However, the positive significant coefficient of remittances in crop income equation implies that incremental inflow of remittances by an unit has raised the crop income of the farm household by 0.02 percentage points. The farm households in the study area invested 30.55 per cent of their remittances in domestic agriculture,[12] which might have helped in the realisation of higher output and income from crop cultivation. The present results are consistent with the findings of Rozelle *et al*. (1999), Taylor *et al*. (2003) and Tuladhar *et al*. (2014). The findings of the present study offer evidences in support of the predictions of NELM theory, that migration is associated with lost-labour effects and remittances loosen capital constraints on farm production in general.

With reference to the determinants of migration in the study area, it has been observed that the coefficient of household size, total value of assets holding, information networking, distance to commercial bank from village, and exposure of flood in the village have turned out to be positively significant. Plausible explanation for such findings could be the fact that household with larger family size has less difficulty in releasing the additional family members from domestic agriculture for engaging in gainful and remunerative occupation outside domestic agriculture. Interestingly, information networking by a predecessor migrant might have worked as a signalling mechanism in pulling the labourer of the farm household to migrate from agriculture to non-farm activities for financial security in the study area. The distance of commercial bank from village has significantly encouraged migration of labourers from domestic agriculture. Increased financial literacy and access to small loan under the wave of financial inclusion programme has helped them in engaging in self-employed business activity such as grocery store, vegetables store, hardware store, rice mill, electronic repairing shop.[13] The crop damage by flood in the preceding farming season forced the household member(s) to migrate outside domestic agriculture. However, aggregate family income from all sources seen to have significant inverse relationship with migration outside agriculture. Families with larger farm size managed to earn larger income from crop cultivation thereby able to maintain a decent standard of living and retain their family members in indigenous farming activities.

The number of migrants, number of dependents and age of migrant has turned out positive and significant determinant of remittances in the study area (Table 3). Remittance in the present case is treated as cost of migration, as it works as a compensation of lost labour that has left domestic agriculture. The estimated results reflect that outmigration of an additional member from domestic agriculture increased the inflow of remittances by 4.06 percentage points while remittances stimulate crop income by 0.02 percentage points in the study area (Table 3). The household with larger dependency ratio urges greater financial need for their families insisting migrant labourers to remit more money towards their family. It seemed that maturity in age and experience of the migrant labourer contributed towards higher earning capacity thereby enabling them to send greater remittances to their families.

VI

CONCLUSION

The present study was undertaken for jointly determining the factors influencing migration, remittances and their impact on crop income of farm households in agriculturally two important contiguous districts in central Brahmaputra valley of Assam. The analysis of data reveals that migration in the study area significantly determined by household size, total value of assets holding, networking influence, and proximity to the commercial bank, flood proneness of the village. The inflow of remittances towards the farm households is strongly influenced by the number of migrants, dependents, and age of migrants. The migration of labourer from domestic agriculture in the study area has negatively influenced the household crop income though it has not reduced crop yield. The present set of analysis corroborate the argument that inflow of remittances sent by migrant labourers partially compensate for the lost labour effects, contributing to household incomes directly and indirectly by stimulating crop production or crop income. The findings of the study offer evidences in support of the NELM theory, that labour migration adversely affected household crop income, in terms of rising cost of cultivation while remittances received have compensated the households by reducing the credit and insurance constraints.

NOTES

1) Mahatma Gandhi National Rural Employment Guarantee Act.

2) FL stands for imputed value of family labour.

3) A1=All actual expenses incurred in production by owners which includes value of (i) hired human labour, (ii) hired bullock labour, (iii) owned bullock labour, (iv) maintenance of owned machinery, (v) hired machinery, (vi) seeds, (vii) manures, (viii) fertilisers, (ix) plant protection chemicals, (x) irrigation charges, (xi) depreciation on farm buildings and implements, (xii) interest on working capital, (xiii) insurance premium, (xiv) land revenue, and (xv) miscellaneous expenses.

4) A2=A1+ rent paid for leased in land.

5) The Nagaon and Morigaon stands second and fourth position among the districts of Assam by sharing 85.66 and 84.16 per cent of crop area out of total utilised land of the districts respectively during 2016-17 (Government of Assam, 2017).

6) The present study has considered a farm household member or members as migrant, who is or are absent for at least six preceding months in household agricultural activities with specific reference to Sali paddy or Boro paddy or Ahu paddy.

7) Unskilled labourer are those types of workers in agriculture who are involved in sowing, harvesting, weeding, ploughing, winnowing and threshing including helper on agricultural field.

8) With 58 per cent and 69 per cent area under paddy out of gross cropped area in Nagaon and Morigaon districts respectively (Ministry of Agriculture and Farmers Welfare, Government of India, 2016-17).

9) Reported income being estimated using cost A2 to understand the variation in income with absence of family labour for migrant household.

10) Ordinary Least Square, Instrumental Variable, Indirect Least Square, and 2SLS.

11) 3SLS, Full Information Maximum Likelihood, and Limited Information Maximum Likelihood, Seemingly Unrelated Regression.

12) As per field survey the sampled farm households on an average invested INR 24092.86 in domestic agriculture which was 30.55 per cent of total remittances received during the previous farming season.

13) The field survey figures reveals that 23.21 per cent of migrants were engaged in business activity like hardware store, fishery business, rice mill, grocery store, electronic repairing shop, etc.

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APPENDIX

TABLE A1. DISTRICT WISE PERCENTAGE SHARE OF TOTAL CULTIVATORS AND AGRICULTURE LABOURERS OUT OF TOTAL WORKFORCE IN ASSAM DURING LAST THREE CENSUS

District/Year (1)	1991 (2)	2001 (3)	2011 (4)	District/Year (5)	1991 (6)	2001 (7)	2011 (8)
Kokrajhar	65.80 (16.27)	43.12 (22.61)	45.95 (16.51)	Karbi Anglong	77.00 (6.93)	59.68 (13.99)	58.16 (15.90)
Dhubri	52.71 (21.93)	37.44 (23.94)	30.65 (25.55)	Dima Hasao	60.00 (2.87)	48.06 (4.48)	52.31 (5.67)
Goalpara	57.55 (18.84)	36.97 (18.32)	34.90 (20.91)	Cachar	39.03 (18.49)	22.84 (13.32)	19.79 (11.29)
Barpeta	59.98 (17.61)	40.87 (15.95)	36.53 (17.61)	Karimganj	44.27 (17.34)	24.92 (15.00)	23.63(16 .79)
Morigaon	72.00 (11.84)	52.96 (19.88)	44.88 (21.64)	Hailakandi	48.00 (17.90)	35.30 (14.45)	30.65 (14.59)
Nagaon	58.38 (16.05)	38.48 (19.92)	35.31 (20.02)	Bongaigaon	59.00 (17.38)	37.63 (17.19)	32.61 (18.53)
Sonitpur	51.96 (11.45)	33.87 (12.96)	32.32 (14.91)	Chirang	0	0	41.42 (18.17)
Lakhimpur	74.68 (5.73)	68.54 (7.03)	55.66 (10.21)	Kamrup	39.75 (9.61)	24.72 (9.06)	29.54 (15.82)
Dhemaji	83.40 (4.81)	73.92 (7.38)	73.21 (6.05)	Kamrup (M)	0	0	5.14 (3.46)
Tinsukia	39.34 (6.56)	31.06 (6.15)	26.82 (8.57)	Nalbari	53.06(20. 81)	39.12 (14.38)	21.69(13 .07)
Dibrugarh	36.07 (7.66)	29.17 (7.63)	24.11 (10.92)	Baksa	0	0	36.70 (23.25)
Sivasagar	49.64 (6.67)	35.87 (7.01)	28.43 (9.98)	Darrang	67.04 (12.08)	45.63 (15.44)	39.85 (25.13)
Jorhat	48.37 (5.86)	37.51 (7.75)	29.25(1 0.66)	Udalguri	0	0	36.17 (21.08)
Golaghat	57.79 (9.68)	44.20 (10.07)	39.71(1 3.88)	Assam	54.75 (12.57)	39.21 (13.28)	33.93 (15.42)

Source: Author's computations based on data collected from Office of the Registrar General and Census Commissioner, India.

Notes: Figures off the bracket are cultivators and agricultural labourers in the bracket.

TABLE A2.RESULTS OF IDENTIFICATION TEST

Conditions (1)	(2)(2)	Equations (iii) (3)	(iv) (4)	(v) (5)
Order condition	(A - B) ≥ (G - 1)	8 >2	14 >2	20 >2
Rank condition	ρ(Δ) = (T - 1)	2	2	2

Source: Same as Table 1.

Notes: A is number of predetermined variables in the model; B is number of predetermined variables in a particular equation; G is number of endogenous variables in a particular equation; Δ is the matrix of excluded variables at the rest of the equation of the system equations; T is the number of endogenous variables in the model (Kmenta, 1997).

TABLE A3. RESULTS OF ENDOGENEITY TEST (WU-HAUSMAN)

Variables (1)	Crop income (2)
Migration	3.439 (0.065)
Remittances	0.0789 (0.08)

Source: Same as Table 1.

Figures in off bracket are Chi^2 and p value in brackets. H_0= the variable is exogenous.

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Changing Agricultural Labour Market and Its Effects on Farm Economy in India

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ABSTRACT

The paper presents long-run changes in agricultural labour market and its effects on farm economy. Further, the effect of COVID-19 led disequilibrium in labour market on cost of cultivation of paddy and wheat has been quantified. The evidence from both census and NSSO surveys point out rising employment diversification towards non-farm sectors. Census estimates of agricultural labour are higher than NSSO estimates which is partly explained by adoption of different 'minor' time criteria by these sources to identify marginal/subsidiary labour. Census based evidences suggest distress-led transition of cultivators to agricultural labours, whereas NSSO surveys based evidences refute such trends and point out towards development-led employment diversification wherein both cultivators and agricultural labours move towards more productive non-farm sectors. The recent NSSO survey (2017-18) reveals deceleration in withdrawal of cultivators and acceleration in withdrawal of agricultural labours. Successive cost of cultivation surveys also report a consistent decline in labour use in crop cultivation and therefore externally validate the trends from NSSO surveys. However, despite reduction in labour use, labour cost has increased. Due to inelastic demand for labour, increase in wages could not bring proportionate decrease in labour use and resulted in increase in labour cost in crop cultivation. Short-term disequilibrium in labour supply caused due to COVID-19 led lockdown increased cost A_1+FL by 1.1 per cent in wheat and 4.6 per cent in paddy. However, farmers in Bihar did not witness any benefit on account of increased labour supply due to large scale reverse migration.

Keywords: Labour market, NSSO, Census, Farm economy, COVID-19.

JEL: E24, J43, O15, Q15,

I

INTRODUCTION

Structural change in the sectoral composition from agriculture to non-agricultural sectors is an important indicator of economic development. Like other countries, India is also witnessing such changes (Papola, 2012; Soni and Subrahmanya, 2020). This is evident from the declining share of the agriculture sector in national output and employment. Between 1972-73 and 2017-18, the share of agriculture in gross value added (GVA) and employment has declined by 24 and 30 percentage points, respectively. However, dependency of workforce on agriculture is still far higher than its contribution in GVA. Presently, 44.1 per cent of the workforce engaged in agriculture produces only 17 per cent of the output. Many scholars have argued to

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accelerate employment diversification towards more productive non-agricultural sectors (Kumar *et al*., 2011; Himanshu *et al*. 2011; Chand *et al*. 2017).

Employment diversification, though desirable from economic development point of view, has definite implications on agriculture. The outward movement of agricultural labour creates labour scarcity for timely completion of farm operations, particularly during peak season. Further, contraction in labour supply if unaccompanied by reduction in its demand (through labour saving technologies) can lead to increase in wages and inflate labour cost. As labour constitutes a predominant share in production cost (Raghavan, 2008; Srivastava *et al*. 2017), increased wage bill can adversely affect farm profitability. Tracking long-run changes in labour supply in agriculture and assessing its effects on farm economy assume significant importance in formulating effective strategies for management of labour use in agriculture.

The unprecedented occurrence of COVID-19 pandemic has created disequilibrium in the rural labour market. The closure of non-essential economic activities due to imposition of lockdown to curb the virus infection forced a sizable number of migrant casual labours of urban areas to return to their native villages. Further, COVID-19 checked rural to rural movement of seasonal labours for performing farm jobs on contractual basis in the labour deficit states. Therefore, in few states size of rural labour force increased, whereas the states depending on seasonal labour faced labour scarcity for farm operation. It is pertinent to assess the differential effects of COVID-19 led short-run changes in labour supply on farm economy in labour-deficit and labour-surplus states.

In this context, the paper provides empirical evidences on temporal changes in agricultural labour supply based on alternative data sources and assesses its effects on the farm economy. Further, likely effects of COVID-19 led changes in labour supply on farm economy are predicted by analysing the existing structure of labour market. The specific objectives of the paper are; (1) to examine long-run trends in estimates of agricultural workforce from census and National Sample Survey Office (NSSO) surveys, (2) analyse the effects of withdrawal of agricultural labours on farm economy, and (3) evaluate differential effect of COVID-19 led changes in labour supply on farm economy in labour-deficit and labour-surplus states.

II

DATA AND METHODOLOGY

In India, census and NSSO surveys are the two primary sources of data on employment. Census, which is conducted at decennial frequency, provides wide range of data on demographic and socio-economic characteristics of the Indian population. In census, persons engaged in economically productive activities for a major/minor part of the reference period, are classified as main/marginal workers. The latest available census data pertains to the reference year 2011. On the other hand, NSSO conducts household surveys on employment and unemployment issues at the interval of five years to enquire about multi-dimensional characteristics of participation of labour force in different economic activities and to provide estimates of various indicators of employment structure at the national and state-level. The latest available quinquennial NSSO data on employment pertain to the reference year 2017-18. In the present study, the estimates on agricultural workforce from both census and NSSO surveys are compared and long-run trends (1993-94 to 2017-18) in employment in agriculture sector have been analysed.

Further, macro-level trends in agricultural workforce have been cross-examined using the estimates from farm-level cost of cultivation (COC) surveys of Directorate of Economics and Statistics, Government of India. For this, an aggregate time series of labour use (family and hired) was constructed using COC summary data on ten principal crops in 19 states. The selected crops include paddy, wheat, maize, jowar, gram, arhar, rapeseed & mustard, groundnut, sugarcane, and cotton which covered 64.58 per cent of the gross cropped area (GCA) in the country in 2015-16. The area cultivated under each crop in the respective state was used as weight to construct aggregate time series. Additionally, aggregate time series were also constructed for the variables, namely labour cost, cost A_1+FL[1] and return from the cultivation of these crops to observe the general trends in farm economy in correspondence with changing labour use. Cost and returns were expressed in real terms using Consumer Price Index for Agricultural Labour (2004-05=100).

The decline in labour use in agriculture may have positive or negative effect on the cost of cultivation depending on the associated changes in wages. The inter-relationships among these variables have been established by estimating price elasticity of labour using plot-level COC data for the period 2000-01 to 2016-17. It is hypothesised that changes in labour supply will influence the prevailing wage rates and its effect on cost of cultivation can be ascertained using estimated elasticity coefficients. Following Srivastava *et al*. (2017), the elasticity coefficients were estimated at the national level by fitting the transcendental logarithmic (translog) cost function in ten crops.

To evaluate the differential effect of changes in labour supply due to COVID-19 on farm economy in labour-surplus and labour deficit states, separate models were fitted for Punjab (labour-deficit state) and Bihar (labour-surplus state) in paddy and wheat crops and elasticity coefficients were estimated. Further, field level observations were reported on the change in prevailing wage rates during April-June 2020 as compared to the previous year in Bihar and Punjab for selected farm operations. Using the estimated elasticities and average change in wage rates, the effect of change in labour supply due to COVID-19 on farm economy is assessed and its implications are discussed.

III

RESULTS AND DISCUSSION

Comparison of Census and NSSO Estimates of Agricultural Workforce

Both Census and NSSO provide the estimates of employment in India. It is pertinent to compare the estimates from these two different sources and see how close data correspond to each other. Gender and occupation category wise disaggregated data on agricultural workforce participation rate (AGWPR) from large NSSO rounds and closest census years are presented in Table 1. For the comparison, it is essential that both sources follow similar concepts and have the same reference period. Census as well as NSSO follow the same definition to identify a worker – a person engaged in 'economic activity' during a reference period. Both sources use a reference period of one year and the set of production related activities accepted as 'economic activities' are almost the same (Kasturi, 2015). Further, in order to account more than one economic activities performed by a worker during the reference year, census (as well as NSSO) provide count of 'main' ('principal activity') and 'marginal' (subsidiary activity) workers using 'major' and 'minor' time spent criteria on performing an activity, respectively. 'Major' time spent criteria (6 months or more during the reference year) used in both sources is the same. However, there is a difference in the 'minor' time criteria adopted by census and NSSO while identifying marginal (subsidiary status) worker. Those who have worked less than six months in

TABLE 1. CHANGES IN THE AGRICULTURE WORKFORCE PARTICIPATION BASED ON CENSUS AND NSSO SURVEYS

(per cent)

		Census		NSSO		Ratio of NSSO over census		Percentage point change between 2001 and 2011	
Sector (1)	Gender (2)	2001 (3)	2011 (4)	2004-05 (5)	2011-12 (6)	2001 (7)	2011 (8)	Census (9)	NSS (10)
Population (crore)	Male	53	62	-	-	-	-	-	-
	Female	50	59	-	-	-	-	-	-
	Person	103	121	-	-	-	-	-	-
All workers	Male	51.7	53.3	54.7	54.4	1.06	1.02	1.6	-0.3
	Female	25.6	25.5	28.7	21.9	1.12	0.86	-0.1	-6.8
	Person	39.1	39.8	42.0	38.6	1.07	0.97	0.7	-3.4
Ag. workers	Male	28.3	27.7	27.8	23.7	0.98	0.86	-0.6	-4.1
	Female	19.6	17.4	21.2	13.7	1.08	0.79	-2.2	-7.5
	Person	24.1	22.7	24.6	18.9	1.02	0.83	-1.4	-5.7
Cultivator	Male	16.1	13.3	16.4	14.4	1.02	1.08	-2.8	-2.0
	Female	8.4	6.1	9.9	6.9	1.18	1.13	-2.3	-3.0
	Person	12.4	9.8	13.3	10.7	1.07	1.09	-2.6	-2.6
Ag. labour	Male	10.8	13.3	9.3	7.3	0.86	0.55	2.5	-2.0
	Female	10.0	10.5	7.2	4.6	0.72	0.44	0.5	-2.6
	Person	10.4	11.9	8.3	6.0	0.80	0.50	1.5	-2.3
Others Ag. workers*	Male	1.5	1.1	2.1	2.0	1.4	1.8	-0.4	-0.1
	Female	1.2	0.8	4.1	2.3	3.4	2.9	-0.4	-1.8
	Person	1.3	0.9	3.1	2.1	2.4	2.3	-0.4	-1.0

*Plantation crops (tea, coffee, coconut), livestock, fisheries and forestry.

an economic activity during the reference year are counted as ‘marginal workers’ in census. On the other hand, NSSO provides subsidiary status (synonymous as ‘marginal worker’) to only those workers who have worked for at least 30 days to less than 6 months during the reference period. Thus, those working less than 30 days in a year in an economic activity are excluded from being counted as ‘subsidiary worker’ in NSSO surveys, but are counted as ‘marginal worker’ in census. This may be one source of deviation in the estimates from these sources, if any. Apart from this, the estimates could also partly vary due to differences in the geographical coverage and coverage of segments of the population (Choudhury and Mukherjee, 2008).Although magnitude of estimates may vary due to several sampling and non-sampling errors, both the sources shall provide a consistent trend in the employment. This aspect is empirically examined in the following sections.

According to 2004-05 NSSO employment survey, 24.6 per cent of India’s population (58.6 per cent of total workers) was engaged in agricultural activities (Table 1). This estimate is very close to the 2001 census estimate of 24.1 per cent. Both sources also reported predominance of cultivators (over agricultural labours) among the total agricultural workers in 2001/2004-05. Further, AGWPR declined between 2001/2004-05 and 2011/2011-12 in both census and NSS surveys. As the overall worker participation rate remained almost constant (in census) or declined at relatively slower rate (in NSSO surveys), declining AGWPR indicates a rising trend in employment diversification away from agriculture towards non-agricultural sectors. Several scholars have also observed rising employment diversification in the country and have provided plausible explanations (Mukhopadhyay and Rajaraman, 2007; Kumar *et al*., 2011; Himanshu *et al*. 2011).

It is to be noted that the rate of decline in AGWPR was significantly higher in NSSO surveys (-5.7 per cent) as compared to census (-1.4 per cent). Disaggregation of agriculture workers revealed that it is primarily accounted by the wide variation and contrary trend in the estimates of agricultural labour from these sources. The 2001 census estimate of agricultural labour was 20 per cent higher than 2004-05 NSSO estimates. The subsequent 2011-12 NSSO survey reported 2.3 percentage points decline in the agricultural labour participation rate as compared to 1.5 percentage points increase in it in 2011 census. As the rate of decline in the participation of cultivators was uniform in census as well as NSSO surveys, contrary trend in agricultural labour explained the differential rate of decline in AGWPR between the two sources. The gap between census and NSSO estimate of agricultural labours widened to 50 per cent by the year 2011-12.

The share of main (principal status) workers in total agricultural workers was calculated to investigate whether adoption of different ‘minor’ time spent criteria in identifying marginal (subsidiary status) workers explains lack of correspondence in the estimates of census and NSSO surveys, particularly for agricultural labours (Table 2). The results reveal that more than 81 per cent of total cultivators are main workers, and census and NSSO estimates are close to each other. However, there exists significant difference in the share of main agricultural labours in total agricultural labours between the two sources. In NSSO surveys only 6 per cent of total agricultural labours have subsidiary status, whereas in census marginal agricultural labours constitute 40 per cent share. It implies that up to 34 per cent of labours of census work only for less than 30 days in agriculture and they do not qualify to be counted as subsidiary agricultural labours in NSSO surveys. Further, the evidences indicate that outcome of this definitional difference is more striking for female workers. Thus, definitional difference in 'minor' time spent criteria is a source of gap in the estimate of agricultural labour between census and NSSO surveys. Nevertheless, contrary trends in estimates of agricultural labour are not explained by this.

TABLE 2. SHARE OF MAIN AGRICULTURAL WORKERS IN TOTAL AGRICULTURAL WORKERS

Sector		Census		NSSO		Ratio of NSSO over census	
	Gender	2001	2011	2004-05	2011-12	2001	2011
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ag. workers	Male	84	78	97	98	1.16	1.26
	Female	53	55	72	71	1.36	1.28
	Person	72	69	87	88	1.21	1.27
Cultivator	Male	92	88	97	98	1.06	1.11
	Female	61	64	73	71	1.21	1.11
	Person	81	81	88	90	1.08	1.11
Ag labour	Male	72	67	99	100	1.38	1.49
	Female	45	50	88	85	1.94	1.70
	Person	60	60	94	94	1.59	1.58
Others ag workers*	Male	85	81	93	94	1.10	1.17
	Female	60	56	41	41	0.68	0.74
	Person	74	71	59	66	0.80	0.93

*Plantation crops (tea, coffee, coconut), livestock, fisheries and forestry.

Declining cultivators and increasing agricultural labours between the past two census years have been termed as rising casualisation of Indian agriculture (Gupta, 2016). Often it is attributed to the diminishing profitability of smallholders who are increasingly forced to sell their land and become agricultural labour. This distress-led argument of changing composition of agricultural workers based on census data is refuted if NSSO survey based declining trends in both cultivators and agricultural labours are believed to be correct. The trends based on NSSO surveys support the argument of development-led employment diversification wherein both cultivators and agricultural labours move out of agriculture.

Long-Run Trends in Estimated Agricultural Workforce and Labour Use in Crop Cultivation

Gender and occupation wise worker participation rates from the successive NSSO surveys were applied to census population to estimate the size of agricultural workforce. Table 3 presents changes in the estimated agricultural workforce during 1993-94 to 2017-18.The sub-period 1993-94 to 2004-05 witnessed an increase in agricultural workforce (usual status) by 25 million at annual growth rate of about 1 per cent. The size of agricultural labour did not increase and incremental agricultural workforce during this period was only due to increase in the cultivators. The subsequent period till 2011-12 witnessed an unprecedented decline in the absolute number of agricultural workers by 37 million at annual growth rate of 2.09 per cent. The decline in agricultural workforce was due to withdrawal of both cultivators and labours, particularly female workers. The annual rate of withdrawal of female workers was more than 4 per cent in both cultivator and labour categories. As the period 2004-05 to 2011-12 was a period of high agricultural growth (Chand and Parappurathu, 2012), withdrawal of female workers is often characterised as an outcome of the improved economic conditions of farm households (Kannan and Raveendran, 2012). Most of these female workers did not join even non-farm sectors and confined themselves either in household activities or pursued education, resulting in the decline in labour force itself. Decline in male agricultural labours could be due to inter-sectoral movement of labours in anticipation of higher income as non-farm sectors in rural areas are up to five times more productive than casual activities at farm (Chand *et al*. 2017).

TABLE 3. CHANGES IN AGRICULTURAL WORKFORCE (USUAL STATUS) IN INDIA DURING 1993-94 TO 2017-18

	Cultivators			Agricultural Labours			Agricultural Workers		
Period	Male	Female	Total	Male	Female	Total	Male	Female	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Absolute numbers (million)									
1993-94	90	56	146	58	40	97	148	96	244
2004-05	101	72	172	57	40	96	157	112	269
2011-12	99	52	151	51	29	80	150	82	232
2017-18	109	39	148	33	21	54	142	60	202
Compound growth rate (per cent)									
1994-2005	1.10	2.49	1.64	-0.17	0.00	-0.12	0.62	1.52	0.97
2005-2012	-0.29	-4.44	-1.88	-1.43	-4.38	-2.56	-0.68	-4.35	-2.09
2012-2018	1.75	-4.92	-0.38	-7.21	-5.02	-6.43	-0.90	-5.04	-2.29

Source: Authors' estimates based on NSSO estimates on activity-wise distribution of workers and census population.

During the recent period 2011-12 to 2017-18, withdrawal from agriculture accelerated and another 30 million agricultural workers left agriculture. The withdrawal from agriculture sector during the recent years was primarily led by agricultural labours, while the withdrawal by cultivators decelerated. The growth rate in the decline in the female agricultural workers accelerated to 5.04 per cent during recent period as compared to 4.35 per cent during previous period. Interestingly, male agricultural labours declined at historically highest rate of 7.21 per cent per annum during the latest period. Thus, successive NSSO surveys during the last 24 years have revealed consistent declining trend in agricultural labours in the country. On the other hand, declining trend in cultivators is slowing down over time. In fact, the number of male cultivators has increased between 2011-12 and 2017-18. This could be either due to limited capacity of non-farm sectors to absorb the incoming workforce or effect of ongoing agricultural reforms raising their expectations about remunerative returns.

The gradual withdrawal of labourers from agricultural activities is also reflected from the declining labour use in crop cultivation in COC surveys (Table 4). Although the estimates of labour use from COC surveys are not directly comparable with NSSO estimates on the number of agricultural labours, trends in average labour use can be taken to externally validate trends in NSSO estimates. Similar to NSSO employment surveys, successive COC surveys have reported consistent decline in labour use in crop cultivation over time with significantly higher rate during the recent period 2011-12 to 2016-17. Further, reduction in labour use occurred for both male and female labours. The declining labour-intensity in crop cultivation is desirable if it is accompanied by a commensurate increase in farm mechanisation and farm operations are not affected. Such investigations are vital but outside the scope of the present study.

TABLE 4. CHANGES IN AVERAGE LABOUR USE AND COST OF CULTIVATION OF MAJOR CROPS DURING 1993-94 TO 2016-17

	Average labour use (Hrs./ha)			Average real labour cost (Rs./ha)	Average real labour wages (Rs./hr)	Average real cost A_1+FL (Rs./ha)	Share of labour cost in cost A_1+FL*
Year	Male	Female	Total				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Absolute numbers							
1993-94	455	246	701	4367	6.2	10585	41.3
2004-05	419	223	642	4971	7.7	12938	38.4
2011-12	412	220	632	7205	11.4	15651	46.0
2016-17	366	189	555	7218	13.0	15705	46.0
Growth rate (per cent)							
1994-2005	-0.89	-1.13	-0.97	1.30	2.10	2.03	-
2005 -2012	-0.26	-0.15	-0.22	5.45	5.82	2.76	-
2012-2017	-2.34	-2.99	-2.56	0.04	2.67	0.07	-

*At current prices.

Effect of Withdrawal of Agricultural Labours on Farm Economy

Presently, labour constitutes 46 per cent share in average cost of cultivation (CostA_1+FL) of principal crops (Table 4). Due to a predominant factor of production, changes in labour supply have cost implications for the farmers. It is hypothesised that contraction in labour supply due to its withdrawal from agriculture pushes wages upwards which in turn leads to reduction in its use in farm operations. The cost implications of labour withdrawal largely depend on the relative changes in wages and labour use, and labour share in cost of cultivation.

A perusal of Table 4 reveals that average labour use in crop cultivation declined by 8 per cent between 1993-94 and 2004-05. But, despite reduction in labour use, labour cost at real prices increased by 14 per cent on account of 33 per cent rise in real wages. Incremental labour cost contributed 26 per cent of the total increase in Cost A_1+FL during this period. Nevertheless, the share of labour in CostA_1+FL reduced from 41.3 per cent in 1993-94 to 38.4 per cent in 2004-05 due to relatively higher increase in cost of other factors of production. The subsequent period till 2011-12 witnessed significant rise in real labour wages which resulted in 45 per cent increase in labour cost (despite decline in labour use). This inflated real cost A_1+FL by 82 per cent and the share of labour in cost increased to 46 per cent by the year 2011-12. Interestingly, decline in the labour use accelerated during the latest period 2011-12 to 2016-17 which negated the effect of rising wages on labour cost.

These evidences indicate that despite the reduction in labour use in crop cultivation, labour cost could not be saved during the past 24 years. This phenomenon is explained by the inelastic nature of demand of labour in crop cultivation. The estimated price elasticities of labour demand was negative and less than one in all the selected crops with the average value of -0.21 (Table 5). This implies that in the situation of wage rise, labour use in crop cultivation reduces less than proportionately resulting in rising labour cost. As the magnitude of reduction in labour use is insufficient to negate the wage-push cost inflation, it is necessary to promote farm mechanization and improve its economic access to farmers through institutional innovations (e.g. custom hiring centres). Srivastava *et al* (2017) have observed that present level of farm mechanisation is inadequate to offset the wage-push cost inflation in Indian agriculture.

TABLE 5. ESTIMATED ELASTICITIES OF LABOUR DEMAND IN SELECTED CROPS IN INDIA

Crop (1)	Price elasticity of labour demand (2)
Paddy	-0.20
Wheat	-0.27
Jowar	-0.25
Maize	-0.22
Arhar	-0.22
Gram	-0.16
Groundnut	-0.16
Rapeseed and Mustard	-0.23
Cotton	-0.20
Sugarcane	-0.20
Overall	-0.21

Source: Authors' estimation.

The estimated parameters of models have not been given due to paucity of space and can be obtained from the authors.

Effect of COVID-19 Pandemic Led Change in Labour Supply on Farm Economy

After the first COVID-19 confirmed case reported on January 30, 2020 in Kerala, Indian government took proactive step and announced nationwide lockdown on March 24, 2020, for 21 days. Owing to the rising number of cases, lockdown was further extended till May 3, 2020. As period of lockdown coincided with *rabi* harvest and *kharif* sowing seasons, agricultural activities (along with selected other essential services) were permitted with social distancing provisions. The labour-deficit state like Punjab, where farmers primarily depend on outside contractual labour for wheat harvesting and paddy transplanting, faced labour shortage to carry out these operations due to inter-state movement restrictions. The farm-level observations revealed that labour scarcity resulted in 24.4 and 46.6 per cent increase in wages for wheat harvesting and paddy transplanting in 2020 over previous year, respectively. The effect of such wage rise on cost was ascertained using estimated price elasticity of labour and share of these operations in cost A_1+FL.

A perusal of Table 6 reveals that due to the wage rise, estimated labour cost for harvesting of wheat and transplanting of paddy increased by 15.62 and 40.54 per cent, respectively in Punjab. Multiplication of change in labour cost with its share in Cost A_1+FL provides likely effect of COVID-19 led change in labour supply on cost of cultivation. The results show 1.1 per cent and 4.6 per cent change in Cost A_1+FL of wheat and paddy, respectively. In absolute terms, it is Rs. 287 per hectare for wheat and Rs. 1668 per hectare for paddy at 2016-17 prices.

TABLE 6. EFFECT OF COVID-19 ON FARM ECONOMY OF PUNJAB AND BIHAR

State (1)	Crop (2)	Price elasticity of labour demand (3)	Change in wages in 2020 (April-June) over 2019 (April-June) (per cent) (4)	Change in labour cost (per cent) (5)	Share of transplanting/ harvesting labour cost in costA_1+FL (per cent) (6)	Change in costA_1+FL due to change in wages (per cent) (7)
Punjab	Paddy	-0.13	46.6	40.54	11.4	4.6
	Wheat	-0.36	24.4	15.62	6.8	1.1
Bihar	Paddy	-0.18	Nil		13.9	-
	Wheat	-0.25	Nil		14.5	-

Source: Authors' estimation

In case of Bihar, it was expected that reverse migration would positively contribute to farm economy by pushing labour wages downwards due to increase in labour supply. However, farm-level observations revealed no change in labour wages as reverse migrating labour did not work at farm and preferred to work in public work programmes like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). Also, most of the labours started coming back to urban centres as soon as lockdown was relaxed (The Economic Times, 2020). Thus, disequilibrium in labour market created due to reverse migration did not show any effect on cost of cultivation in Bihar.

IV

CONCLUSIONS AND POLICY IMPLICATIONS

The evidences from census and NSSO surveys clearly point out rising trend in employment diversification from agriculture to non-farm sectors. NSSO surveys have reported relatively higher rate of decline in participation of agricultural workers as

compared to census. This is primarily accounted by wide variation and contrary trend in the estimates of agricultural labours from these data sources. The 2001-census estimates of agricultural labours were 20 per cent higher than 2004/05-NSSO estimates, and the gap further widened to 50 per cent by 2011-12. One of the sources of variation in the estimate of agricultural labour is “minor” time spent criterion used by these sources which excludes upto 34per cent of agricultural labours of census to be counted as subsidiary agricultural labours in NSSO surveys. Further, census provides evidences on rising casualisation of Indian agriculture wherein cultivators are turning to agricultural labours. On the other hand, NSSO surveys reveal consistent declining trend in both cultivators and agricultural labours. Such contrary trends in census and NSSO surveys create confusion while drawing policy implications. Census based evidences suggest distress-led transition of cultivators to agricultural labours, whereas NSSO surveys based evidences refute such trends and point out towards development-led employment diversification wherein both cultivators and agricultural labours move towards more productive non-farm sectors.
The recent NSSO survey reveals deceleration in withdrawal of cultivators and acceleration in withdrawal of agricultural labours. Slow-down in withdrawal of cultivators could be due to the effect of ongoing agricultural reforms raising their expectations about remunerative returns from farming. This could also imply limited capacity of non-farm sectors to absorb the incoming workforce and necessitates strengthening of rural non-farm sectors so as to generate gainful employment opportunities. Successive cost of cultivation surveys also report a consistent decline in labour use in crop cultivation and therefore externally validate (though not directly comparable) the trends from NSSO surveys.

Withdrawal of agricultural labour affects farm economy either by creating physical scarcity of labour or through the rise in farm wages. Due to inelastic demand of labour, increase in wages could not bring proportionate decrease in labour use and resulted in increase in labour cost in crop cultivation. Thus, the extent of decline in labour use is found to be insufficient to negate the wage-push cost inflation. This warrants concerted efforts to accelerate pace of farm mechanisation and its economic access to farmers to partially substitute labour. Short-term disequilibrium in labour supply caused due to COVID-19 led lockdown increased cost A_1+FL by 1.1 per cent in wheat and 4.6 per cent in Paddy. However, farmers in Bihar did not witness any benefit on account of increased labour supply due to large scale reverse migration as labours preferred working in MGNREGS over farms.

NOTE

1) Cost A_1 comprises of all paid out cost components such as value of hired human labour, hired bullock labour, maintenance and upkeep charges on owned bullock labour, upkeep charges of owned machines, hired machine charges, seed cost, pesticides cost, manure cost, fertiliser cost, canal irrigation charges, depreciation of implements and farm buildings, land revenue cess and other taxes, interest on working capital and miscellaneous expenses on other inputs. Imputed value of family labour (FL) was estimated by multiplying working hours of family labour with prevailing wage rate.

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Is Labour Productivity of Irrigated Crops Better than Rainfed Crops?: A Meta-Data Analysis

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ABSTRACT

An intricate question arises in the context of labour productivity is whether any perceptible variation exists in it among different crops cultivated under irrigated and rainfed conditions. We tried to answer this puzzle in this paper using the cost of cultivation survey data covering period from 1975-76 to 2016-17. It is known that labour productivity changes across crops and therefore, a total of six crops (three irrigated and three rainfed crops) cultivated in 12 different states are considered for the analysis. The labour productivity is estimated under four dimensions which are (1) ratio of value of output (Rs/ha) to total labour man-hours, (2) ratio of value of output to total human labour cost (Rs/ha) incurred for cultivating the crops, (3) ratio of yield (kg/ha) to total labour man-hours, and (4) ratio of yield to total human labour cost (Rs/ha) incurred for cultivating the crops. To study the changes in labour productivity, growth rate and averages are computed by dividing the study period into three, viz., Period-I (1975-76 to 1990-91), Period-II (2000-01 to 2016-17) and for the entire period (1975-76 to 2016-17). It was found that the labour productivity estimated under all four dimensions is higher among the irrigated crops in different states as compared to the rainfed crops in both period-I and period-II. The labour productivity both in terms of value of output and yield (in kg) computed using labour man-hours as denominator has increased for all the six irrigated and rainfed crops. However, when the estimate is made using total labour cost as denominator, the labour productivity either declines or does not increase appreciably for both irrigated and rainfed crops.

Keywords: Farm labour productivity, Human labour; Irrigated crops, Rainfed crops, Value of crop output

JEL: J2, J3, E24, Q16

I

INTRODUCTION

The Indian agricultural sector has undergone several changes after the introduction of green revolution during the mid-sixties. The high-yielding varieties (HYVs) led technology has not only prompted the use of yield increasing inputs such as chemical fertilisers and pesticides but also the use of farm machineries such as tractors, harvesters, threshers, winnowers, etc. For instance, the use of tractors (which is an important constituent in farm machineries) has increased from just three per 1000 hectares of net sown area (NSA) in 1962-65 to 167 per 1000 hectares of NSA in 2005-08 at the all India level (Bhalla and Singh, 2012). Despite rapid increase in farm mechanisation in Indian agriculture, the role of human labour is still very important

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in carrying out different operations because of two reasons: (a) machineries are not available in the market to perform all the required operations for cultivation of all the crops, and (b) farm holdings are highly fragmented and small in size in India where machineries cannot be used extensively. In fact, an increased scarcity of farm labour of late has been reported in different parts of the country (Gulati *et al*., 2013; Chand and Srivastava, 2014).

Since farm labour accounts for the largest share in the total labour force of the country and the incidence of poverty is higher among the farm labour households in rural areas, a large number of studies have been carried at different time points relating farm labour with different parameters. Rudra and Sen (1980) analysed the relationship between farm size and labour use in the context of debate on farm size and productivity relations in the 1980s, while Chattopadhyay (1984) studied the transformation of labour use in Indian agriculture using farm management survey data of different time points from 1950s and 1960s. Utilising NSSO data on employment and unemployment relating to the periods 1993-94 and 2009-10, Chand and Srivastava (2014) have provided a detailed account of the changes in the rural labour market and their implications for agriculture.

Farm labour productivity plays a critical role in deciding the wage rate of labour and therefore, many scholars have studied this issue over the years. With the help of data from the farms of Indian Agricultural Research Institute for the years 1951-52 to 1954-55, Kahlon and Bharadwaj (1959) have shown that the labour productivity is mostly determined by the volume of production and product prices. Concerned with the contrasting beliefs on the use and productivity of agricultural labour, Mellor (1963), after reviewing various studies and providing an empirically appropriate conceptual framework for analysing farm labour use with productivity, underlined that "in most densely populated low income countries there is a positive marginal product from additional increments of labour applied to agricultural production"(p. 532).

While studying the inter-state variations in agricultural labour productivity and sources of labour productivity growth using data from four time points, namely, triennium averages ending 1964-65, 1972-73, 1977-78 and 1982-83, Dev (1988) concludes that the growth in productivity of crop was the major source for the rise in labour productivity and the contribution of land-man ratio to the variation in labour productivity was higher than that of land-productivity. After making a detailed analysis using the results generated from numerous regression models with the help of data from 281 districts for the period 1962-65 and 1970-73, Bhalla and Alagh (1983) surmises that "………. labour productivity in modern agriculture depends on the intensity of use of both mechanical and biological inputs. Since high growth districts are the predominant users of available tractors and tubewells (and other inputs) in the country, capital intensity per worker is the main determinant of labour productivity in these districts" (p.834). Recently, while studying the agricultural labour productivity and its determinants using data collected from different sources for the period 1991-92 to 2016-17, Shanmugan and Baria (2019) have shown an increasing trend in labour productivity in agriculture with marginal variations between various estimates across various dimensions of time-series measurements.

Although a large number of studies have analysed the farm labour productivity in India and neighbouring countries (Selim, 2012), not many focused on the comparison of labour productivity between irrigated and rainfed crops/regions. Besides helping to increase the farm wage rate and reducing rural poverty (Narayanamoorthy and Deshpande, 2003; Narayanamoorthy, 2007), irrigation coverage plays a paramount role in deciding the productivity of crops as well as its value of output (see, Dhawan, 1988; Narayanamoorthy *et al*., 2015). Productivity of crops is a key factor that decides the labour productivity. Not only the productivity of crops, but the cost of cultivation, cost incurred on wage labour, wage rate and value of crop output are also the important determinants of labour productivity. These parameters distinctly varied between the crops that are cultivated under irrigated and rainfed conditions. Therefore, we have attempted here to analyse farm labour productivity from different crops cultivated under irrigated and rainfed condition using spatial and temporal data. The following specific issues and questions are attempted:

1) Is labour productivity between irrigated and rainfed crops cultivated in different states differ significantly?
2) How far labour productivity among different crops differs when estimated in terms of value of crop output in monetary terms and absolute productivity (kg/ha)?
3) What are the trends in labour productivity among different irrigated and rainfed crops estimated under different dimensions?
4) Does labour productivity for the same crop differs when cultivated under irrigated or rainfed condition in different states?

II

METHODS AND DATA

The entire analysis in this study is carried out using Cost of Cultivation Survey (COCS) data published by the Commission for Agricultural Costs and Prices (CACP) of the Ministry of Agriculture and Farmers' Welfare, Government of India. CACP has been publishing CCS data on selected crops with all operations including labour use since 1970-71. Here, we have taken data from 1975-76 to 2016-17, for which latest data is available for ready use. Since the major objective of the study is to analyse the temporal and spatial pattern of labour productivity in different crops cultivated under irrigated and rainfed conditions, the study has considered three irrigated crops, namely, paddy, wheat and sugarcane and three rainfed crops, namely, tur (red gram), groundnut and cotton. Productivity of crops, labour use and other parameters are varied from state to state due to various reasons. Therefore, in order to find out whether any variation exists in farm labour productivity within the same crop cultivated in different states, two states for each crop are selected for the analysis. That is, data from a total of six crops and 12 states are used in this study.

The details of selected crops, states and the data period are presented in Table 1.

TABLE 1. CROPS, STATES AND DATA USED FOR THE STUDY

(*values in Rs. are at 2004-05 prices*)

	Crops (1)	State (2)	Parameters (3)	1970-71 to 2016-17 Average (4)	SD (5)	No. of years data available/used (6)
Irrigated crops	Paddy	Andhra Pradesh	HL (Man hrs)	979.94	214.22	41
			HLC (Rs./ha)	10058.23	3894.90	41
			VOP (Rs./ha)	25147.98	8342.11	41
			Yield (kg/ha)	4289.44	1182.15	41
		Punjab	HL (Man hrs)	553.50	183.87	38
			HLC (Rs./ha)	7621.03	1138.17	38
			VOP (Rs./ha)	33722.95	8101.62	38
			Yield (kg/ha)	5708.26	830.53	38
	Wheat	Punjab	HL (Man hrs)	319.86	130.92	45
			HLC (Rs./ha)	5871.96	612.63	45
			VOP (Rs./ha)	23920.28	6400.61	45
			Yield (kg/ha)	3691.98	831.54	45
		Haryana	HL (Man hrs)	360.82	84.66	42
			HLC (Rs./ha)	6820.96	1779.83	42
			VOP (Rs./ha)	23059.28	6606.64	42
			Yield (kg/ha)	3530.98	855.96	42
	Sugarcane	Maharashtra	HL (Man hrs)	2233.59	471.45	38
			HLC (Rs./ha)	21123.18	8177.27	38
			VOP (Rs./ha)	70778.59	22811.74	38
			Yield (kg/ha)	84154.16	10292.26	38
		Uttar Pradesh	HL (Man hrs)	1204.57	101.62	42
			HLC (Rs./ha)	9612.56	2728.07	42
			VOP (Rs./ha)	44865.22	14506.10	42
			Yield (kg/ha)	45945.14	6116.46	42
Rainfed crops	Tur	Madhya Pradesh	HL (Man hrs)	442.88	98.47	33
			HLC (Rs./ha)	4205.28	1283.73	33
			VOP (Rs./ha)	12594.53	4025.74	33
			Yield (kg/ha)	685.58	188.10	33
		Uttar Pradesh	HL (Man hrs)	585.29	82.24	30
			HLC (Rs./ha)	5553.63	1252.51	30
			VOP (Rs./ha)	17506.72	2377.53	30
			Yield (kg/ha)	962.83	188.90	30
	Groundnut	Andhra Pradesh	HL (Man hrs)	668.50	112.20	33
			HLC (Rs./ha)	6938.11	3346.12	33
			VOP (Rs./ha)	17443.80	8786.46	33
			Yield (kg/ha)	1042.94	376.56	33
		Gujarat	HL (Man hrs)	490.80	81.20	39
			HLC (Rs./ha)	6488.40	2707.43	39
			VOP (Rs./ha)	17737.84	7219.33	39
			Yield (kg/ha)	1033.82	440.72	39
	Cotton	Karnataka	HL (Man hrs)	699.91	126.37	30
			HLC (Rs./ha)	6089.49	2974.81	30
			VOP (Rs./ha)	18294.57	8961.49	30
			Yield (kg/ha)	856.17	406.40	30
		Maharashtra	HL (Man hrs)	819.35	132.87	30
			HLC (Rs./ha)	8879.29	4887.99	30
			VOP (Rs./ha)	19641.90	9561.79	30
			Yield (kg/ha)	928.53	486.75	30

Source: Computed using data from CACP (various years).
Notes: SD - standard deviation; HL - human labour; HLC - human labour cost; VOP - value of output.

Data on human labour use in terms of man hours (LMH), total human labour cost (HLC) in monetary terms (Rs./ha), yield of crops (kg/ha) and value of crop output (VOP) in monetary terms (Rs./ha) are the variables primarily used for computing the labour productivity under different dimensions. Since the study uses time-series data, all the cost and income related data are converted into constant value using Consumer Price Index of Agricultural Labour (CPIAL) with the base year 2004-05 to study the real change in labour productivity over time.

Generally, labour productivity is measured in terms of ratio of total agricultural output to total labour input following the broader framework of growth accounting method postulated by Solow (1957), which is also employed recently by Shanmugan and Baria (2019). However, we cannot always capture the real picture of farm labour productivity in terms of value of output alone because the numerator namely VOP (Rs./ha) used in this method is highly influenced by the market price of the crop which highly fluctuates in India(see, Narayanamoorthy, 2013; CACP, 2018). Due to the excess supply of agricultural commodities in certain seasons and distortions in prices created by middlemen, farmers do not get the expected price for their produces in the market (Narayanamoorthy and Suresh, 2013, NITI Aayog, 2015; 2016). This often dampens the total value of output realised from the cultivation of crops. Given this, when one estimates the farm labour productivity using the value of output as numerator and total labour input as denominator, the farm labour productivity may turn out to be very low. Can we then say that the labour productivity is lower in India using the results estimated from this kind of method? Actually, the entire computations have larger weights in the fluctuations of prices. These problems can be avoided when the farm labour productivity is measured in terms of actual productivity of crops (kg/ha). Keeping this in view, in this study, we estimate the farm labour productivity under the following four dimensions:

$$FLP_{VH} = \frac{VOP}{LMH} \quad ....(1)$$

$$FLP_{VC} = \frac{VOP}{HLC} \quad ....(2)$$

$$FLP_{YH} = \frac{Yield}{LMH} \quad ....(3)$$

$$FLP_{YC} = \frac{Yield}{HLC} \quad ....(4)$$

where, FLP = farm labour productivity, VOP = value of crop output in Rs./ha at 2004-05 prices; LMH = labour man hours per ha; HLC = human labour cost in Rs./ha at 2004-05 prices; Yield = productivity of crops in kg/ha; v = short form of value of output; h = short form of labour man-hours; c = short form of human labour cost; y = short form of yield of crop.

In equation (1), the farm labour productivity (FLP_{vh}) is measured relating value of crop output (v) with labour man hours (h), which is estimated by dividing per hectare value of crop output (VOP) in Rs./ha with human labour man-hours (LMH).

In equation (2), the farm labour productivity (FLP_{vc}) is measured relating value of crop output with human labour cost (c), which is estimated by dividing per hectare value of crop output with the cost incurred on human labour for cultivating each of the selected crops.

In equation (3), the farm labour productivity (FLP_{yh}) is measured relating yield (kg/ha) of crop with labour man-hours (h), which is estimated by dividing per hectare yield of crop with human labour man hours (LMH) used for the crop.

In equation (4), the farm labour productivity (FLP_{yc}) is measured relating yield of crop (y) with human labour cost (c), which is estimated by dividing per hectare of yield of crop with the cost incurred on human for cultivating crop (Yield/HLC).

After having estimated the labour productivity through these four approaches, we estimated growth rates for the same using log-linear function ($\log Y = \alpha + bt$) to find out the growth in labour productivity during different periods for all the six irrigated and rainfed crops cultivated in 12 states.

III

RESULTS AND DISCUSSION

It is a well accepted fact that precise measurement of farm labour productivity is very difficult and challenging as the productivity of crops is determined by a host of factors where labour is one of the factors. Along with yield increasing inputs such as fertilisers and pesticides, human labour, bullock labour and machine labour are also used for cultivating crops. The use of labour (all types) changes considerably from crop to crop and also every year due to various endogenous and exogenous factors. Therefore, even with rigorous econometric analysis, it would be very difficult to find out the exact contribution of human labour to production of crop as well as the human labour productivity. The difficulties in estimating the productivity of labour and machinery particularly tractor are amply explained by Binswanger (1978). Understanding the difficulties in measurement, in this study, we estimate the labour productivity only by taking into account the human labour use both in terms labour man-hours and total labour cost incurred for cultivating the selected six crops.

(A)*Labour Productivity (in Rs.) per Man-Hour (VOP/LMH)*

The first dimension of labour productivity that we have estimated for this study is the ratio of labour productivity to labour man-hour. The amount of labour hours spent for carrying out various agricultural operations will have direct impact on the productivity of crops as it explains the intensity of labour use. If higher labour is used in any farm means, either the agricultural operations are carried out systematically or the yield of crop is higher; increased crop output also warrants higher labour for harvesting operation. Therefore, the labour productivity is measured in terms of labour man-hours. Table 2 presents the labour productivity in Rs. per man-hour of labour for both irrigated and rainfed crops for all the selected states. As the labour use pattern has been changing over the years, labour productivity is computed by dividing the period of analysis into three, namely, period-I (1975-76 to 1990-91), period-II (2000-01 to 2016-17) and for the entire period (1975-76 to 2016-17) to see whether any perceptible changes are taking place in it. It is clear that the labour productivity computed in terms of labour man-hours has increased with fluctuations over the years in both irrigated and rainfed crops (see, Figure 1). In the case of paddy cultivated in Andhra Pradesh, the labour productivity increased from Rs. 15.19/man-hour in period-I to Rs. 39.02/man hour in period-II, with the growth rate of 4.20 per cent per annum. Similarly, in the case of cotton cultivated in Maharashtra, it increased from Rs. 14.07/man hour to 26.83/man hour with the growth rate of 3.79 per cent per annum. Similar trend is also observed in all the crops and the states selected for the analysis.

TABLE 2. LABOUR PRODUCTIVITY – IN MONETARY TERMS PER LABOUR HOUR

(*values in Rs. are at 2004-05 prices*)

			Period – I (1975-76 to 1990-91)			Period – II (2000-01 to 2016-17)			All Period (1975-76 to 2016-17)		
	Crops (1)	State (2)	Average (Rs.) (3)	CV (4)	Growth Rate (5)	Average (Rs.) (6)	CV (7)	Growth Rate (8)	Average (Rs.) (9)	CV (10	Growth Rate (11)
Irrigated crops	Paddy	Andhra Pradesh	15.19	14.46	1.09^{ns}	39.02	35.69	4.99^{a}	28.56	55.60	4.20^{a}
		Punjab	34.47	22.46	5.67^{a}	87.03	31.33	4.07^{a}	70.43	47.80	4.58^{a}
	Wheat	Punjab	42.81	21.12	2.18^{a}	146.19	42.68	6.20^{a}	100.24	69.53	5.05^{a}
		Haryana	38.70	22.62	3.46^{a}	88.59	29.38	3.76^{a}	68.40	47.17	3.65^{a}
	Sugarcane	Maharashtra	23.88	15.66	0.32^{ns}	38.84	38.21	3.98^{a}	33.33	41.94	2.60^{a}
		Uttar Pradesh	29.16	21.53	2.68^{b}	42.24	27.69	2.96^{a}	37.26	31.66	2.06^{a}
Rainfed crops	Tur	Madhya Pradesh	18.75	24.39	7.94^{c}	33.12	32.73	3.23^{a}	29.63	38.74	3.33^{a}
		Uttar Pradesh	25.22	16.46	1.23^{ns}	32.06	16.55	0.41^{ns}	30.47	19.02	0.86^{b}
	Groundnut	Andhra Pradesh	17.35	39.37	9.44^{a}	29.56	39.32	3.82^{a}	26.23	44.99	3.56^{a}
		Gujarat	29.59	22.33	2.49^{c}	38.92	26.03	2.33^{a}	35.18	29.27	1.79^{a}
	Cotton	Karnataka	23.42	34.24	4.95^{ns}	26.39	41.05	4.87^{a}	25.50	39.33	2.18^{a}
		Maharashtra	14.07	29.46	0.64^{ns}	26.83	24.62	3.00^{a}	23.00	36.42	3.79^{a}

Source: Computed using data from CACP (various years).

Notes: CV - Coefficient of variation; growth rate is computed using log-liner function; growth rate is in percent per annum; a, b, c are significant at 1, 5 and 10 per cent level respectively and ns – not significant.

Whether any distinct difference exists in labour productivity between the irrigated crops and the rainfed crops is the main focus of this paper. The results show that the

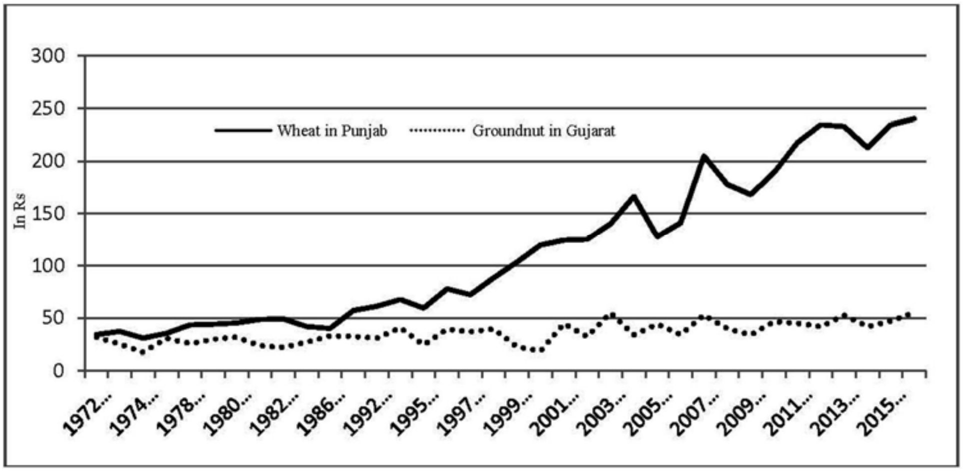

Figure 1. Labour Productivity (VOP/LMH) in Wheat and Groundnut.

labour productivity per man-hour in most crops is higher for irrigated crops than those crops cultivated under rainfed condition in period-I. The range of labour productivity varies from Rs. 15.19 to Rs. 42.81 for different irrigated crops during period-I, but the same vary from Rs. 14.07 to Rs. 29.59 for rainfed crops during the same period. However, in the case of irrigated paddy cultivated in Andhra Pradesh, the labour productivity comes to only Rs. 15.19 during period-I, which is lower than the labour productivity of many rainfed crops. The position of labour productivity changes completely during period-II, where it ranges from Rs. 38.84 to 146.19 for irrigated crops and from Rs. 26.39 to Rs. 38.92 for different rainfed crops. These changes noted from period-I to period-II could be due to three reasons. First, the increased productivity in different crops during period-II may have increased the labour productivity. Second, the increased use of machine labour that increased considerably since 1990-91 as per the CCS data may have also contributed to increased productivity of labour. Third, the substantial increase in minimum support prices for irrigated crops like paddy, wheat and sugarcane particularly during the last 15 years or so may have also contributed to increase in labour productivity in period-II. On the whole, the analysis shows that the labour productivity measured by dividing the value of output (Rs.) with labour man-hours is higher among the irrigated crops than the rainfed crops.

(B) *Labour Productivity in per Unit of Labour Cost (in Rs.) (VOP/HLC)*

Many authors have used measurement of labour productivity by dividing the value of output with the total labour cost incurred for cultivating the crop. Although this method of measurement has serious limitations due to the fact that the numerator number VOP used in this type of measurement is highly influenced by exogenous factor, namely, market price, we have also employed this method to estimate the labour productivity specifically to find out the variations in it as compared to other three dimensions of labour productivity. Some studies using CCS data have shown that the cost incurred on account of labour input has increased substantially than the other major inputs especially after the introduction of MGNREGS (Gulati *et al.*, 2013; Narayanamoorthy *et al.*, 2014). Has the recent increase in labour cost affected the productivity of labour?

Table 3 presents the labour productivity measured by dividing the value of output (Rs./ha) with the total labour cost incurred for cultivating the selected crops. As expected, the labour productivity in different irrigated and rainfed crops has either declined or not increased much in most of the crops in period-II as compared to period-I. Interestingly, there seems to be no significant difference in the labour productivity between the irrigated and rainfed crops in period-I. The labour productivity ranges from Rs. 2.87 to Rs.4.93 for irrigated crops in period-I, while the same ranges from Rs.3.05 to Rs. 4.58 for rainfed crops. In some irrigated crops, the average labour productivity is lower than the rainfed crops in period-I. Though the labour productivity of both irrigated and rainfed crops have declined in period-II as compared to period-I, it is found to be relatively better among the irrigated crops (see, Figure 2). In period-II, the range of labour productivity varies from Rs. 2.42 to Rs. 4.67 among different irrigated crops, whereas the same ranges from Rs. 2.17 to Rs. 3.18 among the rainfed crops. The decline in labour productivity between the two periods could have happened because of the following two reasons. First, the cost of labour incurred for different crops might have increased at a faster rate that may have

TABLE 3. LABOUR PRODUCTIVITY – VALUE OF PRODUCTION PER UNIT OF WAGE COST

(*values in Rs. are at 2004-05 prices*)

			Period – I (1975-76 to 1990-91)			Period – II (2000-01 to 2016-17)			All Period (1975-76 to 2016-17)		
	Crops (1)	State (2)	Average (Rs.) (3)	CV (4)	Growth Rate (5)	Average (Rs.) (6)	CV (7)	Growth Rate (8)	Average (Rs.) (9)	CV (10	Growth Rate (11)
Irrigated crops	Paddy	Andhra Pradesh	2.87	20.69	-2.27[b]	2.42	8.93	1.83[ns]	2.62	18.28	-0.76[a]
		Punjab	3.80	15.95	3.04[b]	4.67	10.54	0.51[c]	4.40	15.13	0.99[a]
	Wheat	Punjab	3.32	10.77	0.58[ns]	4.60	10.65	0.96[a]	4.03	19.21	1.29[a]
		Haryana	3.16	21.39	2.26[b]	3.59	13.78	-0.99[a]	3.42	17.76	0.43[c]
	Sugarcane	Maharashtra	4.93	26.95	-5.24[a]	2.94	25.13	-0.10[c]	3.67	37.49	-2.16[a]
		Uttar Pradesh	4.87	17.42	0.94[ns]	4.61	18.12	0.92[c]	4.71	17.83	0.81[ns]
Rainfed crops	Tur	Madhya Pradesh	3.30	19.09	4.09[ns]	2.96	19.58	-0.11[ns]	3.04	19.70	-0.35[a]
		Uttar Pradesh	3.61	18.55	-2.19[ns]	3.18	23.76	-2.81[ns]	3.28	22.81	-1.79[a]
	Groundnut	Andhra Pradesh	3.05	24.76	4.00[ns]	2.59	54.10	-1.24[ns]	2.72	46.53	-1.67[b]
		Gujarat	3.09	24.96	2.27[c]	2.66	22.08	-0.34[ns]	2.80	23.11	0.45[ns]
	Cotton	Karnataka	4.58	28.03	0.47[ns]	2.68	27.38	0.16[ns]	3.25	39.03	-2.19[a]
		Maharashtra	3.21	33.16	5.93[ns]	2.17	1.29	0.97[ns]	2.48	34.92	-2.03[a]

Source and Notes: Same as in Table 2.

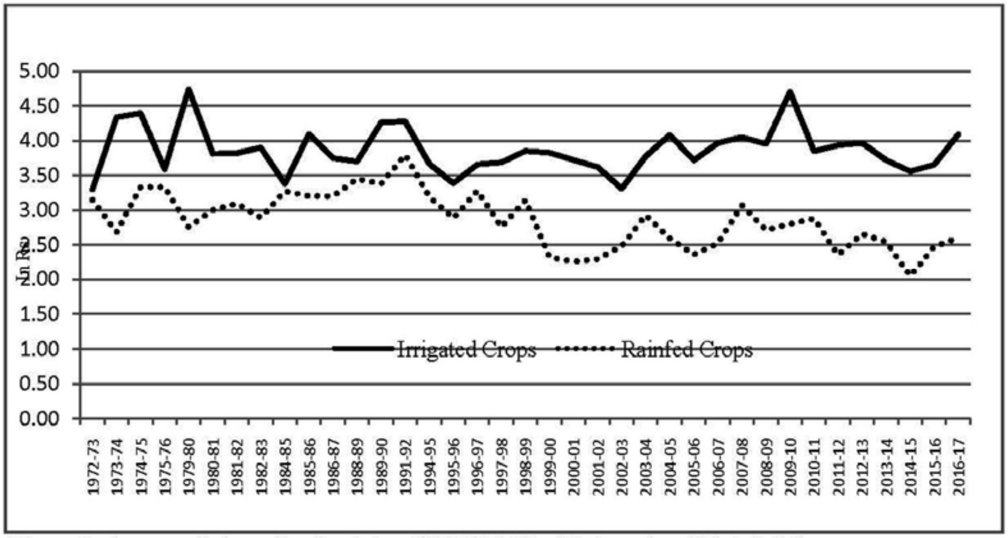

Figure 2. Average Labour Productivity (VOP/HLC) of Irrigated and Rainfed Crops.

ultimately dampened the labour productivity. Second, the prices received by the farmers for crops may not have increased in consonance with the cost of cultivation that may have also indirectly affected the value of output realised. On the whole, the results suggest that the labour productivity computed in relation to the labour cost seems to be relatively higher in most number of irrigated crops and states than those crops and states where rainfed crops are cultivated.

(C) *Labour Productivity in Volume of Yield per Labour Hour (Yield/LMH)*

The third dimension of labour productivity that we have computed is the ratio of yield (in kg) to total labour man-hours utilised for cultivating the selected crops. This would tell us how much yield is generated from every hour of labour used for cultivating the selected crop. Since the values of numerator and denominator used in this method of estimation are not influenced by the exogenous factors, namely, price of the crop, this value of labour productivity is expected to reflect the near reality. It is to be noted here that the increased use of labour hours does not necessarily lead to reduction in labour productivity, but rather it can increase the productivity of labour through yield augmentation. For instance, when weeding and intercultural operations are carried out for a crop more than once by employing more labour that helps increasing the productivity of crops through which the labour productivity can also be increased.

The average labour productivity in kg of yield to one hour of labour for irrigated and rainfed crops cultivated in different states is presented in Table 4. Unlike the labour productivity which is estimated by dividing the labour cost, the labour productivity in kg of yield for every hour of labour use has impressively increased in period-II as compared to period-I in both irrigated and rainfed crops. During period-I, the labour productivity ranges from 2.77 kg to 35.09 kg for irrigated crops, while it ranges only from 0.61 kg to 1.96 kg in rainfed crops. Similarly, during period-II, it ranges from 6.42 kg to 44.98 kg for irrigated crops and from 1.25 kg to 2.22 kg for rainfed crops.

TABLE 4. LABOUR PRODUCTIVITY – VOLUME OF YIELD PER LABOUR HOUR

			Period – I (1975-76 to 1990-91)			Period – II (2000-01 to 2016-17)			All period (1975-76 to 2016-17)		
	Crops (1)	State (2)	Average (kg) (3)	CV (4)	Growth Rate (5)	Average (Kg) (6)	CV (7)	Growth Rate (8)	Average (kg) (9)	CV (10)	Growth Rate (11)
Irrigated crops	Paddy	Andhra Pradesh	2.77	12.08	1.52[a]	6.42	33.55	4.62[a]	4.82	50.65	3.81[a]
		Punjab	6.58	22.21	5.04[a]	14.01	24.88	3.15[a]	11.66	39.37	3.73[a]
	Wheat	Punjab	6.98	27.07	3.89[a]	21.85	41.97	5.61[a]	15.24	66.68	4.90[a]
		Haryana	6.34	31.39	5.78[a]	13.59	17.97	2.03[a]	10.65	39.83	3.55[a]
	Sugarcane	Maharashtra	30.01	14.96	2.77[a]	44.98	18.42	1.95[a]	39.47	25.75	2.09[a]
		Uttar Pradesh	35.09	10.93	1.68[a]	40.14	9.99	1.10[a]	38.22	12.09	0.81[a]
Rainfed crops	Tur	Madhya Pradesh	1.19	16.13	-0.26[ns]	1.71	27.91	2.50[a]	1.59	30.34	2.21[a]
		Uttar Pradesh	1.61	17.53	-4.80[ns]	1.67	17.15	-1.66[a]	1.65	17.01	-0.89[c]
	Groundnut	Andhra Pradesh	1.05	22.44	5.14[c]	1.77	25.34	2.78[a]	1.58	32.72	3.03[a]
		Gujarat	1.96	28.49	3.82[ns]	2.22	29.22	2.18[a]	2.06	32.62	1.63[a]
	Cotton	Karnataka	1.03	28.66	3.58[ns]	1.25	39.30	5.91[a]	1.19	37.87	2.75[a]
		Maharashtra	0.61	24.44	4.03[ns]	1.29	28.87	4.69[a]	1.08	41.16	4.75[a]

Source and Notes: Same as in Table 2.

While comparing the labour productivity of irrigated crops with rainfed crops, the results clearly show that the labour productivity is substantially higher among the irrigated crops than the counterpart rainfed crops. In fact, the labour productivity of irrigated crops such as paddy and wheat has increased more than two times in period-II over the level of period-I, which is not observed in any of three rainfed crops considered for the analysis. As per the data of Ministry of Agriculture and Farmers Welfare (Government of India, 2019), the average productivity of paddy and wheat in different states in India has increased appreciably over the years due to the introduction of yield augmenting varieties which might have helped to increase the labour productivity of these crops. This means that the technological development (seed varieties) plays an important role in increasing the productivity of labour especially when it is estimated in terms of yield. The inference that comes out from this analysis is that the labour productivity has increased much higher among the irrigated crops than that of the rainfed crops in all the selected states.

(D) *Labour Productivity in Volume of Yield per Unit of Labour Cost*

How the labour productivity in kg of yield changes to labour cost incurred for cultivating the crops is the fourth dimension of labour productivity that we have estimated in this study. This is estimated by dividing the yield (kg/ha) of crop with that of the labour cost incurred for cultivating the crop. The objective of this estimate is to see whether the labour cost incurred for the crops has any role in augmenting the labour productivity. Here, two possibilities are possible. If the yield of crop increases at a rate more than the rate at which the per hectare labour cost increases, then the labour productivity in kg of yield would increase for every rupee spent on labour. Conversely, when the labour cost increases more than the rate at which the rate of yield is increasing, then the labour productivity is expected to decline. As mentioned earlier, the labour cost has increased at a faster rate since the beginning of 2000s and accentuated further after the introduction of MGNREGS, the evidence of which can be seen from the price policy reports published by the Commission for Agricultural Costs and Prices (see, Gulati, *et al.*, 2013). With this background, we have analysed the results of labour productivity.

Table 5 presents the values of labour productivity in kg per rupee of labour cost for both irrigated and rainfed crops cultivated in different states. Similar to the labour productivity estimated earlier using value of output with the total labour cost (VOP/HLC), the labour productivity in kg has either not increased much or declined between period-I and period-II for both irrigated and rainfed crops. During period-I, the labour productivity ranges from 0.52 kg to 6.09 kg for irrigated crops, whereas the same ranges only from 0.14 kg to 0.23 kg for rainfed crops. But, during period-II,

TABLE 5. LABOUR PRODUCTIVITY - VOLUME OF YIELD PER UNIT OF WAGE COST

			Period – I (1975-76 to 1990-91)			Period – II (2000-01 to 2016-17)			All Period (1975-76 to 2016-17)		
	Crops (1)	State (2)	Average (kg) (3)	CV (4)	Growth Rate (5)	Average (kg) (6)	CV (7)	Growth Rate (8)	Average (kg) (9)	CV (10)	Growth Rate (11)
Irrigated crop	Paddy	Andhra Pradesh	0.52	17.61	-1.83^{c}	0.40	9.27	-0.34^{ns}	0.46	19.89	-1.15^{a}
		Punjab	0.73	14.23	2.38^{b}	0.77	10.22	-0.40^{ns}	0.75	11.62	0.14^{ns}
	Wheat	Punjab	0.54	17.90	2.36^{a}	0.70	10.15	0.39^{ns}	0.63	18.17	1.15^{a}
		Haryana	0.52	29.24	4.58^{a}	0.54	16.18	-1.48^{a}	0.53	21.90	0.27^{ns}
	Sugarcane	Maharashtra	6.09	19.04	-2.79^{c}	3.55	19.62	-2.13^{a}	4.49	33.93	-2.67^{a}
		Uttar Pradesh	5.99	19.78	0.61^{ns}	4.49	13.36	-0.94^{a}	5.06	22.30	-1.16^{a}
Rainfed crops	Tur	Madhya Pradesh	0.21	23.78	4.11^{ns}	0.16	20.95	-0.84^{ns}	0.17	26.28	-1.46^{a}
		Uttar Pradesh	0.23	25.94	-8.23^{c}	0.17	32.09	-4.45^{a}	0.18	33.27	-3.34^{a}
	Groundnut	Andhra Pradesh	0.19	13.42	-0.29^{ns}	0.16	58.11	-2.29^{a}	0.17	48.22	-1.70^{a}
		Gujarat	0.21	35.83	3.61^{ns}	0.15	25.50	-0.49^{ns}	0.17	34.43	0.62^{ns}
	Cotton	Karnataka	0.20	21.68	-0.90^{ns}	0.13	21.28	1.19^{c}	0.15	32.31	-1.62^{a}
		Maharashtra	0.14	22.06	-2.54^{a}	0.10	12.84	0.72^{c}	0.11	23.13	-1.08^{a}

Source and Notes: Same as in Table 2.

the same ranges from 0.40 kg to 4.49 kg for irrigated crops and from 0.10 kg to 0.17 kg for rainfed crops. These results clearly show that the yield of crop generated from every rupee of cost incurred on the labour input has declined in the recent years. This means that the rate of increase in labour cost is higher than the rate of increase in yield of crops in both irrigated and rainfed crops. Interestingly, this has happened even in sugarcane crop which is often treated as high value commercial crop in India; the average labour productivity of sugarcane of the two selected states declined from 6.04 kg in period-I to 4.02 kg in period-II (see, Figure 3). Despite decline in labour productivity in period-II over its level in period-I, it is still found to be much higher among the irrigated crops in all the states as compared to rainfed crops. One thing that clearly comes out from this analysis is that the increased cost of labour appears to have dampened the labour productivity in both irrigated and rainfed crops.

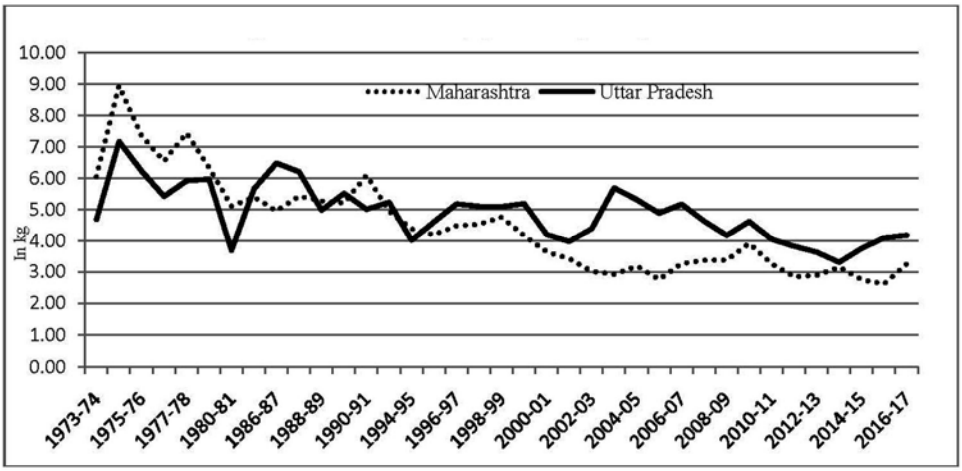

Figure 3. Labour Poductivity (Yield/HLC) in Sugarcane.

IV

CONCLUSIONS

The foregoing analyses clearly indicate that the farm labour productivity estimated under four different dimensions are not the same among the irrigated and rainfed crops cultivated in selected 12 states. This was an expected result but what is intriguing is that this difference is changing over years and also when one opts for fine measurement of labour productivity. Despite variations between the crops and within the crop, the labour productivity is found to be higher among the irrigated crops as compared to the rainfed crops in both period-I (1975-76 to 1990-91) and period-II (2000-01 to 2016-17). The labour productivity increases substantially when the estimates are made using labour man-hours as denominator instead of total labour cost incurred for cultivating the crops. That is, the labour productivity both in terms of value of output (Rs./ha) and yield (kg/ha) increases from every labour man-hour used for cultivating the selected crops. But, this picture changes completely when the estimates are made using the total labour cost (Rs./ha) incurred for cultivating the crops as denominator. The average labour productivity either declines or does not increase appreciably in any of the irrigated and rainfed crops when labour cost spent for the crops increases. It appears that the labour productivity is getting dampened because of slow growth in value of crop output as compared to the increasing rate of labour cost required for cultivating different crops. This means that along with the improvement in production process, there is also need to improve the system that can help increasing the value of crop output. Fixing the minimum support prices in consonance with the cost of cultivation for different crops, timely procurement of crops by state agencies and reducing the marketing expenditures of agricultural commodities will help in augmenting the value of crop output that will help both the farmers and the farm labourers.

The composition of labour used for cultivating different crops has changed considerably over the period. The use of machine labour for carrying out different operations in farming has been increasing at a faster rate. This is particularly more so in the irrigated areas where farming is practiced intensively. This study has not considered the cost of machine labour used for cultivating the selected crops. Given the fast increase mechanical devices, there are possibilities that the labour productivity estimated in this study under four different dimensions might undergo change. But that will unmask the usual errors in computing labour productivity and probably the difference between the two regions may widen as machine labour capital cost may not be spread over the life of the machine. Therefore, a well constructed econometric analysis needs to be carried out by incorporating the machine labour cost to get more solid answers about the farm labour productivity. Field level studies covering the various irrigated and rainfed crops also need to be carried out to assess the real picture of farm labour productivity as CCS data used in this study has certain limitations.

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Agricultural Skilling and Its Impact on Agricultural Commercialisation, Crop Diversification and Employment Choice of Small Holder Agricultural Households: A Study Based on 70th Round of NSSO

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ABSTRACT

This paper has used unit level data available from the 70th Round of NSSO survey on *Situation Assessment of Agricultural Households* to study the impact of agricultural training and extension services on three important dimensions of small holder farming, viz., commercialisation of staples, viz., rice and wheat, crop diversification and employment choice. A Household Commercialisation Index is constructed to determine the intensity of household participation in the output market by small holders. Using a two-step Heckman Selection model, the research shows that training and extension services have a key role in motivating small holder farmers in participating in the output market; however, these factors did not have any significant impact on determining the intensity of commercialisation. Training and extension services have also been found effective in promoting crop diversification among small holder households. Besides bringing out the role of skilling in securing integration of small holders in the output market of rice and wheat and in promoting crop diversification, the study also sheds light on the other determinants of small holder commercialisation and diversification. The Treatment Effect Models show that both commercialisation and diversification have beneficial effects on small holder welfare as they serve to increase the monthly per capita expenditure of these households. Further, using a Heckman Probit Model to control for selectivity in participation in labour market, the study finds that agricultural skilling reduces the probability of a worker belonging to small holder household in engaging in casual daily wage based employment and in unpaid family labour in agriculture; on the other hand the probability of engagement in self-employment activities in agriculture is enhanced by exposure to agricultural training programmes. The findings of the study underscore the need for massive expansion in agricultural skill development and extension services for enabling small holder farmers in India to emerge from the shackles of subsistence farming and in generating sustainable agricultural livelihoods.

Keywords: Agricultural skill development, Agricultural commercialisation, Crop diversification, Employment, Heckman selection model, Herfindahl Index, Heckman probit model, Tobit model, Treatment effect model

JEL: E24, J21, J24, J43, Q16

I

INTRODUCTION

Increasing smallholder incomes and ensuring livelihood security of small and marginal farmers has been a much sought after yet elusive goal of development policy in India. A paradox of India's development experience has been that a decline in agricultural share in gross domestic product (GDP) has not been accompanied by a concomitant decrease in the share of labour force engaged in the primary sector. Low

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productivity of labour in the farm sector has not only posed a serious hindrance to rural poverty alleviation; it has also been accompanied by rising inequality between rural and urban incomes and living standards. Further, pressure of a burgeoning population has resulted in increased fragmentation of agricultural holdings. A study on India's agricultural sector conducted by Singh *et al.,* (2002) has mentioned that small-holder families constitute nearly half of the country's population; but they also comprise more than half of India's poor and malnourished population. According to the Tenth Agricultural Census conducted in 2015-16, the small holder and marginal farmers who own less than 2 hectares of land constitute 86.2 per cent of all farmers but own just 47.3 per cent of the arable land (Bisht *et al.*, 2020). With income from marginal and small holdings not being large enough to sustain livelihoods, there has also been an increasing trend of casualisation of rural farm labour. It is being increasingly realised that raising smallholder incomes is critical for ensuring inclusive growth, tackling rural poverty and meeting broad macro targets of food and nutritional security. Doubling farmer's income has been an oft quoted policy slogan in recent times. The policy envisioned by the Central Government seeks to double income of farmers by the year 2022 taking 2015-16 as the base. Among the various measures that are considered pivotal for raising farm incomes are increase in agricultural productivity, improvement in total factor productivity, diversification towards high value crops, increase in cropping intensity, improvement in terms of trade and shifting cultivators to non-farm and subsidiary activities (Chand, 2017). However, fulfilment of these objectives is critically linked to enhancement of the skill base of farmers in various aspects of agricultural practices and procedures, post-harvest management, value-addition and food-processing. As mentioned by Ganguly *et al*. (2019), "use of modern technologies requires skills that may be different from those necessary for subsistence traditional agriculture. This requires policy attention and institutional support to provide appropriate skills and vocational training to people engaged in not only production activities in agriculture, but all along the agricultural value chains and food-processing sector". This paper therefore, examines the impact of agricultural training and extension services on three aspects of small-holder farming, viz., agricultural commercialisation of staples (rice and wheat), crop diversification and employment choice among small holders. Here, it may be mentioned that commercialisation of smallholder agriculture has been considered essential to improve incomes and better access to diversified and nutritious food (Pingali *et al*., 2019. According to Barrett (2008), "The transition from low productivity semi-subsistence agriculture to high productivity commercialised agriculture has been a core theme of development and agricultural economics for half a century or more". Given the importance of staples from the point of view of food and nutritional security at the micro and macro-levels, transformation from subsistence to commercialised farming of staples is of utmost relevance (Abdullah *et al*., 2017). At the same time, diversification towards high value crops also becomes significant to meet the increasing demand for these items in the domestic and export markets (Birthal *et al*., 2007). Research reveals that diversification into high value crops can reduce poverty among agricultural households with the biggest impact being for small holders (Birthal *et al*., 2015). Besides, crop diversification is being increasingly looked upon as an important strategy for Climate Smart Agriculture (CSA) (Makate *et al*., 2016).Against this backdrop, this paper uses the Situation Assessment Survey conducted by the NSSO (70th Round) to evaluate the status and intensity of agricultural commercialisation of small holder rice and wheat growers in India and their determinants with special emphasis on agricultural training and extension. Besides, the role of skilling in the adoption of diversified farming practices is also evaluated. Further, the relevance of agricultural training in altering occupational choices of workers belonging to small-holder agricultural households is assessed. The objectives of the paper may be stated as follows: (a) To assess the extent of agricultural commercialisation among small holder rice and wheat growers in India and to determine the factors influencing the decision to participate in output markets and further, the intensity of participation (with special focus on the role of agricultural training), (b) To evaluate the role of agricultural skilling in promoting crop diversification among small holders.(c) To ascertain the effects of agricultural commercialisation and crop diversification on the economic welfare of small holder agricultural households and (d) To study the effects of agricultural training (skilling) on the occupational choices of workers belonging to small holder agricultural households. The paper is organised in four sections including the introduction. Data and methodology issues are outlined in Section II. The main analytical findings are reported in Section III. The last section summarises and concludes the findings.

II

DATA AND METHODOLOGY

The study is based on unit level data available from the 70th Round on the NSSO survey on Situation Assessment Survey of Agricultural Households. The survey was conducted in two rounds: the first round was carried out between January 2013 and July 2013 while the second round was conducted between August 2012 and 31st December, 2013. The first round collected information relating to agricultural production and practices for the agricultural season in the preceding six months that is July 2012 to December 2012. The second round extracted information on various aspects of farming during January 2013 to June 2013. A household was considered to be an agricultural household if it had a value of agricultural produce not less than that of Rs.3000 and also had at least one household member who was self-employed in agriculture either in principal status or subsidiary status during the past 365 days. The data set consists of a short panel with 35,200 households being surveyed in the first visit and 34,907 of the same households being surveyed during the second visit. Apart from data on farming expenses and receipts, the survey also collected information on the other aspects of agricultural households such as indebtedness, crop insurance, monthly consumption expenditure, extension services etc. The survey was carried out in rural areas only.

A small holder agricultural household in the study is defined as a household owning up to 2 hectares of land. For studying commercialisation of staples among smallholders, households growing rice (or wheat) as one of the crops either in the *kharif* or *rabi* seasons were considered. The analysis was carried out separately for rice and wheat crops. Here, it may be noted that market participation or commercialisation of agriculture may be considered from an input as well as output perspective. Commercialisation on the input side entails greater use of quality inputs that are procured from the market. However, in the present study, we focus on output commercialisation. Accordingly, a Household Commercialisation Index (HCI) is compiled for each household as follows:

$$HCI = \frac{Quantity\ of\ \ i^{th} crop\ sold\ during\ the\ year}{Quantityof\ the\ i^{th} crop\ produced\ during\ the\ year} \quad ....(1)$$

The range of HCI varies between zero and one with zero indicating complete lack of market participation and one, indicating perfect integration. In order to ascertain the determinants of household commercialisation we employ a Heckman Selection Model (HSM). The choice of HSM is explained by the fact that the intensity of household commercialisation can be studied only for those households who participate in the output market giving rise to the problem of self-selection. The HSM involves a two-step procedure.[1]In the first step, the probability of a household participating in the output market is modelled using a selection (Probit) model as follows:

$$\begin{aligned} &Y_i = 1(Household\ participates\ in\ the\ output\ market\ of\ i - thcrop) \\ &if Y_i^* = x_i\beta_i + \mu_i > 0 \\ &\quad = 0\ (Household\ does\ not\ participate\ in\ the\ output\ market), otherwise \end{aligned}$$

where, Y_i and Y_i* are, respectively, the observed and latent variables corresponding to the household's decision to participate in the output market of the i-th crop, *x* is the vector of covariates, and $\mu$is the stochastic error term.

The outcome equation for assessing the determinants of the intensity of household commercialisation is

$$HCI_i = x_i\lambda_i + \delta_i \quad ....(2)$$

where, HCI is the Household Commercialisation Index, x is a vector of covariates, δ is the stochastic error term and i refers to the i-th crop. The dependent variable in the outcome equation being continuous, a linear model is estimated.[2]

The extent and determinants of crop diversification are assessed with a Crop Diversification Index (CDI) based on the share of cultivated area devoted to various crops. Accordingly, we have

$$CDI = 1 - HI \qquad ....(3)$$

where, HI is the Herfindahl Index and is computed as follows

$$HI = \sum_{i=1}^{n} s_i^2$$

here, s_i represents the proportion of cultivated area under the i-th crop and is computed as $s_i = \frac{A_i}{\sum_i^n A_i}$, where A_i is the area under the i-th crop. The value of the HDI ranges from 0 to 1, with 0 indicating complete specialisation and one indicating complete diversification. Hence, the value of HDI being censored, we use a Tobit model to evaluate the determinants of crop diversification.

To assess the impact of commercialisation and crop diversification on household welfare, Treatment Effect Model (TEM) has been used. Household welfare has been measured in terms of Monthly Per Capita Expenditure (MPCE). The use of TEM is warranted as difference is baseline characteristics of households can lead to biased estimates of Ordinary Least Squares (OLS) regression.

Evaluation of the impact of agricultural skilling on employment choice of workers has been made using a Heckman Probit Model (HPM). Since employment status is observed for only those people who participate in the labour market, the decision to seek employment in a given activity is not independent of the decision to participate in the labour market that is, there is selectivity bias. The equation for Labour Force Participation is

$$\begin{aligned} LFPR &= 1(Individual\ is\ in\ the\ labour\ force)\ if LFPR^* = x\gamma + € > 0 \qquad ....(4) \\ &= 0\ (individual\ is\ not\ in\ the\ labour\ force), otherwise \end{aligned}$$

where, LFPR and LFPR* are, respectively, the observed and latent variables corresponding to the labour force participation decision of the individual , x is the vector of covariates including the treatment and € is the stochastic error term.

The outcome equation for evaluating the factors influencing the decision to participate in the i-th employment is

$$\begin{aligned} EMP_i &= 1(Individual\ is\ in\ the\ i^{th}\ employment)\ if EMP_i^* = x\alpha + \theta > 0 \\ &= 0, otherwise \qquad ....(5) \end{aligned}$$

As employment status of individuals is observed only if $x\gamma + \epsilon > 0$, the HPM simultaneously estimates Equations (4) and (5) and then tests for independence of the two equations. Equation (5) is estimated for five alternative employment scenarios viz., (a) self-employed in agricultural sector (b) Employer in agricultural sector (c) Unpaid family worker in agricultural sector (d) Salaried worker and (e) Casual daily wage labourer. The alternative scenario in each of these cases is that the worker is employed in some other employment than the category under consideration. Further, in both HSM and HPM, suitable exclusion criterion was used. The exclusion criterion of HSM and HPM entail that all variables in the outcome model should be included in the selection equation; further the selection equation should contain at least one variable that is excluded from the outcome model (Wooldridge, 2013).

III

RESULTS AND DISCUSSION

3.1 *Descriptive Statistics of Sample Households*

Descriptive statistics relating to sample households are presented in Table 1. Of the 35,200 sample households who were surveyed during the first visit 73.83 per cent were small holder households. Households with semi-medium land holdings comprise 18.92 per cent of the sample. About 5 per cent of the sample households had medium landholdings and large landowners formed only 2.29 per cent of the

TABLE 1. DESCRIPTIVE STATISTICS OF SAMPLE HOUSEHOLDS

(1)	(2)
Percentage of small holder households (<= 2 ha.)	73.83
Percentage of households with semi-medium land holdings (>2ha &<= 4ha)	18.92
Percentage of households with medium land holdings (>4ha &<=10ha)	4.96
Percentage of households with large land holdings (> 10 ha)	2.29
Percentage of SC households	13.24
Percentage of ST households	18.96
Percentage of OBC households	40.32
Percentage of Forward Caste Households	27.48
Percentage of households with off-farm income	93.01
Percentage of female-headed households	8.42
Average size of land owned by households (in ha.)	1.4
Percentage of household heads with no education	34.41
Average household size	5.4
Percentage of Labour Force (15-64 years) receiving agricultural training	2.4
Percentage of non-agricultural workers in the sample	13.52
Percentage of workers with no education	32.62
Percentage of workers with less than primary education	10.63
Percentage of workers with primary education	12.63
Percentage of workers with middle school education	19.27
Percentage of workers with secondary school education	12.81
Percentage of workers with higher secondary education & above	12.87
Percentage of households who accessed agricultural extension services	60.54

Source: Based on author’s calculation from NSSO data.

sample. The average size of land owned by the households is 1.4 hectares. OBC households comprised the largest caste group with 40 percent of the sample households belonging to this category. The percentage of Forward caste, Scheduled Caste (SC) and Scheduled Tribe (ST) households in the sample were 27.48, 13.24 and 18.96 respectively. Female-headed households made up 8.42 per cent of the total sample households. More than 34 per cent of the household heads were illiterate. Interestingly, 93 per cent of the sample households had access to income outside cultivation. The average household size is 5.4. Only 2.4 per cent of the sample individuals in the age group of 15-64 years who were in the labour force reported that they received training in agriculture. Nearly, 61 per cent of the sample households reported that they availed agricultural extension services at least once during the agricultural year. About 33 percent of the workers in the age group (15-64) years were illiterate. Only 13.52 percent of the workers in the sample were engaged in non-agricultural activities. Further, out of the 35,200 households in the sample, 19,098 households cultivated rice at least once during the agricultural year of which 14,182 households were small holders. Also, out of the 11,009 households that cultivate wheat as one of the crops, 7688 households were small holders.

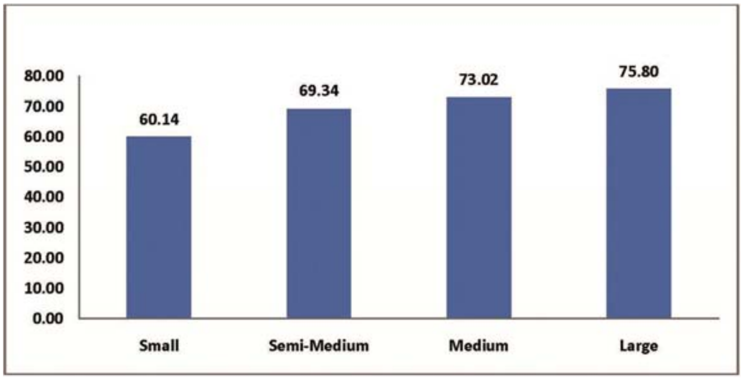
A description of variables used for the regression analysis is given in Table 2. It may be noted that in case of education, individuals with either no education or those who have not attended formal schooling are taken as the base category. Four caste categories, viz., SC, ST, OBC and Forward Caste have been used in the analysis with forward caste households constituting the base category. With regard to religion, other religions apart from Hindu and Muslims were taken as the base. The rest of the information contained in Table 2 is self-explanatory and does not warrant further discussion.

3.2 *Impact of Agricultural Skilling on Commercialisation*

Since the first objective of the study is to evaluate the factors associated with the commercialisation of staples consisting of rice and wheat growers, only those households that cultivate rice or wheat as one of the crops in either of the two agricultural seasons have been considered for the purpose of compilation of the Household Commercialisation Index (HCI). Therefore, taking rice into consideration, those agricultural households that did not cultivate rice either during the *kharif* or *rabi* season were not considered in the analysis; the same procedure was followed for wheat. Figure 1 shows the HCI of rice calculated as the percentage of total quantity marketed to total quantity produced by size class of land owned. It is observed that the value of the HCI is the lowest for small holders and rises monotonically as the size of land holding increases implying that there is significant scope for increasing the rate of market participation for small holders. Thus, small land owning households on an average are found to be selling only 60 per cent of their rice output in the market whereas for large land owners, the corresponding figure is at 76 per cent. Similarly, in the case of wheat, the average value of the HCI is very low for

TABLE 2. DESCRIPTION OF VARIABLES USED IN REGRESSION ANALYSIS

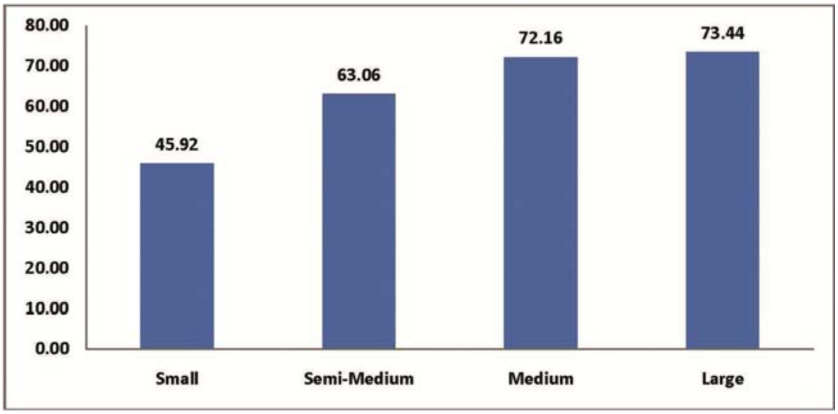
Variable (1)	Description (2)
AGE_HH	Age of Household Head (in completed years)
AGE2_HH	Square of age of Household Head
AGE	Age of individual (in completed years)
AGE2	Square of age of individual
SEX_HH	Sex of household head (Dummy=1, if household head is male, 0 otherwise)
SEX	Sex of worker(Dummy=1, if male; 0 otherwise)
SC	Caste dummy(=1, if household/ individual belongs to SC category, 0 otherwise)
ST	Caste dummy(=1, if household/ individual belongs to ST category, 0 otherwise)
OBC	Caste dummy(=1, if household/ individual belongs to OBC category, 0 otherwise)
HHS	Household size
DR	Dependency rate
TRAINDUM1	Dummy=1, if any member of the household received agricultural training, 0 otherwise
TRAINDUM2	Dummy=1, if individual has received agricultural training, 0 otherwise
EXTENDUM	Dummy=1, if household accessed agricultural extension services any time of the year
PCLAND	Size of land owned per capita(in hectare)
LANDCUL	Size of cultivated land (in hectares)
IRR	Dummy=1, if household has access to irrigation, 0 otherwise
BPRIM_HH	Dummy=1, if household head had below primary education; 0 otherwise
PRIM_HH	Dummy=1 , if household head has read up to primary school, 0 otherwise
MIDDLE_HH	Dummy=1, if household head has read up to middle school; 0 otherwise
SEC_HH	Dummy=1, if household head has secondary education; 0 otherwise
HS_HH	Dummy=1, if household head has high school education and above; 0 otherwise
BPRIM	Dummy=1, if individual had below primary education; 0 otherwise
PRIM	Dummy=1 , if individual has read up to primary school, 0 otherwise
SEC	Dummy=1, if individual has read up to middle school; 0 otherwise
MIDDLE	Dummy=1, if individual has secondary education; 0 otherwise
HS	Dummy=1, if individual has high school education and above; 0 otherwise
HIN	Dummy=1, if household/ individual is Hindu; 0 otherwise
MUS	Dummy=1, if household/ individual is Muslim; 0 otherwise
OFFARM	Dummy=1, if household has access to off-farm income
YIELD	Yield per hectare of cultivated land
NOCROP_OTHRICE	Number of crops grown other than rice
NOCROP_OTHWHEAT	Number of crops grown other than wheat
SEASON	Dummy=1, if *kharif* season; 0 otherwise
OPER_AGRILAND	Dummy=1, if the households to which the worker belongs operated any land for cultivation



Source: Based on Author's calculation of NSSO data

Figure 1. HCI of Rice by Size Class of Land Owned.

small holders at 45.92 indicating that small holder wheat cultivating households on an average sell 45 per cent of their wheat output in the market compared to 73 per cent for large landowners. Clearly, as in the case of rice, the proportion of wheat offloaded in the market increases with increase in size of land owned (Figure 2).



Source: Based on author's calculation from NSSO data.

Figure 2. HCI of Wheat by Size Class of Land Owned.

The incidence of subsistence farming among rice and wheat growers for various categories of owned land is shown in Table 3. It is observed that 53per cent of the small holder rice growers and 61 per cent of small holder wheat growers were engaged in subsistence farming that is, they did not sell any part of their produce. The prevalence of subsistence farming is lower among semi-medium and medium landowners. However, there appears to be a U shaped pattern in the prevalence subsistence farming among land owning groups with large land owners having a higher incidence of subsistence farming. This perhaps can be explained by the fact that large landowners lease out sizeable portions of their cultivable lands and a greater portion of production from self-cultivated land is retained for meeting the consumption requirements of the household.

TABLE 3. PERCENTAGE OF SUBSISTENCE FARMERS BY SIZE CLASS OF LAND OWNED

Land Size (1)	Rice (2)	Wheat (3)
Small holders	53.37	60.48
Semi-Medium	36.36	30.85
Medium	35.18	24.44
Large	49.38	47.52
Total	48.19	51.37

Source: Based on author's calculation from NSSO data.

Table 4 presents the result of the HSM for determining the factors that influence the decision by small holder rice growers to participate in the output market and also the factors affecting the intensity of such participation. The estimates of the selection

TABLE 4. RESULTS OF HECKMAN SELECTION MODEL-RICE

	Outcome equation (HCI)			Selection equation (Y_1)		
	Coefficient	z	P value	Coefficient	z	P value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
AGE_HH	-0.002	-1.18	0.237	0.009	1.63	0.102
Age2_HH	0.000	0.89	0.374	0.000*	-1.87	0.061
Sex_HH	0.007	0.52	0.601	0.068	1.63	0.103
SC	-0.038***	-3.77	0	-0.042	-1.13	0.257
ST	-0.110***	-11.36	0	-0.167***	-4.73	0
OBC	-0.005	-0.61	0.543	-0.054*	-1.91	0.056
HHS	-0.007***	-5.35	0	-0.062***	-12.88	0
DR	-0.044***	-2.92	0.003	-0.015	-0.28	0.782
TRAINDUM1	0.021	1.62	0.105	0.124**	2.35	0.019
EXTENDUM	-0.002	-0.34	0.737	0.244***	11.04	0
LANCUL	0.028***	6.05	0	1.281***	48.78	0
IRR	0.126***	17.37	0	0.415***	17.18	0
BPRIM_HH	-0.050***	-5.13	0	0.051	1.46	0.145
PRIM_HH	-0.050***	-5.26	0	0.058*	1.67	0.094
SEC_HH	-0.015	-1.47	0.141	0.083***	2.57	0.01
MIDDLE_HH	-0.048***	-5.32	0	0.095**	2.46	0.014
HS_HH	-0.027**	-2.56	0.011	-0.020	-0.52	0.605
HIN	-0.080***	-7.51	0	0.095**	2.41	0.016
MUS	-0.149***	-10.9	0	0.253**	4.88	0
SEASON	0.064***	8.4	0	0.543***	18.94	0
OFFARM	-0.049***	-4.76	0	-0.021	-0.54	0.592
Constant	0.803***	16.23	0	-1.366***	-8.33	0
YIELD				0.000***	5.83	0
NOCROP_OTHRICE				0.068***	5.64	0
Mills lambda	-0.027**	-2.1	0.036			
Wald Chi	831.95***					

Source: Based on author's calculation from NSSO data.
***, ** and* Significant at 1, 5 and 10per cent level, respectively.

equation shows that the probability of a small holder household participating in the rice output market is positively impacted if the household has at least one member who has undergone training in agriculture. This is indicated by the positive and significant value of the coefficient of the training dummy (TRAINDUM1). Availability of agricultural extension services also increases the likelihood of small holder participation in the output market for rice. In fact the coefficient for extension services is nearly double the coefficient for training and is significant at one per cent indicating that extension services have a greater impact on the probability of market integration than training. Availability of irrigation facilities exert a potent influence in determining smallholder's access to output markets as does the size of land cultivated by the household. The scope for commercialisation is higher in the *kharif* season given that rice in India is primarily a *kharif* crop. While age and sex of the household head do not seem to be related to household's decision to engage in the output market, education of the household head is found to be exerting a crucial influence. Thus, taking illiterate household heads as the base category, as education level of the household head improves; the likelihood of market participation also increases. However, the dummy relating to higher education was not found to be significant.

Hindu and Muslim households are more likely to be involved in rice output market than households belonging to other religious groups. The probability of participation in the output market declines if the household belong to the ST category and also when the household size increases. The variables YIELD and NOCROP_OTHRICE were introduced in the selection equation to meet the exclusion criterion of HPM. Both the variables have been found to be statistically significant although the co-efficient of YIELD is very small. The availability of off-farm income was not found to be important in explaining the smallholder rice growing households' decision to participate in the product market.[3]

The outcome equation for determining the factors that influence the intensity of commercialisation of rice by small holders reveals that training and extension do not have a significant impact on the value of HCI. Nor were factors relating to age and sex of household head found to be relevant in determining the intensity of commercialisation However, increase in educational attainments of household head were found to lower the extent of rice commercialisation of small holder households. Households belonging to SC and ST communities have a lower average value of HCI compared to forward caste households. Ironically, while Hindu and Muslim households are more likely to engage in the output market for rice compared to other religious groups (as depicted by the selection equation), their intensity of participation in terms of proportion of output marketed is found to be lower than the base category. Increase in the size of land cultivated by small holders and availability of irrigation increases the value of the HCI. On the contrary, increase in household size and dependency rate lowers HCI for small holders. Off-farm income was found to be associated with lower values of HCI. The value of HCI was likely to be higher during the *kharif* season. The coefficient for Mills Lamda is significant implying that the selection equation and outcome equation are not independent. The Wald chi square is significant showing that all regression coefficients in the model are not simultaneously zero. This demonstrates the utility of the model in explaining the determinants of the intensity of commercialisation by small holder households.

We now examine the impact of commercialisation on the monthly per capita income of small holder rice growers. Two different treatment models are estimated. In the first model the treatment variable is a dummy that takes a value one if the household participates in the output market and zero otherwise. In the second model, the dependent variable is also a dummy variable that takes a value one if the HCI for a household is greater than 50 per cent and zero otherwise. Thus, while the first model captures the impact of commercialisation on MPCE, the second model helps us to understand the effects of the intensity of commercialisation on MPCE. Both models have been estimated using two alternative treatment methods, viz., Doubly Robust Estimators (DRE) and Nearest Neighbour Matching (NNM). The results are reproduced in Table 5. According to the DRE, the average treatment effect of the first model is INR 59.66 rupees and that of the second model is INR117.34. According, to NNM, the values of the ATE in the first and second models are INR 100.33 and

INR162.30 respectively. The difference in the estimates obtained from the two methods notwithstanding, the results of the TEM shows that commercialisation of rice increases the MPCE of small holder households. Further, the benefits from commercialisation are larger at higher levels of commercialisation.

TABLE 5. EFFECT OF COMMERCIALISATION OF RICE ON MPCE

	Model 1			Model 2		
Treatment method	Coefficient	z	P value	Coefficient	z	P value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Doubly robust estimators	59.66***	2.78	0.005	117.34***	4.21	0
Nearest neighbour matching	100.33***	3.57	0	162.30***	3.82	0

Source: Based on author's calculation from NSSO data.
*** Significant at 1 per cent.

The results of the HSM for wheat are shown in Table 6. As in the case of rice, training and extension have been found to positively influence the decision to participate in the output market (selection equation) but these variables were not found to be having any significant impact on the intensity of commercialisation (outcome equation) of wheat output. Apart from training and extension, the other factors which had a positive impact on the decision to participate in the product

TABLE 6. RESULTS OF HECKMAN SELECTION MODEL-WHEAT

	Outcome equation (HCI)			Selection equation(Y_2)		
	Coefficient	z	p value	Coefficient	z	p value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
AGE_HH	0.001	0.49	0.623	0.003	0.34	0.737
AGE2_HH	0.000	-0.8	0.426	0.000	-0.42	0.673
SEX_HH	-0.005	-0.28	0.776	0.123	1.86	0.062
SC	0.007	0.44	0.662	-0.139***	-2.41	0.016
ST	-0.033*	-1.96	0.05	0.140**	2.1	0.036
OBC	-0.034***	-3.51	0	-0.019	-0.47	0.639
HHS	-0.008***	-5.29	0	-0.046***	-7.32	0
DR	0.002	0.1	0.924	-0.129	-1.62	0.104
TRAINDUM	0.010	0.88	0.378	0.131**	2.21	0.027
EXTENDUM	0.015	1.87	0.061	0.203***	6.05	0
LANDCUL	0.054***	6.9	0	1.572***	37.25	0
IRR	0.027	1.26	0.207	0.699***	10.94	0
BPRIM_HH	0.023	1.6	0.109	-0.002	-0.03	0.974
PRIM_HH	0.011	0.75	0.453	-0.014	-0.23	0.815
SEC_HH	-0.006	-0.42	0.674	0.060	1.16	0.246
MIDDLE_HH	-0.016	-1.3	0.195	0.023	0.41	0.683
HS_HH	-0.007	-0.52	0.603	0.076	1.35	0.178
HIN	-0.113***	-6.93	0	-0.751***	-7.72	0
MUS	-0.068***	-3.3	0.001	-0.453***	-4.09	0
OFFARM	-0.014	-1.68	0.093	-0.243***	-7.22	0
CONSTANT	0.701***	11.25	0	-1.078***	-4.37	0
YIELD				0.000***	7.07	0
NOCOTH_WHT				0.102***	5.98	0
Mills Lamda	-0.0373**	-2.37	0.018			
Wald Chi2	180.8***					

Source: Based on author's calculation from NSSO data.
*** and ** Significant at 1 and 5 per cent level, respectively.

market are size of cultivated land, yield per hectare, number of crops grown other than wheat and availability of irrigation facilities.ST households also are more likely to engage in the output market for wheat compared to general caste households. The factors which reduce the probability of output market participation in case of wheat are household size and availability of off-farm income. Hindu and Muslim households also had lower probability of participating in the output market compared to other religious groups.[4]

The outcome equation of table which reports the determinants of the intensity of wheat commercialisation reports only a few significant factors. Thus, ST and OBC households are likely to have lower intensity of wheat commercialisation than forward caste. The value of HCI increases with every increase in the size of cultivated land and decreases with an increase in household size. Hindu and Muslim households are likely to have a lower value of HCI on an average than households of the base category. The Mills Lamda is significant indicating that the Selection and Outcome equations are not independent and that the use of the HSM is justified. The Wald chi square test statistic has also been found significant. Thus, the null hypothesis that all coefficients in the equation are simultaneously equal to zero is rejected.

The implications of market integration among small holder wheat growers for MPCE are depicted in Table 7. The specification of the TEM in case of wheat is the same as that of rice. Thus, two TEM are estimated. In the first model, the dependent variable is a dummy that takes the value one, if a household offloads a portion of its produce in the output market and is zero. In the second model, the dependent variable is also a dummy that takes the value one if a household sells more than 50 per cent of its produce and is zero otherwise, both models have be used employing two different methodologies to check for robustness. The DRE for the first TEM shows that if a household participates in the output market, its MPCE is likely to be higher by INR 60 on an average compared to a household that engages in the subsistence farming of wheat. The estimates of the same model using the NNM method, puts the value of the ATE at 67.27. In both the cases, the value of the ATE has been found to be significant. In case of the second TEM, the value of the ATE obtained by DRE technique is INR 90.82 and that obtained by NNM method is 102.43. Again, both coefficients are positive and significant. The comparison of the two models indicates that higher levels of market integration on the output side are associated with better welfare outcomes.

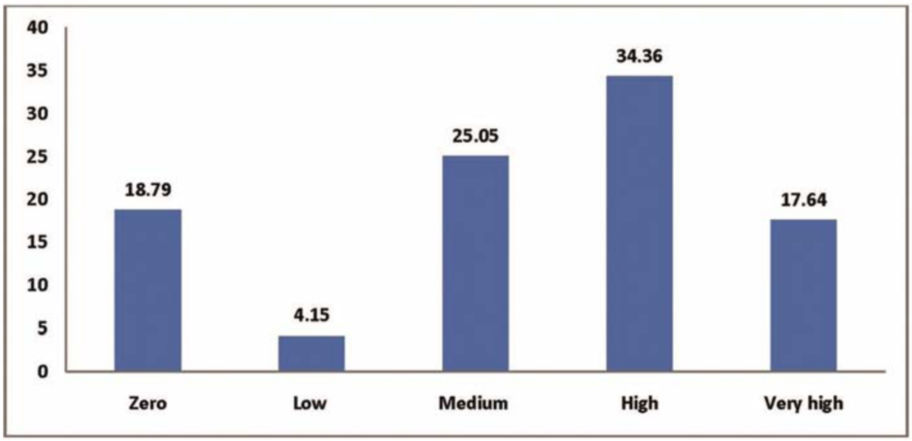
TABLE 7. EFFECT OF COMMERCIALISATION OF WHEAT ON MPCE

	Model 1			Model 2		
Treatment method	Coefficient	z	P value	Coefficient	z	P value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Doubly robust estimators	51.64**	2.28	0.022	90.82***	3.40	0.01
Nearest neighbour matching	67.27***	2.62	0.009	102.43***	3.69	0

Source: Based on author's calculation from NSSO data.
*** and ** Significant at 1 and 5 per cent level, respectively.

3.3 *Impact of Agricultural Skilling on Crop Diversification*

The distribution of small landowners by various categories of CDI is shown in Figure 3.About 18.79 per cent of the small holders cultivate only one crop throughout the year, i.e., they have zero value of CDI. Less than 4 per cent of the small holders have CDI between zero and 0.25. About a quarter of the households have CDI in the medium range while 34 per cent of the households had high level of CDI. 17.64 per cent of the small holder households had CDI value of greater than .75 Thus, more than half of the small land owing households had CDI scores above .50.



Source: Based on author’s calculation from NSSO data.

Figure 3.Distribution of CDI for Small Landowners.

The results of the Tobit regression shown in Table 8 depict the determinants of crop diversification among small holder households. It is observed that irrigation is the single most important factor influencing the CDI. Availability of irrigation on an average increases the CDI by 0.19. If the household has at least one member who has received formal training in agriculture the CDI increases by 0.034 units. Likewise availability of extension services increases CDI by 0.060 units. An increase in the educational attainment of the head of the household head increases the value of the CDI. Increase in per capita land owned and access to off-farm earnings also enhances the value of CDI by 0.048 and 0.045 units respectively. The CDI of female headed households is less than that of male headed households by 0.033 units indicating that female headed households are likely to be less diversified compared to male-headed households. The value of CDI tends to be lower for SC, ST and OBC households compared to general category households. Although the value of the coefficients of age and household size are statistically significant, the absolute size of coefficients is very small.

TABLE 8. DETERMINANTS OF CROSS DIVERSIFICATION: MARGINAL EFFECTS OF TOBIT REGRESSION

Variable (1)	Coefficient (2)	z (3)	P value (4)
AGE_HH	0.003***	2.57	0.01
AGE2_HH	0.000	-1.39	0.163
SEX_HH	-0.033***	-3.99	0
BPRIM_HH	0.022***	3.04	0.002
PRIM_HH	0.053***	7.21	0
MIDDLE_HH	0.052***	7.59	0
SEC_HH	0.031***	3.92	0
HS_HH	0.048***	5.97	0
HIN	-0.125***	-15.69	0
MUS	-0.056***	-5.36	0
HHS	0.007***	6.32	0
DR	0.012	1.12	0.265
IRR	0.191***	38.32	0
PCLAND	0.048***	3.36	0.001
TRAINDUM	0.034***	3.04	0.002
EXTENDUM	0.060***	13.04	0
SC	-0.037***	-4.8	0
ST	-0.014***	-1.91	0.056
OBC	-0.045***	-7.92	0
OFFARM	0.045***	5.13	0
LR Chi2	2407.84***		0

Source: Based on author's calculation from NSSO data.
*** denotes significant at 1 per cent

The outcome of treatment effect model for analysing the impact of crop diversification on monthly per capita expenditure of households is shown in Table 9. Here, it may be mentioned that CDI is calculated by considering gross cropped area of a household for the entire agricultural year. However, the data sets reports monthly household expenditure for two seasons, viz., *kharif* and *rabi* on a 30 day recall basis. Hence, for evaluating the impact of crop diversification on MPCHE, we take the average of the two values reported for each agricultural season. Two types of treatment are considered. In the first case, the treatment dummy takes a value 1 if the value of CDI for a household is greater than zero and is zero otherwise. In the second case, the treatment dummy takes a value 1 if the CDI of a household is greater than .5 and is zero otherwise. Thus while the first TEM helps in assessing the average impact of crop diversification on MPCE, the second model enables us to have an idea of the impact of higher diversification. As in the case of HCI, here also the two models are estimated using two different treatment methods. The doubly robust estimators show that after matching for baseline covariates, the MPCE of a household practicing crop diversification is likely to be higher than a household for which CDI is zero by INR 155. According to the estimates obtained using nearest neighbour matching method, the average gain in MPCE resulting from treatment is about INR185. Similarly, in case of the second model, it is found that the average treatment effects employing the doubly robust estimators and nearest neighbour estimators were INR 210 and INR 229 respectively. Hence, two conclusions can be drawn from the aforesaid analysis.

Firstly, notwithstanding the difference in estimates arising from different treatment methods, it may be concluded that small holder households opting for crop diversification are likely to have higher MPCE compared to those households who specialise in the production of a single crop. Secondly, the gains in MPCE are likely to increase with increase in the value of the CDI.[5]

TABLE 9. EFFECT OF CROP DIVERSIFICATION ON MPCE

	Model 1			Model 2		
Treatment method	Coefficient	z	P value	Coefficient	z	P value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Doubly robust estimators	154.65***	10.53	0	210.21***	15.89	0
Nearest neighbour	185.14***	12.44	0	229.24***	16.58	0

Source: Based on author's calculation from NSSO data.
*** significant at 1 per cent.

3.4 *Effects of Skilling on Occupational Choice of Workers*

The effect of agricultural skilling on occupational choice of workers aged 15-64 years from small holder households has been analysed using five mutually exclusive occupational categories. Thus, five different outcome models have been estimated each for a specific type of employment. The selection equation for labour force participation is however the same in all cases. The specification of the outcome equations in the five cases are shown in Table 10.

TABLE 10. DESCRIPTION OFDEPENDENTVARIABLES IN THE OCCUPATION CHOICE MODELS

Model (1)	Dependent variable (2)
Model 1	Z_1=1, if the worker is self-employed in agriculture, 0 otherwise
Model 2	Z_2=1, if the worker is an employer engaged in agriculture, 0 otherwise
Model 3	Z_3=1, if the worker is an unpaid family worker engaged in agriculture, 0 otherwise
Model 4	Z_4=1, if the worker is engaged in regular/salaried jobs, 0 otherwise
Model 5	Z_5=1, if the worker is engaged in casual daily wage based employment, 0 otherwise

The LFPR (selection) equations estimated for each model contain the same variables and yield more or less the same conclusions (Table 11). The probability of a person participating in the labour market increases with an increase in age; however, the same probability decreases with further increase in the age of the individual. Males are more likely to seek employment than females. Individuals belonging to SC, ST and OBC households have higher probability of participating in the labour market compared to those from forward caste households. Taking illiteracy as the base education category, an increase in educational base of a person is accompanied by a reduction in the probability of seeking employment in the labour market. Interestingly, the absolute size of the co-efficient related to an educational dummy increases with every increase in the level of education. Probability of labour market participation also falls for every increase in household size. The co-efficient relating

TABLE 11. DETERMINANTS OF LABOUR FORCE PARTICIPATION - SELECTION EQUATION

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
AGE	0.189***	116.97	0.188***	117.06	0.188***	116.9	0.188***	116.87	0.187***	115.54
AGE2	-0.002***	-100.59	-0.002***	-101.05	-0.002***	-100.27	-0.002***	-100.85	-0.002***	-99.67
SEX	1.386***	175.34	1.378***	175.58	1.401***	170.92	1.378***	175.51	1.371***	173.39
BPRIM	-0.156***	-11.41	-0.157***	-11.55	-0.163***	-12.05	-0.157***	-11.52	-0.152***	-11.19
PRIM	-0.113***	-8.9	-0.110***	-8.66	-0.124***	-9.84	-0.109***	-8.56	-0.102***	-8.08
MIDDLE	-0.179***	-16.05	-0.176***	-15.8	-0.204***	-18.26	-0.174***	-15.67	-0.167***	-15.05
SEC	-0.368***	-29.85	-0.363***	-29.49	-0.388***	-31.45	-0.361***	-29.33	-0.352***	-28.64
HS	-0.390***	-31.78	-0.380***	-31.27	-0.423***	-34.77	-0.378***	-31.07	-0.368***	-30.11
TRAINDUM2	0.589***	14.88	0.591***	14.93	0.563***	14.49	0.590***	14.88	0.597***	15.02
SC	0.186***	15.31	0.188***	15.43	0.183***	15.26	0.189***	15.52	0.189v	15.63
ST	0.543***	50.02	0.549***	50.72	0.517***	48.75	0.550***	50.68	0.548***	50.97
OBC	0.190***	22.31	0.191***	22.39	0.159***	18.87	0.193***	22.56	0.197***	23.16
PCLAND	0.456***	16.61	0.389***	14.76	0.748***	26.41	0.391***	14.76	0.359***	13.86
HHS	-0.007***	-4.76	-0.012***	-9.42	-0.024***	-21.78	-0.013***	-9.34	-0.019***	-13.56
HIN	0.228***	26.94	0.234***	27.33	0.216***	30.6	0.230***	26.5	0.237***	28.64
DR	-0.048***	-3.55	-0.016	-1.24	-0.058**	-5.26	-0.016	-1.18	-0.018	-1.4
OPER_AGRILAND	-0.064***	-3.71	-0.077***	-4.44	-0.176***	-9.8	-0.077***	-4.44	-0.062***	-3.6
CONSTANT	-4.068***	-113.18	-4.016***	-113.06	-4.150***	-117.62	-4.013***	-112.76	-3.972***	-110.87

*** significant at 1 percent; ** significant at 5 percent.

to dependency rate is negative across all equations but significant only in the first and third models. Compared to other religious groups, an individual from a Hindu household has higher probability of participation compared to other groups. The probability of a person entering the labour market is higher for an individual who has received training in agriculture compared to an individual with no agricultural training. An individual belonging to a household that operates agricultural land has lower probability of labour market engagement.

The results of the outcome model relating to employment choice given in Table 12 are summarised below.

(1) The probability of a person being self-employed in positively and significantly associated with training, age, size of land available per capita and involvement in agricultural operations. Among the factors that increase the possibility of a person pursuing self-employment activities in agriculture, the coefficient relating to the training dummy is quite large. Males and ST workers are also more likely to pursue this vocation. As educational base improves, the likelihood of self-employment in agriculture declines monotonically. This can be inferred from the growing absolute size of the coefficients of dummies pertaining to higher levels of education.

(2) Agricultural training also significantly enhances the probability of an individual being an employer within the agricultural sector. The coefficient relating to the training dummy in the second model is .224 and it has been found to be statistically significant. An improvement in the educational base of the workers also increases the scope for a person to act as an employer in agriculture. However, SC, ST and OBC households are less likely to act as employers as are female workers. Size of per capita land holding is the single most important factor influencing employment in this category.

(3) The results of the third model reveals that a person receiving training in agriculture is less likely to be employed as unpaid family worker in agriculture. SC, ST and OBC workers are also less likely to be involved in unpaid family work compared to workers from forward caste. Interestingly, a worker with better education is more likely to engage himself in unpaid agricultural work within the household compared to a person with no education. Per capita land and operation of agricultural holdings again stand out as very important factors that positively impact on employment in this category.

4) The probability of a person being engaged in regular salary/ wage based employment is lower if the individual has received agricultural training. The likelihood of pursuing this vocation is also negatively related to both the size of per capita land holding and the dummy for the operation of agricultural holdings. The last result reveals that if the worker belongs to a cultivating household he has lower probability of pursuing wage based employment. SC, ST and OBC workers also have lower possibility of being engaged in wage based employment as do female workers.

(5) The results of the last model displays the very important finding that a worker who has received agricultural training is less likely to pursue casual daily wage-based

TABLE 12. DETERMINANTS OF OCCUPATIONAL CHOICE - OUTCOME EQUATION

	Model 1		Model 2		Model 3		Model 4		Model 5	
Variables	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
AGE	0.170***	69.61	0.107***	15.69	-0.173***	-100.92	0.048***	7.25	-0.061***	-14.59
AGE2	-0.002***	-53.64	-0.001***	-11.95	0.002***	81.81	-0.001***	-7.64	0.001***	10.4
SEX	1.240***	92.99	0.643***	19.16	-1.616***	-190.36	0.208***	4.41	-0.108***	-3.32
BPRIM	-0.008	-0.56	0.126***	2.97	0.044***	3.41	0.216***	7.73	-0.092***	-5.56
PRIM	-0.019	-1.33	0.270***	6.83	-0.010	-0.82	0.387***	15.72	-0.152***	-9.77
MIDDLE	-0.164***	-12.44	0.298***	8.44	0.101***	9.14	0.563***	25.37	-0.254***	-16.48
SEC	-0.231***	-15.08	0.298***	7.74	0.185***	14.74	0.820***	32.54	-0.343***	-16.53
HS	-0.498***	-32.46	0.197***	5	0.112***	8.93	1.323***	55.48	-0.642***	-26.14
TRAINDUM2	0.297***	11.76	0.224***	4.65	-0.384***	-14.42	-0.178***	-4.35	-0.231***	-7.05
SC	-0.017	-1.08	-0.042	-1.02	-0.223***	-18	-0.098***	-4.29	0.248***	14.7
ST	0.087***	6.84	-0.654***	-12.2	-0.284***	-27.38	0.013	0.62	0.053***	3.11
OBC	0.006	0.53	-0.037	-1.53	-0.078***	-9.25	-0.085***	-5.43	0.016	1.29
PCLAND	0.682***	24.43	1.008***	21.09	0.285***	11.97	-0.710***	-13.37	-1.780***	-33.86
OPER_AGRILAND	0.232***	9.08	0.603***	4.41	0.600***	29.45	-0.258***	-9.16	-0.582***	-28.35
CONSTANT	-5.679***	-95.8	-6.459***	-31.44	4.177***	106.6	-2.664***	-14.27	1.757***	15.9

*** significant at 1 percent; ** significant at 5 percent.

occupations. This is evident from the negative and significant value of the training dummy. Expectedly, workers with higher levels of education are less likely to pursue casual jobs. However, SC, ST and OBC workers are more likely to be involved in these activities that entail great physical labour and drudgery. Individuals belonging to households that cultivate land for agricultural purposes are less likely to be engaged in these jobs. Likewise, the increase in per capita availability of land also lowers the possibility of employment based on daily wages. As indicated by the sex dummy, male workers are less likely to be employed in casual activities compared to female workers. As age increase the probability of employment in these jobs decline. However, the co-efficient of age (squared) is positive indicating that people beyond a certain age who participate in the labour market are perhaps compelled to work as daily wage based labourers in the absence of other assets.

IV

SUMMARY AND CONCLUSION

This paper has evaluated the determinants of three crucial aspects of small holder farming in India with special reference to the role of agricultural training and extension services. The household data shows that less than 2.5 per cent of the workers (in the age group 15-64 years) belonging to agricultural households have received formal training in agriculture. While access to extension services are more widespread, yet about 40 per cent of the sample households did not have access to any kind of extension facilities. There is also likely to be a wide variability in the availability of such services across the country. The prevalence of subsistence farming was comparatively higher among small holders; further, the average value of the HCI was also low among small holders indicating low intensity of commercialisation. The results of regression analysis show that agricultural training and extension have a positive influence on determining a small holder household's decision to participate in the output market for both rice and wheat crops. However, these factors were not found to be strong enough in explaining the intensity of participation as the coefficient attached to these factors although still positive were not statistically significant. Apart from training and extension services, other factors were also found to be important in explaining both the decision to participate as well as the intensity of such participation notable among which were the availability of irrigation facilities and size of cultivated land. The results of the TEM reveals that after adjusting for differences in household background characteristics, involvement in commercialisation of staples by small holders has a positive influence on the MPCE of these households. Further, the gains from commercialisation rise as the intensity of commercialisation increases. Training and extension services were found to be pivotal in influencing crop diversification among small holders. However, availability of irrigation was found to be the single most important factor in determining crop diversification. The factors such as education of the household head, size of per capita land owned and availability of off-farm earnings were also found to be having a positive impact on the value of the diversification index. Possibly, the processes of commercialisation and diversification are not entirely independent of each other as diversified cropping systems may provide a sense of income security to small holder households to offload a greater part of the production of staples in the market. The HSM for both rice and wheat showed that the probability of participating in the output marker is higher for those households which grow other crops along with the staple crop during the course of the agricultural year. As in the case of commercialisation, crop diversification produces beneficial welfare effects in terms of gains in MPCE. Also, the size of these gains is higher at higher levels of diversification. The average increments in MPCE associated with crop diversification among small holders was found to be larger than those from commercialisation of staples. Lastly, skilling of workers were found to be increasing the likelihood of self-employment in agriculture besides enhancing the probability of an individual acting as an employer within the agricultural sector. Skilling also reduced the probability of an individual engagement in unpaid family work. However, the most important outcome of skilling was seen in terms of its effect on reducing the possibility of casual daily wage based employment among workers of small holder households. In view of the potential gains from skilling, it can therefore be argued that the scope of skill development in agriculture should be extended on a massive scale. This assumes added significance in view of the fact that only a miniscule portion of the workers in the rural areas have access to such training. The gaps in the availability of extension services also need to be closed. The setting up of the Agricultural Skill Council of India and current emphasis on revamping the extension services provided by Agricultural Universities and Krishi Vikas Kendras in the country is a welcome step in the right direction.

NOTES

1) The HSM incorporates a variable called Mills Lambda in the outcome equation to correct for self-selection A significant value of Mills lambda rejects the null hypothesis that the Selection and Outcome Models are independent.

2) Although the HCI is a censored variable with upper limit at one and lower limit at zero, the Heckman Selection Model in STATA does not permit the estimation of Tobit model in the outcome equation. Hence, linear model is used.

3) Factors such as availability of insurance, awareness about minimum support prices and credit can also have a significant impact on commercialisation of rice and wheat. These variables were however found to be highly correlated with both training and extension services. Hence, these factors were not incorporated directly into the regression analysis to avoid problem of multi-collinearilty as their combined effect can be represented by yhat of training and agricultural extension.

4) The dummy for seasonal variation was not included in the HSM model of wheat as there were no small holder households involved in wheat production during *kharif* season.

5) The CDI is calculated by taking into account the share of various crops in gross cropped area for the entire agricultural year from July 2012 to June 2013. However, the NSSO data reports monthly consumption expenditure on 30 day recall basis during both the visits. To evaluate the impact of crop diversification on MPCE, we take the mean monthly expenditure of a household from both schedules. In case of those households which were not included in the second schedule, the monthly consumption expenditure for the first visit was considered.

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Rising Capital Intensity and Employment Potential of Indian Food Processing Industry

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ABSTRACT

In this paper, we have examined the capital intensity, financial performance and employment potential of the Indian food processing industry (FPI) using the industry-level data for 1980-2018. During the past three decades, capital intensity in FPI increased from Rs.0.07 to Rs.1.04 million per person. The employment growth is not appreciable as compared with the output growth in the food industry as a whole. However, in the recent period (2004-05 to 2017-18), the high growth rate of investment (11.64 per cent) coupled with an increasing trend in employment with the growth rate of 2.23 per cent per annum was noted. Despite increased capital investment, financial performance of the FPI in certain standard business parameters was found to be low, which may set back the investors. Employment pattern in the industry witnessed contractualisation of the labour force with rising demand for skill-oriented managerial and supervisory employees. This reorientation in the pattern of employment is also reflected in the wage distribution, where workers' wage share reduced to 52.55 per cent from 60.80 per cent, whereas it increased for the supervisory and managerial category from 16.54 per cent to 30.29 per cent in the total emolument. The results of estimated employment function showed the rising potential of FPI in generating employment alongwith rising capital intensity. Efforts are therefore need to be focused on the high-value commodities such as meat, fish, fruits and vegetables and feed industry to improve the output level which has more potential. Further, being a large contributor to the employment, grain industry can be expanded to the nutri-rich cereals, to absorb surplus labour in the country.

Keywords: Food processing industry, Capital intensity, Employment, Financial performance

JEL: L66, D24, E24, Q13

I

INTRODUCTION

Traditionally, agriculture being the principal source of livelihood, provided employment to more than 50 per cent of the households in India directly and indirectly. However, over the period, there has been a decrease in the total number of workers in agriculture with a sharp decrease in the number of cultivators (NSSO 2014; Government of India, 2018). This shift has also led to an increase in the number of agricultural labour, workers in the non-farm sector and other casual work. In some of the states, casualisation of labour force was also noted, particularly after 2004-05 (Nithyashree and Pal, 2013). This casualisation process is a distressing

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development for the country. At this juncture, the rural non-farm and manufacturing sector are expected to grow and absorb surplus labour in the country, which is also backed by technical progress (Radhakrishna, 2019). The food processing industry (FPI) particularly, is expected to grow fast in view of the fact that India is producing surplus food and horticultural crops, but a low level of processing (less than 10 per cent). In this context, various policy encouraging investments in the manufacturing sector in general and FPI in particular, have been taken up in the country. This has led to increased capital formation particularly after the 1990s. How far these developments have generated employment needs to be understood. Several studies have been carried out to study the employment in the manufacturing sector indicating the growth is not enough to create more employment in the 2000s (Das *et al*., 2009; Das and Kalita, 2009; Thomas, 2013). Recently, an increase in the capital intensity is reported to have a decreasing effect on labour in the manufacturing sector (Kapoor, 2016). However, the literature is scanty on the investment pattern and employment potential of FPI in the recent times. In this context, this study has been undertaken to analyse the pattern of capital intensity, nature of employment and financial performance of FPI in India.

II

METHODOLOGY

The industry-level data published in the *Annual Survey of Industries* (ASI), Ministry of Statistics and Programme Implementation (MOSPI) was used for this study. Gross Value Added (GVA) and capital series were deflated with Wholesale Price Index (WPI) for manufacturing products, manufacturing food products and machinery and equipment of the Office of the Economic Adviser, taking 2011-12 as the base price. The data for three decades from 1980-81 to 2017-18 were compiled to understand the trend in capital intensity and employment generation. The capital intensity was measured by the ratio of real fixed capital to total persons engaged. Fixed capital was measured as the depreciated value of fixed assets (land, building, plant and machinery, transport equipment etc.) which have a normal productive life of more than one year owned by the factory on the closing day of the accounting year, as defined by ASI. Total persons engaged include, directly employed workers, workers employed through contract, supervisory and managerial and other unpaid family members/proprietor. Industries were classified as capital intensive[1] if its value is more than or equal to the median value of all the industries in each year and the remaining industries were grouped as labour intensive. To see the trend in capital intensity in the FPI, the same approach was used, but, here the median value was considered across the sub-sectors within the food industry. Factor remuneration like profit rate, interest rate and debt rate was obtained as follows:

$$\text{Profit Rate} = \frac{\text{Profit}}{(\text{Invested capital} - \text{Outstanding loan})}$$

$$\text{Debt Rate} = \frac{\text{Outstanding loan}}{(\text{Invested capital})}$$

$$\text{Interest Rate} = \frac{\text{Interest paid}}{(\text{Outstanding loan})}$$

2.1 *Financial Performance Indicators*

For assessing the financial performance of the industry, certain standard business parameters were used, formulae and criteria to judge the financial health as follows:

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

$$\text{Quick Ratio (Acid} - \text{test ratio)} = \frac{(\text{Current Assets} - \text{Value of Inventory})}{\text{Current Liabilities}}$$

$$\text{Receivable Days} = \frac{\text{Ending Accounts Receivables}}{\text{Annual Sales}} \text{ X } 365$$

$$\text{Payable Days} = \frac{\text{Ending Accounts Payable}}{\text{Annual Sales}} \text{ X } 365$$

$$\text{Inventory Days} = \frac{(\text{Opening Inventory} + \text{Ending Inventory})/2}{\text{Annual Sales}} \text{ X } 365$$

$$\text{Cash Conversion Cycle} = \text{Inventory Days} + \text{Debtor Days} + \text{Creditor Days}$$

The current ratio and quick ratio of value less than one indicate the weak financial status of the firm which may discourage the investors' attention. Receivable days, payable days and inventory days refer to the average number of days taken by a firm to collect revenue after a sale has been made, how long it takes a company to pay its invoices from supplier and number of days firm takes a company to sell its entire inventory, respectively. Less number of days is preferred, in general below 90. Cash conversion cycle measures the amount of time each rupee invested in the input is tied up in the production and sales process before it is converted into cash through sales. Alternatively, it measures the time between the outlay of cash and the cash recovery, shorter the cycle, better is the firm's financial health.[2]

2.2 *Employment Function*

The potential of generating employment in the FPI was examined by constructing frequently used employment function which shows the relationship between employment, real gross value added (GVA) and real wage rate for the labour force. The specification of the function as follows:

$$ln(W) = a + b\,ln(Y) + c\,ln(WR) + \ dln(W_{-1}\ ) + \ \alpha\, DT + u \qquad \text{....(1)}$$

where W implies the number of workers, Y is the real GVA, WR is the real wage rate, W_{-1} is the number of workers with one-year lag, u is the random error and DT is the intercept dummy which is time-variant and used to see whether employment generation has inclined by the liberalisation. Coefficient of ln (Y) is expected to be positive because an increase in output should increase employment. Again, the coefficient of ln (WR) is expected to be negative, with an increase in real wage rate should reduce employment. Further, ln (W_{-1}) is added, indicative of lag in the adjustment of actual employment to its desired level, the above model requires the coefficients of lagged employment to lie between '0' and '1'. The short-run elasticity of the employment with regard to output, i.e., GVA is given by 'b' and the long-run elasticity by [b/ (1-d)]. Similarly, the short-run elasticity of the employment with regard to real wage rate is given by 'c' and the long-run elasticity is given as [c/ (1-d)].

II

RESULTS AND DISCUSSION

3.1 *Structure of the FPI*

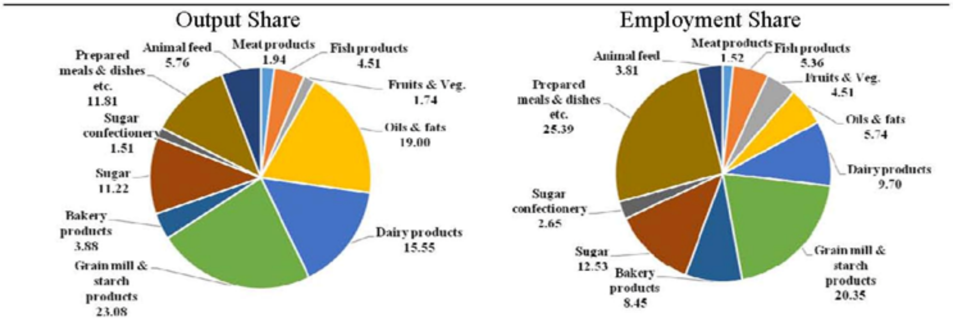
The Indian FPI is characterised by small units and located more in the rural area. As indicated in Table 1, around 37, 833 units are in the organised sector, of which 56.73 per cent are present in the rural sector. Spatially, around 90 per cent of the units are concentrated in 13 states with the highest number of units located in Andhra Pradesh (14. 21 per cent) followed by Tamil Nadu (11.89 per cent), Telangana (9.97 per cent) and Punjab (7.83 per cent). The distribution across the scale of operation and number of employment shows that the industry is dominated by small units and about 70 per cent of the units were operating with less than 100 employees and most of them are micro, small and medium in size and hardly 2 per cent of the firms are large with the turnover more than Rs.250 crore. Like any other manufacturing industry, FPI is mainly composed of the private organisations, viz., individual proprietorship, partnership and the limited companies which are contributed by 80 per cent in the industry as a whole and the rest 20 per cent is collectively shared by public limited companies, co-operatives, handlooms, khadi and other industries. Though there is an increasing trend in attracting investment in the recent period, particularly in the organised sector (Kumar, 2010), investment in research and development and foreign investment is meagre and they contributed by 0.84 and 1.09 per cent, respectively. Further, only 3 per cent of the firms attained the ISO certification.

TABLE 1. KEY INDICATORS CHARACTERISING STRUCTURE OF THE FPI

Indicators (1)	Per cent (2)	Indicators (3)	Per cent (4)
Sector		Type of organisation	
Rural	56.73	Individual proprietorship	29.01
Urban	43.27	Partnership	31.55
State		Public limited company	3.25
Andhra Pradesh	14.21	Private limited company	18.84
Tamil Nadu	11.89	Co-operative Society	1.98
Telangana	9.97	Others	15.37
Punjab	7.83	Scale of operation#	
Maharashtra	6.8	Micro	67.63
Karnataka	5.71	Small	23.52
WB	5.49	Medium	6.90
Gujarat	5.44	Large	1.95
UP	5.22	Firms having ISO certification	
Assam	4.01	With certification	2.89
Chhattisgarh	3.89	Without certification	97.11
Kerala	3.51	Firms with R&D unit	
Odisha	3.11	Yes	0.84
Avg. No. of persons employed		No	99.16
< 10	33.89	Share capital with foreign entity	
>= 10 and <100	35.81	Yes	1.09
>= 100	30.31	No	98.91
Total number of firms: 37,833			

Source: Authors calculations based on ASI data (unit records), MOSPI, 2017-18.
#based on the classification given in Annexure 1.

FPI itself has a wide range of products and broadly it can be grouped into eleven sub-sectors based on 4-digit classification given by National Industrial Classification (NIC), 2008. The sub-sectors contribution in terms of output and employment is presented in Figure 1. The industry output shares in constant terms indicated that the traditional sectors, viz., grain mill and starch products, dairy products, oils and fats and the sugar industry contributed around 68.85 per cent to the total output of the industry. Additionally, the share of an emerging product group – prepared meals and dishes (canned/cooked/ready to eat products) was 11.81 per cent. Employment



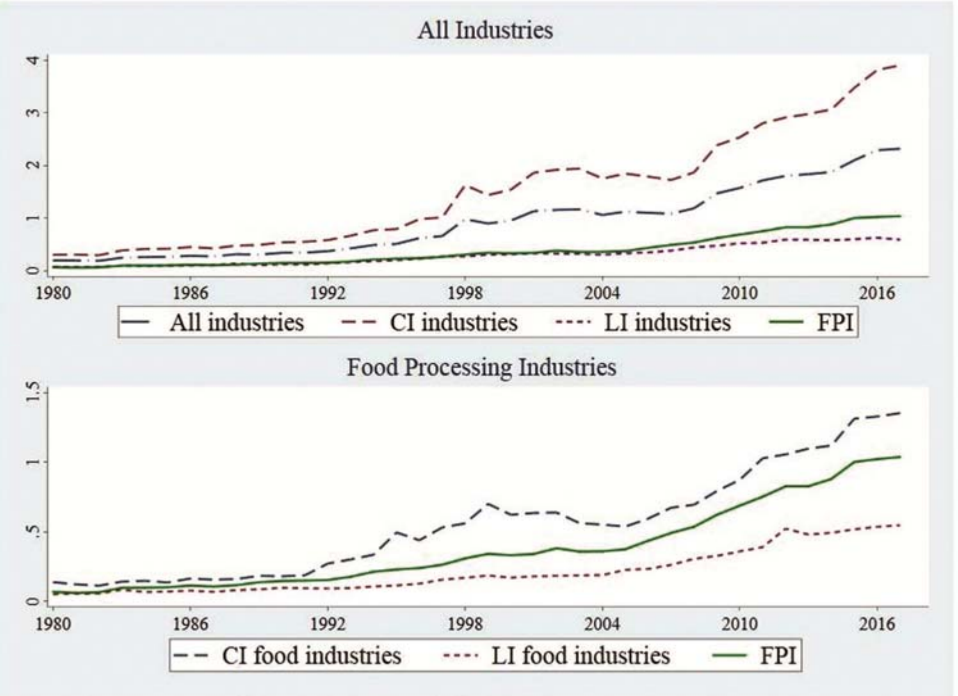
Source: Authors calculations based on ASI data.

Figure 1. Sub-sectors Share (per cent) in Output and Workers in the PI, TE 2017-18.

generation of this sector is always of interest to the various stakeholders in the country, wherein the FPI almost half of the persons employed are in the sub-sectors viz., prepared meals and dishes (25.39 per cent) and grain mill and starch products (20.35 per cent) followed by sugar, dairy and bakery products with the share of 12.53, 9.70, and 8.45 per cent respectively.

3.2*Capital Intensity, Employment Pattern and Growth in the FPI*

An increasing trend in the capital-to-labour ratio is evident to indicate rising capital intensity in the industrial sector in India. The trend in capital intensity in all the industries and FPI is plotted across labour and capital intensive industrial groups in Figure 2. The upper portion of the graph is indicating that the rise in capital intensity is not only a phenomenon in the capital-intensive industry, but the labour-intensive industries also raised its capital investment. The main point to be noted here is that the intensity in the food processing sector grew faster than the other labour-intensive industries particularly after 2005-06.During the past three decades, capital intensity in the FPI increased from 0.07 to 1.04, which is almost 15 times higher than



Source: Authors calculations based on ASI data.

Figure 2. All India Trend in Average Capital Intensity of Production in Food Processing Industries and Other Industries.

that during 1980 and 2018.The capital intensity trend across the labour and capital intensive food industry exhibits significant rise after 1991-92 and 2006-07, wherein capital intensive food industries grew almost 7 times from 1992-93 to 2017-18 and that of six times in the labour-intensive food industry. Some of the spill over benefits of changing the mind-set of the private investors in the 1980s (Rodrik and Subramanian, 2005) and policy initiatives in the liberalised era in terms of relaxing the restrictions on technology imports, delicensing, etc., have led to a significant increase in the capital investment, particularly after the 1990s (Kohli, 2006).Further, efforts to boost the level of competition through passing the Competition Act, 2002 and Micro, Small & Medium Enterprises Act, 2006 might have attained the level of improved investment in the industrial sector.

The rising capital investment particularly, in the labour-intensive industries including FPI, is a cause of worry for the country where the structural transformation from the primary sector to secondary and tertiary to absorb the surplus workforce becomes questionable. And also how far these capital investments will generate output and employment is a matter of concern. To see whether the capital intensive food industry lacks in employment generation but contribute to more value addition, growth rates of GVA, workers, fixed capital and pattern in capital to labour ratio were calculated over the period 1980 to 2018 for the FPI and these are presented in Table 2. This table shows that fixed capital growth surpassed the growth of GVA and workers with a trend growth rate of 9.31, 6.64 and 1.36 per cent per annum between 1980 and 2018. The growth rate of employment is not appreciable as compared with the output growth in the food industry as a whole. However, in the recent period, the high growth rate of investment (11.64 per cent) during 2004-05 to 2017-18, coupled with an increasing trend in employment with the growth rate of 2.23 per cent per annum is notable. This employment growth rate is the highest as compared with the decadal growth in the employment. Across the sub-sectors, traditionally dominated grain mills are more capital intensive in the recent past with the growth rate of real fixed capital 12.61 per cent and this pattern is also seen in the emerging product segment, i.e., dairy (16.94 per cent) and ready to eat /prepared meals product groups (13.59 per cent). Also, the growth of output in these industries is sizeable. But the expected employment generation is found to be low, particularly in the grain (0.49 per cent) and prepared meals (0.81 per cent) industry, which is a matter of concern. These two industry groups constitute around 50 per cent of the total employment share in the FPI. On the other hand, capital intensive food industries such as fish, fruits and vegetables, starch, feed and bakery products followed an increase in the growth rate of capital invested and GVA, along with increased number of workers. Exceptionally, sugar industry follows the path of increased capital investment and decreasing growth trend in output with a negative growth in the number of workers. Therefore, the mixed pattern of rising capital intensity, output and employment indicates the opportunity to explore the employment potential in FPI. The empirical evidence suggests that with increasing capital intensity and declining its productivity

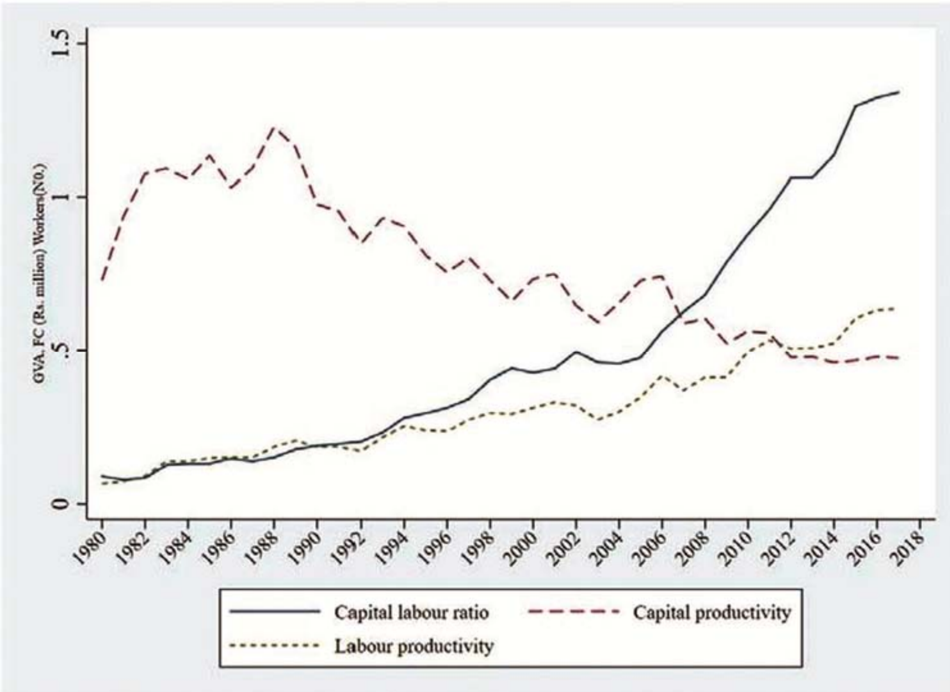
TABLE 2. SUB-SECTOR WISE TREND GROWTH RATE OF KEY INDICATORS OF PRODUCTION IN THE FPI

(in per cent)

(1)	FPI (2)	Meat products (3)	Fish products (4)	Processed Fruits & Veg. (5)	Oils & fats (6)	Dairy products (7)	Grain mill products (8)	Starch products (9)	Bakery products (10)	Sugar (11)	Sugar confectionery (12)	Prepared meals & dishes (13)	Animal feed (14)
	GVA												
1980-2018	6.64	12.99	8.92	11.65	6.34	8.92	8.15	8.52	8.71	3.57	13.8	5.53	11.53
1980-1992	8.43	5.79	10.01	6.68	9.54	13.31	7.33	0.77	10.5	7.37	18.65	8.17	11.16
1992-2003	5.41	8.26	3.2	15.95	2.87	14.08	6.87	9.39	7.42	3.32	15.7	2.35	10.55
2004-2018	7.74	11.18	14.94	13.29	2.78	9.13	7.84	10.99	11.27	2.8	8.27	10.63	14.69
TE 2017-18 ('000 Rs. crore)	817.24	15.2	31.19	37.11	73.62	101.83	126.39	12.79	54.37	120.2	31.35	172.32	40.87
	Workers												
1980-2018	1.36	7.83	5.54	5.95	1.06	4.34	1.83	3.36	4.65	-2.02	7.62	1.66	7.29
1980-1992	-1.44	-1.28	2.27	1.83	3.65	4.34	3.06	1.31	5.38	-5.35	8.68	-2	7.79
1992-2003	0.69	11.98	4.77	7.27	-3.72	2.46	1.78	6.6	1.73	-2.25	2.95	1.74	6.05
2004-2018	2.23	8.44	7.03	4.81	0.82	7.08	0.49	3.22	9.46	-1.04	9.19	0.81	8.36
TE 2017-18 ('000 in No.)	1307	22	63	59	74	127	250	19	95	165	35	351	46
	Fixed capital												
1980-2018	9.31	12.74	11.29	13.75	9.53	9.11	9.24	11.91	10.66	8.37	17.23	9.08	12.37
1980-1992	6.76	-1.18	1.76	8.74	14.2	6.34	5.16	4.64	9.77	4.95	23.86	8.68	6
1992-2003	9.04	20.79	13.6	18.59	5.49	9.42	7.85	16.61	10.46	9.09	15.59	7.62	15.6
2004-2018	11.64	8.25	11.36	11.87	7.07	16.94	12.61	16.75	13.65	9.34	20.49	13.59	19.32
TE 2017-18 ('000 Rs. crore)	1725	24	42	69	144	212	199	48	57	573	67	226	64
	Capital-labour ratio												
TE 1992-94	0.15	0.35	0.14	0.14	0.25	0.22	0.08	0.26	0.13	0.2	0.19	0.08	0.16
TE 2004-05	0.37	0.94	0.39	0.47	0.82	0.42	0.15	0.53	0.26	0.67	0.63	0.15	0.39
TE 2017-18	1.02	0.83	0.56	0.96	1.45	1.24	0.6	2.01	0.47	2.45	1.45	0.53	1.04

Source: Authors calculations based on ASI data.

indicate a substitution of capital for labour (Das *et al*., 2009; Ghose 1994). In this line, the rise in capital intensity with reduction in the productivity of capital during 1980-2018, indicates a capital substitution for labour in the FPI (Figure 3) and the same pattern is observed across all the sub-sectors as well (Table 3).



Source: Authors calculations based on ASI data.

Figure 3. Pattern of Capital Intensity and Factor Productivity in the FPI

TABLE 3. SUB-SECTOR WISE TREND GROWTH OF FACTOR PRODUCTIVITY IN THE FPI

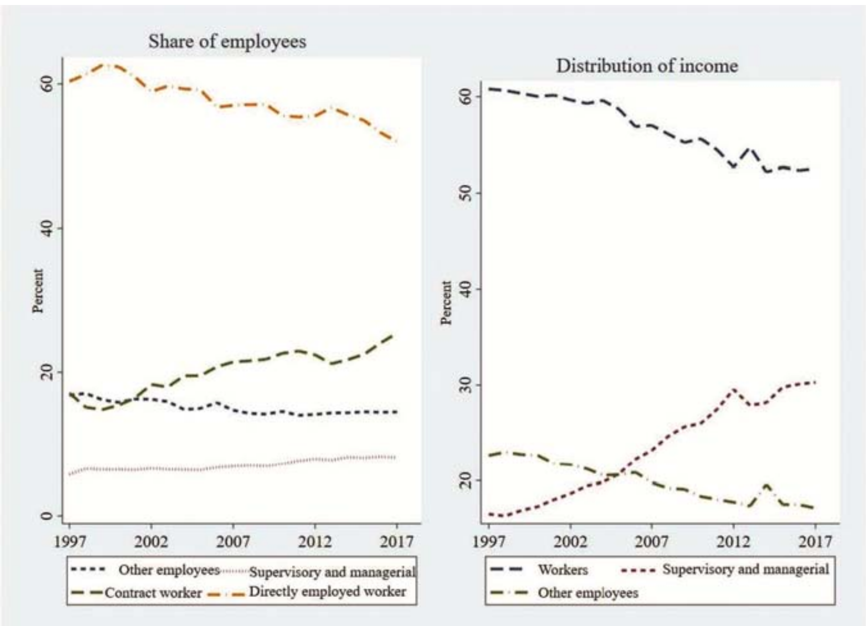
(*per cent*)

(1)	1980-1992 (2)	1992-2004 (3)	2004-2018 (4)	1980-2018 (5)	1980-1992 (6)	1992-2004 (7)	2004-2018 (8)	1980-2018 (9)
	Capital productivity				Labour productivity			
Meat products	7.05	-9.61	2.71	0.22	7.16	-6.04	2.53	4.78
Fish products	8.10	-7.88	3.22	-2.13	7.57	-1.96	7.39	3.20
Processed fruits and vegetables	-1.89	-1.99	1.27	-1.85	4.77	7.27	8.09	5.37
Oils and fats	-4.08	-2.26	-4.00	-2.91	5.68	6.18	1.95	5.22
Dairy products	6.55	4.98	-6.68	-0.17	8.59	12.18	1.92	4.38
Grain mill products	2.07	-1.10	-4.23	-1.00	4.14	5.82	7.32	6.21
Starch products	-3.70	-6.71	-4.93	-3.03	-0.54	0.87	7.52	4.99
Bakery products	0.66	-2.37	-2.09	-1.76	4.86	5.62	1.65	3.88
Sugar	2.30	-6.01	-5.99	-4.43	13.44	4.64	3.88	5.70
Sugar confectionery	-4.20	3.39	-10.14	-2.93	9.18	14.96	-0.84	5.74
Prepared meals and dishes etc.	-0.47	-4.65	-2.60	-3.26	10.38	0.91	9.74	3.81
Animal feed	4.87	-3.45	-3.88	-0.75	3.13	4.79	5.84	3.95
FPI	1.56	-3.29	-3.49	-2.43	10.01	4.47	5.40	5.21

Source: Authors calculations based on ASI data.

3.2.1 *Pattern of Employment, Factor Remuneration and Role of Skill Development*

While the adoption of capital intensive technology may weaken labour growth to a certain extent, but its impact on the quality of work via mechanisation and then skill upgradation is always expected. The share of different categories of workers in the total employment in FPI, presented in Figure 4,indicated that the share of workers who are employed directly (permanent workers) reduced to 51.99 per cent from 60.36 per cent and contract labour rose to 25.42 per cent from 17.10 per cent. The corresponding increase for the supervisory and managerial employees is 8.11 from 5.72 per cent and for the other employees, it is 14.48 from 16.82 per cent between 1997 and 2017. It shows that FPI experiencing contractualisation of the labour force on the one hand and raising demand for managerial and supervisory employees on the other hand. A similar trend is also mentioned in the manufacturing sector as a whole (Kapoor, 2016). Though we cannot generalise rise in the capital intensity for the reason behind contractualisation, in the long run,it may alter the wage distribution pattern across the workers. This can be seen from the exhibit presented in the right side Figure 4, wherein permanent workers' wages reduced to 52.55 per cent from 60.80 per cent with a significant rise in the payment to the supervisory and managerial category from 16.54 per cent to 30.29 per cent in the emolument paid to the employees during 1997-2018. These patterns might be due to the presence of stringent labour regulations and increased import competition led to reduced wages of



Source: Authors' calculations based on ASI data.

Figure 4. Distribution of Number and Income Across Employee Categories in the FPI.

informal workers to improve the competitive advantage and thus profitability (Goldar and Aggarwal, 2012).Also it might be due to the peak operational mandays of the food industry coincide with the harvesting period when wages are high. Across the sub-sectors, almost all the product groups experiencing contractualisation of labour and rise in the demand for managerial and supervisory employees that can be seen in their rising proportion across the employee categories from 2000-01 to 2017-18. Exceptionally, meat and fish industry demand more of permanent workers (Table 4). Therefore, the substitution effect of capital for labour is affecting more of the labour force.

TABLE 4. DISTRIBUTION OF EMPLOYEES ACROSS SUB-SECTORS IN THE FPI

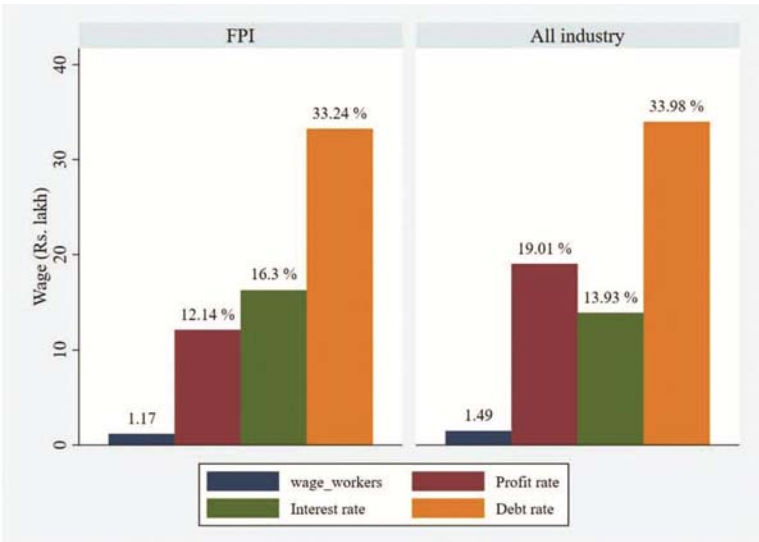
('000 No.)

	Directly employed workers		Through contractors		Supervisory and managerial		Other employees		Total no. of persons engaged	
Sub-sectors	TE 2000-01	TE 2017-18	TE 2000-01	TE 2017-18	TE 2000-01	TE 2017-18	TE 2000-01	TE 2017-18	TE 2000-01	TE 2017-18
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Meat	2.43	11.54	3.14	10.93	0.39	2.89	0.64	3.17	6.59	28.53
Products	(36.89)	(40.44)	(47.55)	(38.31)	(5.87)	(10.14)	(9.69)	(11.11)	(100.00)	(100.00)
Fish products	10.52	44.26	13.30	18.93	2.87	4.75	7.48	6.64	34.17	74.58
	(30.78)	(59.34)	(38.91)	(25.39)	(8.41)	(6.37)	(21.90)	(8.91)	(100.00)	(100.00)
Processed	11.72	26.14	8.16	32.50	2.37	5.93	3.26	8.48	25.51	73.07
fruits and veg.	(45.94)	(35.78)	(31.99)	(44.49)	(9.29)	(8.12)	(12.78)	(11.61)	(100.00)	(100.00)
Oils and fats	49.78	48.11	19.72	25.89	9.05	10.48	16.55	15.04	95.10	99.52
	(52.35)	(48.34)	(20.73)	(26.02)	(9.52)	(10.53)	(17.40)	(15.11)	(100.00)	(100.00)
Dairy	37.86	67.95	11.18	58.74	9.29	16.00	20.19	28.07	78.53	170.76
products	(48.22)	(39.80)	(14.24)	(34.40)	(11.83)	(9.37)	(25.71)	(16.44)	(100.00)	(100.00)
Grain mill	128.90	151.51	80.16	98.90	17.16	30.69	36.41	51.36	262.63	332.46
products	(49.08)	(45.57)	(30.52)	(29.75)	(6.54)	(9.23)	(13.86)	(15.45)	(100.00)	(100.00)
Starch	14.80	13.38	1.44	5.86	1.46	2.09	1.85	2.93	19.56	24.26
products	(75.68)	(55.18)	(7.36)	(24.15)	(7.48)	(8.62)	(9.48)	(12.06)	(100.00)	(100.00)
Bakery	27.52	63.90	2.81	31.56	3.98	9.80	5.51	14.08	39.83	119.34
products	(69.11)	(53.54)	(7.04)	(26.45)	(10.00)	(8.21)	(14.12)	(12.04)	(100.00)	(100.00)
Sugar	182.69	121.45	35.95	43.76	18.24	20.29	78.45	47.96	315.32	233.46
	(57.94)	(52.02)	(11.40)	(18.75)	(5.78)	(8.69)	(24.88)	(20.54)	(100.00)	(100.00)
Sugar	8.91	22.66	0.97	12.03	1.42	3.64	1.94	7.59	13.24	45.91
confectionery	(67.27)	(49.34)	(7.34)	(26.20)	(10.76)	(7.93)	(14.63)	(16.53)	(100.00)	(100.00)
Prepared	293.24	299.74	7.57	51.34	12.31	24.34	28.05	49.32	341.17	424.73
meals-dishes.	(85.95)	(70.57)	(2.22)	(12.09)	(3.61)	(5.73)	(8.22)	(11.61)	(100.00)	(100.00)
Animal feed	9.61	29.94	5.03	15.62	2.08	6.68	4.46	9.80	21.18	62.04
	(45.35)	(48.25)	(23.76)	(25.18)	(9.81)	(10.76)	(21.08)	(15.80)	(100.00)	(100.00)
FPI	779.33	900.57	189.58	406.07	80.86	137.58	205.10	244.44	1254.87	1688.65
	(62.10)	(53.33)	(15.11)	(24.05)	(6.44)	(8.15)	(16.34)	(14.48)	(100.00)	(100.00)

Source: Authors calculations based on ASI data.

Note: Figures in parentheses are respective year percentage share of total no. of persons engaged

Increasing importance of skills complementing capital investment underscores the need for more skill-oriented programmes and schemes, in the core areas of the industrial sector including FPI. Any industry for that matter always attracts highly skilled labour by better payment which in turn depends upon the profitability of the firm or industry. Therefore, achieving assured profitability is the key to attract many investors and also skilled workforce. Factor remuneration in FPI in terms of worker wage and profit rate is compared for all the manufacturing industry for triennium ending (TE) 2017-18 and is presented in Figure 5. On an average, a worker in the FPI earned low wage, i.e., Rs.1.17 lakh per year in comparison with other all industry average (Rs.1.49 lakh per year). Though there is not much difference in the debt rate, slightly high rate of interest is paid by the FPI is noticed in the year TE 2017-18. It is noteworthy to mention here less profit rate in FPI (12.14 per cent) *vis-à-vis* with all industry (19.01 per cent) coupled with low wage rate may not in attract skilled young workers. Skill-orientation programmes for the rural youths with certification may be encouraged and deliberated as a yardstick, so that surplus workforce can be efficiently absorbed in FPI. Also, efforts should be made to improve the profitability, so that food industry can attract investment and skilled workforce, which may be a win-win situation to agriculture and food industry in the country.



Source: Authors calculations based on ASI data.

Figure 5. Factor Remuneration in FPI vis-à-vis All Industries, TE 2017-18

3. 2. *Financial Performance of the FPI*

Financial performance of the FPI using some of the important liquidity parameters is presented in Table 5. Computed current asset ratio for the FPI and its sub-sectors indicated (more than one) that on an average, firm in the industry will be able to pay its current liabilities within a year. However, in the recent period, the financial performance of the sugar industry is not so promising with the value of the current ratio is less than one (0.95). Additionally, an alternative more reliable measure of short-term liquidity is compared in terms of quick-acid-ratio. It indicated that FPI in general and sub-sectors (except processed fruits and vegetable) in particular turn to be weak (with the ratio value less than one) in liquidating its assets, which is a cause of concern, as it may discourage investors. The receivable and payable days measure the average number of days that a company takes to collect revenue after a sale has been made and how long it takes a company to pay its invoices to suppliers, respectively. Lesser the days better will be the financial health and less than 90 days is an acceptable benchmark. FPI's performance found to better with 39 receivable days and 19 payable days, but sugar industry suffers due to the delay in payment to the supplier which is also in line with a low value of current ratio and quick-acid ratio. How best the firm will manage its inventory and how fast it converts inputs into cash flow is captured through inventory days and cash conversion cycle. Over the period, the length of these two indicators has extended between 2000 to 2018, particularly for grain mill and starch industries, and sugar industry. These ratios indicate that the financial performance of the FPI is not sound enough to attract investors.

TABLE 5. PERFORMANCE OF LIQUIDITY ASPECTS IN THE FPI

Year/NIC (1)	FPI (2)	Fish products (3)	Processed fruits and veg. (4)	Oils and fats (5)	Dairy products (6)	Grain mill and starch products (7)	Sugar (8)	Animal feed (9)
	Current ratio							
TE 2000-01	1.3	1.59	1.47	1.38	1.35	1.32	1.11	1.54
TE 2015-16	1.26	1.4	2.11	1.37	1.45	1.52	0.95	1.4
	Acid test ratio							
TE 2000-01	0.6	0.96	0.66	0.74	0.83	0.65	0.19	0.89
TE 2015-16	0.62	0.9	1.55	0.88	0.95	0.59	0.25	0.84
	Working capital to annual sales							
TE 2000-01	0.96	4.88	5.67	3.15	1.89	0.42	0.87	5.23
TE 2015-16	9.8	8.99	49.31	11.07	8.8	19.16	-4.66	8.15
	Receivable days							
TE 2000-01	8.44	20.3	3.24	15.44	20.48	9	4.17	16.09
TE 2015-16	39.4	37.86	153.54	51.04	27.95	48.72	25.17	31.51
	Payable days							
TE 2000-01	4.81	7.12	0.05	17.1	17.17	14.03	31.22	8.98
TE 2015-16	19.41	25.98	53.19	56.62	30.77	36.82	119.95	20.65
	Inventory days							
TE 2000-01	45.15	17.79	32.06	19.68	15.58	34.74	107.37	20.57
TE 2015-16	87.94	38.64	94.34	54.21	34.4	124.48	249.16	32.96
	Cash conversion cycle							
TE 2010-11	113.44	66.92	134.03	39.5	30.42	156.83	159.5	37.15
TE 2015-16	107.92	50.52	194.7	48.63	31.58	136.38	154.38	34.67

Source: Authors calculations based on ASI data.

3.4 *Employment Function in the FPI*

The results of from estimated equation (1) are presented in Table 6. In column 2, the results corresponding to the FPI shows, a significant and positive coefficient of output (0.270) indicating that an increase in output will increase the employment as expected. The coefficient corresponds to the real wage rate found to be -0.054, indicating a negative relationship between employment and the wage rate, however, the coefficient is not significant. But the negative and significant coefficient in meat, fruits and vegetables, grain mill and animal feed industry could be used to draw a general conclusion of negative impact of increased real wage on employment. The significant and positive coefficient value of the lag worker, also lies between '0' and '1', indicating a significant effect of lag in the adjustment of actual employment to its desired level. Of positive and significant coefficient of time dummy indicated a positive impact of liberalisation on employment generation. Thus short-run elasticity of employment for output is 0.270 and the long-run elasticity is 0.283. Similarly, the short- run elasticity of employment concerning the real wage rate is 0.054 and that of the long-run it is 0.056. It is noteworthy to mention here is that since the reduction in the employment due to rising real wages is not higher than the magnitude of employment generated due to higher output both in the short and long-run. Therefore, these findings reiterate the potential of FPI in generating employment along with rising capital investment. High-value commodities such as meat, fish, fruits and vegetables and feed industry can be targeted to improve the output level which has more potential to generate employment than the grain and sugar industry. Being a large contributor to the employment, grain industry can be expanded to nutri-rich cereals, which are in demand for their high nutritional value, thereby FPI will certainly absorb surplus labour in the country.

TABLE 6. EMPLOYMENT FUNCTION ANALYSIS (DEPENDENT VARIABLE = WORKERS NO.)

	FPI	Meat	Fish	Fruits-Veg.	Dairy	Grain mill	Sugar	Animal feed
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.039*	-0.033	0.013	0.006	0.017	0.006	0.086***	0.007
	(0.019)	(0.0421)	(0.016)	(0.004)	(0.055)	(0.007)	(0.027)	(0.002)
Gross value	0.270*	0.797***	0.817***	0.523***	0.317***	0.434**	0.454***	0.767***
added	(0.155)	(0.194)	(0.124)	(0.125)	(0.097)	(0.168)	(0.139)	(0.103)
	[0.283]	[0.795]	[0.804]	[0.488]	[0.334]	[0.442]	[0.440]	[0.800]
Real wage	-0.054	-0.247*	-0.052	-0.412***	-0.208	-0.460***	0.079	-0.172*
Rate	(0.067)	(0.136)	(0.004)	(0.127)	(0.145)	(0.137)	(0.057)	(0.096)
	[-0.056]	[-0.247]	[-0.051]	[-0.385]	[-0.219]	[-0.469]	[0.077]	[-0.179]
Lag workers	0.034**	0.091**	0.015	0.071**	0.049**	0.018**	0.031**	0.040**
	(0.083)	(0.065)	(0.009)	(0.054)	(0.043)	(0.005)	(0.018)	(0.029)
Time dummy	0.043**	0.066	-0.001	0.056	0.016	-0.007	0.067**	-0.007
	(0.020)	(0.050)	(0.031)	(0.040)	(0.025)	(0.028)	(0.028)	(0.033)
Observations	36	36	36	36	36	36	36	36
R-squared	0.49	0.50	0.72	0.67	0.52	0.46	0.33	0.75

Notes: Standard errors in parentheses; figures in square brackets are log run employment elasticity with respect output and real wage rate; ***. **, * indicate significance at 1, 5 and 10 per cent level, respectively.

IV

CONCLUSIONS

This study has analysed the role of capital intensity and financial performance of the Indian FPI. It has also examined the nature and potential to generate employment in the FPI as a whole and its sub-sectors level. The results showed rising capital intensity across the manufacturing sector in general and FPI in particular. In fact, as a labour-intensive industry, FPI took lead in the growth of capital intensity with almost 15 times higher during the period 1980-2018. Despite increased capital investment, financial performance of the FPI in certain business parameters was found to be low, which may discourage the investors. The employment pattern in the industry witnessed contractualisation of the labour force with rising demand for managerial and supervisory workers. This reorientation in the pattern of employment is also reflected in the wage distribution, where the workers share reduced to 52.55 per cent from 60.80 per cent with a rise in the share of supervisory and managerial workers from 16.54 per cent to 30.29 per cent in the total wage bill. Gaining importance of skill complementing capital investment is the need of the hour to focus more on skill-oriented programmes and schemes. The estimated employment function reiterates the increasing potential of FPI in generating employment along with rising capital investment. Efforts are therefore needed to focus on the high-value commodities such as meat, fish, fruits, vegetables and feed industry, to improve the output level which has more potential to generate value and employment. The grain industry being a biggest provider of jobs can be expanded to the nutri-rich cereals to absorb the surplus labour in the country.

NOTES

1) Industries producing beverages, paper and paper products, coke and refined petroleum, chemical, pharmaceuticals, rubber, plastic, metal, electronic, motor vehicle and transport equipment were considered as capital intensive and rest were grouped into labour-intensive manufacturing sector. Similarly, in the FPI, grain mill industry, bakery products and prepared meals identified as labour intensive and remaining as capital intensive.

2) For detailed analysis and variables considered please see (Sanyal and Panigrahi, 2016)

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ANNEXURE 1
CLASSIFICATION OF MICRO, SMALL AND MEDIUM ENTERPRISES (MSME)
IN THE MANUFACTURING SECTOR

Enterprises (1)	Investment (2)	Turnover (3)
Micro enterprises	Up to 1 crore	Up to 5 crore
Small enterprises	1- 10 crore	5 - 50 crore
Medium enterprises	10 - 50 crore	50 - 250 crore

Source: msme.gov.in.

Summaries

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Impact of Migration on Rural Livelihoods of Pudukkottai District – An Economic Analysis

E. Gayathri and C. Prabakar*

The study has been carried out to analyse the impact of migration on the rural livelihoods in Pudukkottai district of Tamil Nadu. Specifically it aims (i) to study the impact of migration on the socio-economic status of rural households; (ii) to empirically determine the key correlates of rural migration in the study area and (iii) to examine the factors responsible for migration of households. Using multistage stratified random sampling technique data was collected from 120 sample households through personal interview using well-structured and pre-tested interview schedule pertaining to the agricultural year 2017-18. The results revealed that the migration had an impact on the livelihood diversification pattern and in turn on the socio-economic conditions of the rural poor. The results depicted the reality that majority of the migrant workforce preferred to be absorbed in non-farm activities as their primary occupation like self-employed or casually employed non-farm activities and agricultural and allied activities. They could diversify their activities mainly due to migration. Contrary to this, the non-migrants still depend on agriculture, for some reasons, might be due to their ancestral occupation. Hence, the government needs to take initiatives in encouraging the farmers to adopt integrated farming in order to reduce the production risks and to revamp the educational system in the rural areas in order to generate adequate productive work force. Moreover, establishing industries in rural areas especially the agro based units would reduce the rural urban migration and thereby the voluntary unemployment and seasonal unemployment in rural areas can be reduced, as the supply of labour is more than the demand. Hence, non-farm avenues need to be generated in the rural areas, by increasing the investments in various subsectors of non-farm sector, through public- private partnership.

Impact of MGNREGA on Rural Women Livelihoods in Cuddalore District of Tamil Nadu – An Economic Analysis

K. Sita Devi and T. Ponnarasi†

An attempt has been made to assess the socio-economic impact of MGNREGA programme on rural women livelihoods in Cuddalore district of Tamil Nadu. For the

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purpose of study primary data were collected through personal interview using well-structured and pre-tested interview schedules from the sample of 80 women beneficiaries of MGNREGA scheme during the months of November-December, 2018 and the study pertained to the agricultural year 2017-18. The descriptive analysis was undertaken using percentages, means, etc., to study the performance of the MGNREGA and their impact on beneficiaries in both pre-and post- MGNREGA situation. The composite index of standard of living was computed for each household combining the social and economic indicators using a scoring technique. A multiple linear regression model was employed to identify the factors influencing the level of participation in MGNREGA scheme. Garrett ranking technique was used to rank the constraints faced by the beneficiaries of MGNREGA scheme. This study has indicated that the rural employment guarantee scheme implemented in rural areas had a positive impact on rural women. Hence, it is suggested that the proper policy planning might redouble their efforts to make MGNREGA programme not only a successful but also a sustainable vehicle of rural development.

Employment Diversification in Rural India: Status and Determinants

Ripi Doni and Alka Singh*

The paper examines the status of rural employment diversification in eight states of northeastern India across gender and empirically analyses the determinants of individual’s participation in various farm and non-farm sectors. The study is based on secondary data. Unit level data from periodic labour force survey (PLFS, 2017-18), has been used to study the determinants of participation of individual in non-farm sector. The study focuses on the sub-sample of 28,278 individuals in rural areas of eight states of northeastern India. The analysis is based on macro level data collected by NSSO as macro level data helps in understanding the broad aspect of economy as a whole. The results of the study indicate around 50 per cent of the rural workforce in northeastern India are still engaged in farm sector. While age, education and training have negative and significant effect on farming. They have positive and significant effect on non-farm activities. The effect of gender is insignificant on farming. While the effect of education is insignificant for construction, training has an insignificant effect on manufacturing. The level of education has positive effect only on the service sector. Hence, the findings can be used in policy formulation with respect to employment and required training for skilled workforce. Such analysis provide a bird's eye view and would serve as the basis for policy formulation. The analysis has brought to the fore the important role, played by education, gender and household characteristics.

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Pattern and Trend in Casualization of Agricultural Labour Absorption in Sugarcane Cultivation in India: An Analysis Across States, Agro-Climatic Zones and Farm Sizes

A.K. Sharma, A.D. Pathak, Rajesh Kumar, A.K. Singh and Brahm Prakash†

The paper analyses the pattern and trend in labour use in sugarcane cultivation across major sugarcane growing states for the period from 2000 to 2017. The labour use scenarios at more disintegrated level, across cane farm sizes as well as in sugarcane intensive agro-climatic zones of two major sugarcane growing states, Maharashtra representing tropical region and Uttar Pradesh representing sub-tropical region in India are also analysed. The labour absorption in sugarcane at national level exhibited a decline by 15.36 per cent to 1337.7 hrs in QE 2016-17 over a period of 17 years (QE 2004-05).The labour use per hectare of sugarcane crop is high in tropical states compared to sub-tropical states. The major cane growing state, Uttar Pradesh used 1191.4 hrs per ha of sugarcane crop while Maharashtra used 1728.8 hrs per ha of crop during QE year 2016-17. The decrease in labour use per ha of sugarcane crop during the reference period was found to the extent of 16 per cent in Maharashtra, just 1.6 per cent in Uttar Pradesh, and 30-43 per cent in other tropical states. The labour intensity in terms of its use per unit of output has decreased by 9.94 per cent in UP and by 21.16 per cent in Maharashtra during the period under consideration. The employment elasticity with respect to yield has remained positive for sugarcane. The growth in crop productivity was associated with reduced use of labour The human labour (HL) component accounted for 32.3 per cent of total cost of sugarcane cultivation at all India level during QE 2016-17, in Maharashtra, it was at about 29 per cent and in UP at 31.3 per cent. The factor share of labour in the value of output also increased from 4.5 per cent to 4.7 per cent at all India level, though insignificantly. It highlights that the labour productivity has increased largely due to mechanisation resulting in displacement of labour, rather than due to the technological changes in cultivation. It also highlights that technological aided productivity improvements have not been able to ensure an increasing share of the output to the labourers during the period under study. Across agro-climatic zones (ACZs) of Uttar Pradesh, the Central Plain Zone (CPZ) has exhibited an increase of 50.7 per cent in total human labour, casual labour (CL), machine labour (ML) and bullock labour (BL) absorption while the main sugarcane intensive zone in western UP (WPZ) has observed a decline in their absorption. The analysis across farm sizes reveals that total HL and CL use has increased on medium farms in UP and on large farms in Maharashtra. On the contrary, the ML use has increased on marginal farms in UP while it has increased on marginal as well as on large farms in Maharashtra. The ML use on marginal cane farms (size up to 0.20 ha) was highest (7.2 hrs in UP

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and 74.1 hrs in Maharashtra in QE 2016-17) and it also increased over time both in UP and Maharashtra. ML use also varied in inverse proportion to the size of the farm in these states. Declining factor shares in some states highlight that the technological changes and associated productivity improvement have not been able to ensure an increasing share of the output to the labourers. The technological changes in the form of mechanisation as well as yield enhancing innovations are to be given emphasis. There is an enormous need to promote drip irrigation, sugarcane cutter planters, ratoon management devices and mechanical harvesters to mitigate acute labour scarcity. The initial very high cost to the purchasing farmers be subsidised. Despite rise in mechanisation, the human labour will continue to be the most important component of crop cultivation. Hence, a system for monitoring the enforcement of standard labour laws be established. The negative impact of labour displacement needs to be reversed by developing non-farm employment avenues as well as the deep penetration of technological change for increasing the labour productivity.

Income Generation Pattern of Women Workers in Agriculture in Prakasam District of Andhra Pradesh

Ch. Gowthami, Y. Radha, K. Suseela and Sk. Nafeez Umar*

The study was conducted to examine the income generation pattern of women workers in agriculture by analysing the wages of women workers participating in various agricultural operations in 12 villages of Prakasam district of Andhra Pradesh. Tabular analysis using descriptive statistics was done to achieve the objective. The income of women workers in agriculture was calculated annually. The results showed that the among all the villages selected, the income of the women workers was highest in Martur village with Rs.70323.20 followed by Edara village with Rs.68377.50 and was least in East Choutupalem village with Rs.38667.80. The income earned by the women workers varied from crop to crop and also from village to village. The income of the women workers was the highest in those villages with chilli and cotton crop because of high demand of the women workers at the time of harvesting and sowing as these operations were done nearly in the same period by the whole village. The study concluded there is a chance of demanding higher wages by the women workers when there is more demand for their work.

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Impact on Employment Generation of Women through Participation in Women Dairy Self-Help Groups in Rajasthan

Ritu Rathore and Ravinder Malhotra†

The study was undertaken to analyse the impact of women dairy self-help groups (SHGs) on employment generation of women. Primary data from 320 respondents comprising 160 SHG members and 160 non-members were collected from two districts viz., Baran and Jhalawar, of Rajasthan. Heckman two stage econometric analyses was done for impact assessment and to address the selection biasness. The results reveal that the average annual days of employment generation though dairy farming was significantly higher for women of member households than that of non-members. It has been revealed that the variables education level, yearly income, involvement in off-farm activities, and prior indebtedness had significant influence on the participation of women in dairy SHGs. Regression results showed that the coefficient of participation dummy was positive and significant which indicates that participation in SHG activities significantly increases the employment generation of women in the study area. Moreover, education level, herd size, land holding, and formal training also significantly affected the employment of women. Hence, it is suggested that the rural poor should actively participate in SHGs. Besides, formal training on different dairy activities should also be provided to improve their skills and consequently increase the employment generation of women.

Female Labour Absorption in Rice Cultivation: An Exploratory Analysis

S. Niyati and Kaushik Bora*

The study analyses the trends in labour absorptive capacity of rice cultivation in India. Panel regression analysis was employed on the data from employment and unemployment surveys of the National Sample Survey Office (NSSO) for 2004-05 and 2011-12.The focus is specifically on women and labour absorption. For the discussion on aggregate estimates of workers in the crop sector and the use of human labour in rice cultivation, the study has considered eleven States including Andhra Pradesh, Assam, Bihar, Chhattisgarh, Haryana, Jharkhand, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal that have more than 60 per cent share in the gross cropped area under rice cultivation. The gender-disaggregated discussion is done for four top rice-producing States - Andhra Pradesh, Punjab, Uttar Pradesh, and West Bengal. At an aggregate level, the findings indicate declining work participation of rural women in agriculture sector in the rice-growing States. In these

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regions, the share of women workers in foodgrain production declined, and the share in other crops like cotton, horticultural crops etc. showed an increase. The paper found a declining magnitude of labour absorption in rice cultivation in all the States. A decline in female labour absorption was noted for Andhra Pradesh, Punjab, and Uttar Pradesh. In West Bengal, there was a mild increase in female labour use in rice cultivation. A sharp contraction in the demand for harvesting and threshing labour was noted. Further farm mechanisation and cropping intensity contributed negatively to the labour absorption in rice cultivation.

Agricultural Labour Diversification to Non-Farm Sectors in India-A Temporal Study

Shaik Muneer[†], D. Kumara Swamy[‡] and T. Lavanya[†]

The paper analyses the diversification of agricultural labour to other sectors during the last four decades in India. The study is based on secondary sources of data. The analysis of data shows that the proportion of rural male labour engaged in the agricultural activities gradually fell from 80.6 per cent in 1977-78 to 66.5 per cent in 2004-05, and then to 55.0 per cent in 2017-18. The proportion of female labour engaged in the agricultural activities also decreased from 88.1 per cent in 1977-78 to 83.3 per cent in 2004-05, and then to 73.2 per cent in 2017-18. While, the proportion of rural male labour has shown increased trend from 1.7 per cent to 14.5 per cent in construction activity, 6.4 per cent to 7.7 per cent in manufacturing, 4.0 to 9.2 per cent in trade & hotels and from 5.3 per cent to 7.6 per cent in other services during 1977-78 to 2017-18. Similar increasing trend was observed in case of rural female labour also. During 2004-05 to 2011-12, movement of labour away from agriculture was found to be highest in Kerala (39 per cent) and lowest in Madhya Pradesh (8 per cent). Low and inadequate wage rates, lack of employment during off season, indebtedness, unfavourable working conditions and marginalisation of agricultural labour were found to be the major reasons for diversion of agricultural labourer to other sectors. This diversion can be gradually reduced by effective implementation of minimum wage act, provision of alternate employment during off season, providing land to landless labourers and sanctioning of loans to needy agricultural labourers.

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Impact of Non-Farm Sector on Employment and Income of Rural Households: Empirical Evidence from Tamil Nadu

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A study was undertaken in the non-farm sector predominant Karur district of Tamil Nadu to assess the impact of RNFS participation on income, employment and food security by a survey of 120 rural households, 60 each from Krishnarayapuram and Karur blocks of the study district. Overall, non-farm employment was highest in manufacturing (34.62 per cent) followed by construction (17.95) and transport sector (14.10 per cent). Logit analysis implied household size, working member's ratio, organization membership, distance from workplace and household income as major determinants while age and land size negatively influence RNFS participation. Multi-nomial logit results indicated that with better education and higher income, the more likelihood that households participated in non-farm self or regular employment. Annual employment per person was 260.97 mandays which was 11.24 per cent higher in non-farm (290 mandays) as compared to farm households (235 mandays). Average earnings in non-farm sector (Rs.340/day) were 66.74 per cent higher than farm sector (Rs.567/day). Gini coefficient for overall income was 0.34 and mean food security index for farm, off-farm and non-farm food secure households were 1.05, 1.01 and 1.11 respectively RNFS serves as a safety net for landless, marginal and small farmers by providing opportunities for income diversification. Government has to strengthen agricultural extension system to enhance technology adoption by farmers, and foster rural entrepreneurship by training and skill development in alternative high income generating activities like agro-processing units, micro enterprises, etc to retain educated rural youth in agriculture sector.

Agricultural Workers in Assam: Extent, Composition and Changes

Anup Kumar Das and Limpi Kalita†

An attempt is made to assess the extent, composition and changes of agricultural workers in Assam with particular focus on agricultural labourers. The study is based on secondary sources of data, Based on cost of cultivation data, the share of cost on hired labour to different types of costs of cultivation has been calculated to know the extent of use of agricultural labour and their intensity of use has been measured in terms of use of hired labour hours per hectare of crop. However, the trends in the extent of use of such labour have been worked out by calculating the percentage

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share of hired human labour hours in the total human labour hours. The study depicts that around half of the workers in Assam are engaged in the agriculture sector and the majority of them are cultivators. The number of both cultivators and agricultural labours are rising over the years. However, while the share of agricultural labours in total workers is rising, it is declining in the case of cultivators. The majority of agricultural workers are main workers and the extent of such type of workers is increasing; shows the increase in the duration of their employment. Despite the higher growth of agricultural labours, the extent and intensity of their use are declining; the increasing adoption of mechanisation is one convincible factor. It is also found that the agricultural wage is increasing in the state but it is still below the all India level. Furthermore, like in the country as a whole, the wage gap between male and female agricultural labourers is still continuing in Assam.

Gender Inequality in Agriculture: A Study on Participation of Women Labour Force and Wage Differentials

Arati Priyadarshini, Subrat Pattanaik and S.N. Mishra*

A study was conducted in Remuna and Baliapal block of Balasore district of Odisha to highlight important contributions of women in farming and rural livelihoods, as compared to men. The paper uses data from primary sources and secondary sources for the purpose of analysis. The primary data was collected by interacting with rural agricultural people using a well-structured and pretested interview schedule. Stratified random sampling technique was adopted for the study and a total sample of 200 farmers were selected from these two villages. From those respondents, data was collected homogeneously, 50 farmers from each category comprising small, marginal, medium and large farmers. The major focus was on gender participation in farming, harvest and livestock activities, impact of technology and factors leading to gender inequality and assessing the gender wage disparities. It is observed that women work have the highest percentage in agricultural sector but they are paid less as compared to men. Participation rate is high in most sectors of agriculture such as transplanting, weed management, water management etc. They have high majority participation in post-harvest activities and livestock activities but in terms of the average daily wage rate as well the amount of credits their shares are very low. men. The scenario is not only seen in Odisha but also in whole India. The women workers across different sectors face wage disparity. A need is suggested therefore to adopt policies to address the inequality and understand the barriers which hinder the nation from achieving its goals related to economic development which leads the empowerment of women through agriculture in India. Technology impact on gender gaps and strategies and policies for future to strengthen and accelerate gender equality in work place have been suggested for bridging the gender gap.

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Gender Disparity in Employment and Wages in Rural Labour Market in Odisha: Some Survey Findings and Empirical Analysis

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Gender disparity prevails by the means of various attributes including gender specificity of agricultural operations, discriminating women in terms of wages, restricting their access to better-paying jobs and system of wage payments. This paper employs t-test to investigate the degree of gender disparity in the rural labour market in Cuttack district of Odisha covering one irrigated village Bahalpada and an adjacent non-irrigated village Erancha with a sample of 50 female labourers, 20 male labourers and 10 employers from each village, where irrigation is used as the indicator of agricultural development. The results indicate that there is no significant difference in the days of work available to male and female in farm activities in the irrigated village Bahalpada; however, there is a significant positive difference in male-female labour days in agricultural work in the non-irrigated village Erancha. Looking at the operation-wise allocation of labour days, in both the villages women tend to allocate significantly greater labour days in comparison to men in transplanting and weeding. Further in Bahalpada, no significant gender gap is noted in the days of work in harvesting and post-harvest operations. Similarly, there is no significant inequality in male-female days of labour in harvest work; yet in case of other agricultural activities a positive significant gap is noticed in Erancha. It is established that despite women being more productive than men in jobs which have been traditionally allotted to them and even showing no significant difference in post-harvest work they tend to receive lower wages than their counterparts. Thus, with agricultural development there remains no significant difference in days of employment in farm activities; nevertheless, the gender-based wage differentials tend to persist and more pronounced in the non-irrigated village Erancha as compared to Bahalpada village. In view of the above bottlenecks faced by female labourers the study suggests a need to enforce pay parity, improve working conditions and empowerment of female agricultural labourers in Odisha state.

Contextualizing Casualization, Calamities and Rural Labour Dynamics

Gummadi Sridevi and Dontha Prashanth*

The present paper examines the trends in the process of casualisation of labour in rural India in order to magnify the potentially affected groups in today’s pandemic, as

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well to locate the dynamics of surplus labour in agriculture and policy analysis in redressal of the problem. Transition of workforce in India is characterized by a change in both residential composition of workforce as well in the sectorial re-allocation of labour from agriculture to non-agricultural occupations. In the process of re-allocation of labour, we find an increasing rate of growth of workforce engaged in trades related to construction activity. Despite structural re-allocation of workforce we find a sizeable workforce in agricultural activity with increasing proportion of agricultural labourers. As we map pre-existing increasing rates of unemployment with a greater magnitude of prevalence amongst socio-economically marginalised sections, we posit of a scenario of wage depression in agricultural activity on account of an increased transfer of labour from urban to rural and non-farm to farm activities in Post-Covid-19 pandemic, with the extent of effects being greater for vulnerable social groups.

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SUBJECT III
AGRICULTURAL TRADE WITH SPECIAL REFERENCE TO PLANTATION CROPS AND INTERNATIONAL TRADE AGREEMENTS

Performance and Determinants of Exports of Coffee from India: A Post-WTO Scenario

Arghyadeep Das*, R. Raju†, T.M. Kiran Kumara and Siddayya‡**

ABSTRACT

Coffee is an important plantation crop and has high export potential. About 70 per cent of total coffee produced in India is exported. India ranks fifth in total coffee exports in the world. The share of coffee export in total agricultural exports, depict a decreasing trend in recent years. To analyse the performance of coffee in post-WTO era, the time series data was divided into three periods, i.e., Period I (1995-96 to 1999-00), Period II (2000-01 to 2008-09) and Period III (2009-10 to 2018-19). Except in Period II, the quantity of export was showed positive and significant growth rate, instability of value of export and unit value of export was higher in Period II as compared to period I and III. Russian Federation, Italy, Germany, Spain, Belgium, Poland are the major export destinations of Indian coffee. Transition Probability Matrix was estimated to examine the retention probability of export share of Indian coffee among the major importers for the aforementioned periods. Markov chain process was used to forecast the share of export of Indian coffee among major importers for 2019-20 to 2024-25. The international price of coffee, exchange rate between rupees and dollars and lagged production of coffee were the few determinants of export of coffee.

Keywords: Coffee, Export, Instability, Markov Chain, Transition Probability Matrix.

JEL.: F13, F17, Q11, Q17

I

INTRODUCTION

The Western Ghats in India is the hub of coffee cultivation. The major coffee producing states in India are Karnataka, Kerala and Tamil Nadu, which together contribute about 97 per cent of India's coffee production. Coffee is predominantly an export-oriented commodity and 65 per cent to 70 per cent of coffee industry earns a foreign exchange to the tune of about ₹ 4,000 crores (Gurusamy and Yamakanith, 2015). The two main varieties of coffee viz., Arabica and Robusta are grown in India. Arabica has more market value than robusta coffee due to its mild aromatic flavour. Robusta mainly used in making various blends due to its strong flavour. Cool and equitable temperature, high altitude and temperature ranging between 15°C to 25°C, is favourable for arabica cultivation.. On the other hand hot and humid climate with

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temperature ranging from 20°C to 30°C is suitable for robusta cultivation. Harvesting of Arabica coffee takes place between the months of November to January, while December to February month is suitable for harvesting of robusta coffee.

India is one of the founder members of World Trade Organization (WTO). The establishment of WTO in 1995, helped from providing a major stimulus for liberalisation of the agricultural sector in our country. India undertook several policy measures to reform its farm sector, in order to fulfil its obligation under WTO Agreements on Agriculture (AoA).Market access, domestic support and export subsidies were the three broad areas of obligation under WTO for India. Reduction of export subsidies has increased the international price of the agricultural commodities, which also provided a golden opportunity for India to boost its exports by making it more competitive in international market. Coffee is an important plantation crop for export, besides the industry has low input intensity and high employment potentiality. The present study has focused mainly to assess the export performance of Indian coffee, discuss the prospects of coffee exports in future and also understand the factors affecting the export of coffee from India.

II

DATA AND METHODOLOGY

The present study is based on export quantity, value of export and unit value of export of coffee from India to major importing countries by compiling the data for 23 years (1995-96 to 2018-19). For the analysis, the total period is sub-divided into three periods, viz., Period I (1995-96 to 1999-2000), Period II (2000-01 to 2008-09) and Period III (2009-10 to 2018-19). The data on export quantity, value of export, unit value of export and production of coffee was collected from *Indiastat.com* website. Data on international price of coffee was collected from FAOSTAT and data on exchange rate was collected from RBI's publications.

Growth and Instability Indices

Compound annual growth rates estimated by using following exponential growth function,

$$y = ab^t$$

where,

y= Dependent variable for which the growth rate was estimated

a and b= parameters of exponential regression

T= Time variable

Compound growth rate was estimated from the fitted exponential regression parameter b

Average annual compound growth rate was calculated as:

Compound growth rate= antilog (logb-1)*100

Significance of growth was judged by student's t-test.

Coefficient for Variation and Instability

In order to study the variability, coefficient of variation and "Cuddy and Della's instability index" was used as the measures of variability.

Coefficient of Variation (CV)

The coefficient of variation (CV) was calculated by the formula

$$C.V(\%) = (\frac{\sigma}{\bar{x}} * 100)$$

Standard deviation (σ)= $\sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$

$\bar{x}$= Arithmetic mean
n= Number of observation

Cuddy and Della Index

Coefficient of variation defined above does not take trend components prevailing in time series data. In order to have a meaningful measure of instability the formula suggested by Cuddy and Della (1978) was used to compute the degree of variation around the trend. The formula suggested by Cuddy and Della (1978) was used to compute the degree of variation around the trend.

Index of Instability= $\mathrm{C.V} * 100 * \sqrt{1 - \mathrm{adj}R^2}$

where,
Adj R^2= Adjusted R^2 of the trend equation

Analysing Trade Directions

The trade directions of export were analysed using the first order Markov chain approach. Central to the Markov chain analysis is the estimation of transitional probability matrix P_{ij}. The elements P_{ij} of the matrix P indicates the probability that export will switch from i-th country to the j-th country with the passage of time (Dent, 1967; Lee *et al.,* 1970; Gillet, 1976). The diagonal elements of the matrix measure the probability that the export share of a country will be retained. Hence, the examination of the diagonal elements will indicate the preference of an importing country for a particular country's exports.

In the context of the present study, the structural changes were treated as a random process with selected importing countries. The average export to a particular country was considered to be a random variable which depended only on the past exports to that country, and can be denoted algebraically by Equation (1):

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} P_{ij} + e \quad \text{....(1)}$$

where, E_{jt} denotes exports from India to the j-th country during the year t, E_{it-1} denotes exports from India to the i-th country during the period t-1, P_{ij} is the probability that exports will shift from the i-th country to the j-th country, e_{jt} is the error- term which is statistically independent of E_{it-1}, t is the number of years considered for the analysis, and r is the number of importing countries. The transitional probabilities P_{ij} which can be arranged in a matrix(c x r) have the following properties:

$$0 \leq P_{ij} \leq 1$$

$$\sum_{j=1}^{r} P_{ij} = 1 \text{ for all 'i'}$$

The minimum absolute deviation (MAD) estimation procedure was employed to estimate the transitional probability, which minimises the sum of absolute deviations (Fisher, 1967; Wagner, 1959). The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation. The linear programming formulation is stated as:

$$MinOP^{*} + Ie$$

Subject to, $XP^{*} + V = Y, GP^{*} = 1, P^{*}e \geq 0$

where,

0= Vector of zeroes,

P^{*}= Vector in which probability P_{ij} is arranged,

I= Appropriate dimensioned column vector of unit,

E= Vector of absolute error (|U|),

Y= Vector of export to each country,

X= Block diagonal matrix of lagged values of Y,

V= Vector of errors, and

G= Grouping matrix to add the row elements of P as arranged in P* to unity.

After calculating the transitional probability matrix, the expected shares of export were calculated by equation (2):

$$Y_{jt} = \sum_{j-1}^{r} y_{it-1} * P_{ij} \; (j = 1,2,3 \ldots \ldots . . r) \quad \text{.... (2)}$$

where, Y_{jt} is the predicted proportions of the j-th country's share at time 't', Y_{t-1} is the observed proportion of the i-th country's share at time 't-1', and P_{ij} is the estimated transitional probability matrix.

Thus, the expected export shares of each country during period 't' were obtained by multiplying the export to these countries in the previous period (t-1) with the transitional probability matrix. Multiple regression analysis was carried out, using ordinary least square (OLS) estimation procedure, in the statistical software E-Views.

Determinants of Exports

The factors affecting the exports of coffee were identified using log-log linear type of function:

$$\ln QT = b_0 + b_1 \ln INTT + b_2 \ln INTC + b_3 \ln ER + b_4 \ln PCC + b_5 \ln P + \mu \quad \ldots (3)$$

where,

QT= total coffee export from India ('000 t),

INTC= international price of coffee ($/kg),

ER= exchange rate with dollar (₹/$)

PCC= per capita consumption of coffee(gm)

P= production of coffee('000 tonnes),

μ = error-term, and

b_1….. b_5 are the regression coefficients and b_0 is a constant.

III

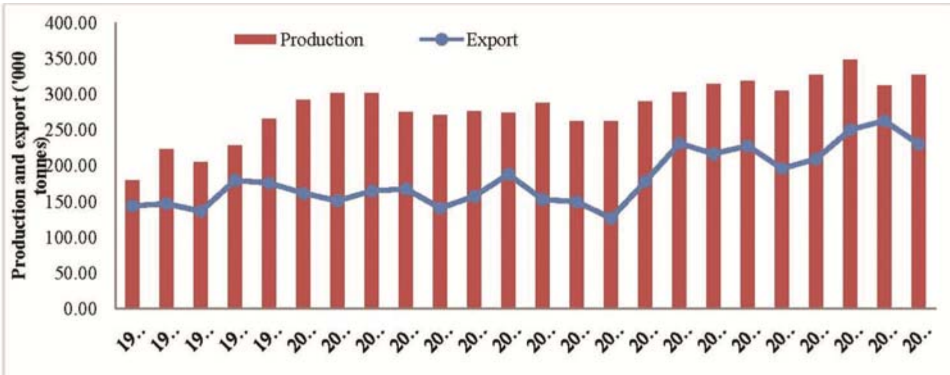
RESULTS AND DISCUSSION

India's Coffee Production and Export Scenario

India ranks seventh in coffee production and fifth in coffee export in the world. In 2017-18, India produced 326 thousand tonnes of coffee (Figure 1).Out of this,70 per cent, i.e., 229 thousand tonnes was exported. Coffee production in India is dominated in the hill tracts of south Indian states, with Karnataka accounting for 71 per cent, followed by Kerala with 21 per cent and Tamil Nadu with 5 per cent of total production (Indiastat.com).

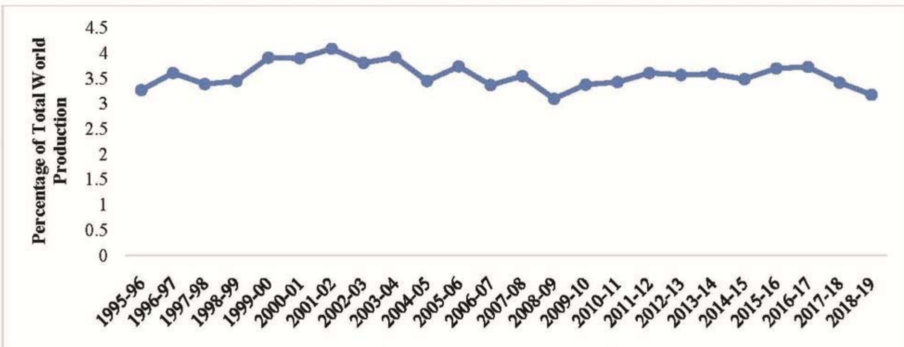
India's share in world's coffee production has almost remainedthe same during post- WTO period. It was 3.26 per cent in 1995-96 and 3.17 per cent in 2018-19 (Figure 2).

India stands in fifth position in total coffee export of the world (3.02 per cent) after Brazil (23.92 per cent), Vietnam (21.18 per cent), Colombia (9.35 per cent), Indonesia (3.64 per cent) and Honduras (5.64 per cent) (Figure 3).



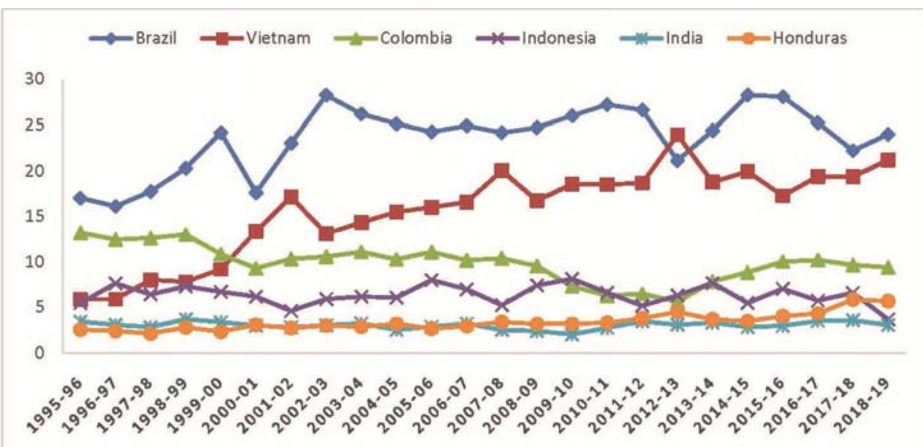
Source: FAOSTAT.com

Figure 1. India's Production and Export of Coffee during 1995-96 to 2018-19.



Source: FAOSTAT.com

Figure 2. India's Share in Total World Coffee Production.



Source: FAOSTAT.com

Figure 3. Share of Major Countries in World Export of Coffee (in Percentage of Total).

The value of coffee exports had increased four-fold from ₹ 1,527 crore to ₹ 6,159 crore in 2017-18, however in the subsequent year it has decreased to ₹ 5,814 crore due to reduction in export quantity (Table 1). The share of coffee exports to total agricultural exports had decreased almost threefold from 7.48 per cent in 1995-96 to 2.12 per cent in 2018-19.The reason behind this was higher exports of agricultural products other than coffee.

TABLE 1. SHARE OF INDIAN COFFEE EXPORT TO TOTAL AGRICULTURAL EXPORTS DURING1995-96 to 2018-19

Year (1)	Total coffee export Quantity ('000tonnes) (2)	Total coffee export Value (in ₹ crore) (3)	Unit value (₹ /tonne) (4)	Agricultural export (in ₹ crore) (5)	Per cent share of total coffee export in agricultural export (6)
1995-96	170	1,527	89,314	20,397.74	7.48
1999-2000	244	1,901	77,619	25,131.66	6.87
2009-10	196	2,071	1,05,645	89,341.50	2.32
2014-15	275	4,905	1,78,146	2,39,681.04	2.04
2015-16	310	5,060	1,63,109	2,15,396.55	2.34
2016-17	346	5,477	1,58,332	2,26,651.91	2.41
2017-18	392	6,159	1,57,205	2,51,563.94	2.45
2018-19	353	5,814	1,64,451	2,74,571.28	2.12

*Source:*Indiastat.com

Growth and Instability of Coffee Exports from India

The compound annual growth rate of India's coffee exports from 1995-96 to 2018-19 is presented in Table 2. During Period I (1995-96 to 1999-2000) export quantity increased at a higher rate (9.13 per cent) than value of export (6.34 per cent), which caused negative growth rate in unit value of export (-2.55 per cent). However growth rate of export quantity turned out negative (-1.09 per cent) during Period II (2000-01 to 2008-09), value of export and unit export value of coffee showed a positive and significant growth rate of 9.16 and 10.41 per cent per annum, respectively. In Period III (2009-10 to 2018-19), growth rate of quantity of export turned into positive and significant (2.47 per cent) and growth rate of both value of export and unit value of export reduced to 5.87 per cent and 3.36 per cent respectively. The exports of agricultural and allied products registered an increasing trend during recent period due to the factors such as adaption of National Agriculture Policy(NAP) by the Government of India, establishment of Agri Export Zones (AEZs), Vishesh Krishi Gram UdyogYojna (VKGUY) and opening of agriculture under WTO (Sahni,2014).

Instability of export quantity increased with time, it was 6.64 per cent in period I, 7.34 per cent in period II and 9.64 per cent in period III. This was due to variability in export quantity. However, instability in value of export increased from 4.61 per cent in period I to 17.77 per cent in period II. Similar trend has been observed in case of unit value of export which increased from 8.36 per cent to 12.86 per cent. This was due to volatility in world prices and political situation in international markets. In

Period III, instability of value of export and unit value of export reduced to 5.30 and 5.26 per cent, respectively, due to more stable trade policies initiated by the Government of India.

TABLE 2. GROWTH, COEFFICIENT OF VARIATION AND INSTABILITY ANALYSIS ON EXPORT OF COFFEE IN INDIA

Particulars (1)	Parameters (2)	Export quantity ('000 tonnes) (3)	Export value (₹ crore) (4)	Unit value (₹/tonne) (5)
Period I	CGR	9.13**	6.34***	-2.55***
(1995-2000)	CV (per cent)	15.51	10.50	8.37
	Instability index	6.64	4.61	8.36
Period II	CGR	-1.09***	9.16***	10.41***
(2000-2010)	CV(per cent)	7.58	31.92	33.09
	Instability index	7.34	17.77	12.86
Period III	CGR	2.47***	5.87***	3.36***
(2010-2019)	CV (per cent)	11.44	11.49	6.84
	Instability index	9.64	5.30	5.26

Note: ***,**,* showed significance at 1, 5 and 10 per cent level respectively.

Major Export Destinations of Indian Coffee

Indian coffee is mainly exported to Italy (20.09 per cent), Germany (8.78 per cent), Russian Federation (7.78 per cent), Belgium (5.60 per cent), Poland (3.80 per cent) and Spain (1.88 per cent) (Table 3).

TABLE3. SHARE OF COFFEE EXPORT FROM INDIA TO MAJOR COUNTRIES DURING 2013-14 to 2018-19

(*values in ₹ crore*)

Year (1)	RussianFederation (2)	Italy (3)	Germany (4)	Spain (5)	Belgium (6)	Poland (7)	Others (8)	Total (9)
2013-14	272.22	1074.80	469.90	79.20	298.36	36.25	2455.84	4650.31
	(5.85)	(23.11)	(10.10)	(1.70)	(6.42)	(0.78)	(52..03)	(100)
2014-15	372.47	1007.47	472.95	92.46	249.12	78.16	2711.48	4905.96
	(7.59)	(20.54)	(9.64)	(1.88)	(5.08)	(1.59)	(53.68)	(100)
2015-16	440.16	1113.02	481.31	82.28	297.57	92.40	2645.37	5059.71
	(8.70)	(22.00)	(9.51)	(1.63)	(5.88)	(1.83)	(50.46)	(100)
2016-17	479.05	1168.40	552.79	123.31	353.77	155.30	2800.14	5477.46
	(8.75)	(21.33)	(10.09)	(2.25)	(6.46)	(2.84)	(48.29)	(100)
2017-18	452.68	1120.66	631.06	137.63	372.98	217.66	3444.21	6159.23
	(7.35)	(18.19)	(10.25)	(2.23)	(6.06)	(3.53)	(52.39)	(100)
2018-19	452.62	1167.95	510.40	109.60	325.73	221.05	3248.29	5814.59
	(7.78)	(20.09)	(8.78)	(1.88)	(5.60)	(3.80)	(52.06)	(100)

Source: Indiastat.com.

Note: Figures in parentheses indicate per cent to total.

Trade Direction of Coffee Export from India

The direction of trade of coffee to different destination for various periods was examined by estimating transitional probability matrix (TPA) in Table 4. There are five major countries, which are importing coffee from India, rest of the countries are pooled under other countries. The diagonal elements in the TPM provide information on the probability of retention of trade, while row elements indicate the probability of loss in trade on account of competing countries. The column elements indicate the probability of gain in trade from the competing countries.

For the period I (1995-96 to 1999-00), Italy showed highest probability of retention of 0.574, which means Italy had retained 57.4 per cent of share of India's coffee export. This was followed by Spain (44 per cent), Russian Federation (39.5 per cent) and Germany (11.8 per cent) in retaining the share of India's export of coffee. During this period the highest gainer among major importing countries was Spain, which was obtaining 59 per cent of Belgium's share and 6.2 per cent Germany's share of import of coffee from India and also retained its own 44 per cent share of import.

TABLE 4. TRANSITION PROBABILITY MATRIX OF COFFEE EXPORT FROM INDIA FROM 1995-96 to 1999-2000

Countries (1)	Russian Federation (2)	Italy (3)	Germany (4)	Poland (5)	Belgium (6)	Spain (7)	Others (8)
Russian Federation	0.395	0.024	0.156	0	0	0	0.424
Italy	0	0.574	0.425	0	0	0	0
Germany	0	0	0.118	0	0.228	0.062	0.592
Poland	1	0	0	0	0	0	0
Belgium	0	0	0	0.409	0	0.59	0
Spain	0	0	0	0	0.558	0.44	0
Others	0.151	0.15	0.088	0.062	0	0	0.567

During period II highest retention was depicted by Italy (38 per cent), followed by Russian Federation (36.6 per cent), Belgium (18.9 per cent) and Germany (1.7 per cent) (Table 5). Highest gainer during this period was Germany, which had a transfer of probability of 0.283 from Russian federation, 0.91 from Poland, 0.601 from Belgium, 0.131 from Spain and retained its own transition probability of 0.017.

TABLE 5. TRANSITION PROBABILITY MATRIX OF COFFEE EXPORT FROM INDIA FROM 2000-01 TO 2008-09

Countries (1)	Russian Fed (2)	Italy (3)	Germany (4)	Poland (5)	Belgium (6)	Spain (7)	Others (8)
Russian Federation	0.366	0	0.283	0	0.12	0.233	0
Italy	0	0.38	0	0	0	0	0.619
Germany	0.736	0	0.017	0	0.231	0.015	0
Poland	0	0	0.91	0	0.092	0	0
Belgium	0	0.128	0.601	0.011	0.189	0.072	0
Spain	0.189	0.679	0.131	0	0	0	0
Others	0.004	0.278	0	0.013	0.022	0.02	0.66

During Period III, Italy showed the highest retention of 14.5 per cent of its import for India's coffee, followed by Russian Federation (13.6 per cent) (Table 6). Highest gainer among major importing countries was Italy, which had obtained 53.3 per cent share of Russian Federation and 44.1 per cent of Spain's share of India's export of coffee and also retained 14.5 per cent of its own share.

TABLE 6. TRANSITION PROBABILITY MATRIX OF COFFEE EXPORT FROM INDIA FROM 2009-10 to 2018-19

Countries (1)	Russian Fed (2)	Italy (3)	Germany (4)	Poland (5)	Belgium (6)	Spain (7)	Others (8)
Russian Federation	0.136	0.533	0.186	0	0.094	0.05	0
Italy	0.242	0.145	0.346	0	0.027	0.087	0.153
Germany	0	0	0	0.039	0	0	0.961
Poland	0	0	0	1	0	0	0
Belgium	0	0	0	0	0	0	1
Spain	0.441	0	0.069	0	0.49	0	0
Others	0	0.332	0	0	0.054	0	0.614

Actual and Estimated Shares of Indian Coffee Export to Importing Countries

The actual and estimated shares of coffee exported from India to different countries (in percentage terms) have been given in Table 7. A comparison of this proportion during the study period revealed that the observed proportions of export shares were consistent with the estimated shares of export, which were derived from the Markov chain process. However, differences have been observed in some years, which could be due to limitation of the model that the present estimates depend only on the previous years' observations and the exports also depend on sudden policy changes, leading to abrupt increase or decrease in the exports to a country.

Projection of Indian Coffee Exports to Major Importing Countries

Table 8 revealed that the export of Indian coffee to different countries which was computed using the transitional probability matrix. It was projected that during 2019-20, the major markets for Indian coffee would be Italy (23.46 per cent), followed by Germany (9.65 per cent), Russian Federation (7.66 per cent), Belgium (5.00 per cent), Poland (4.67 per cent) and Spain (2.42 per cent). Russian Federation, Germany and Poland has shown increasing trend in percentage share of India's coffee export during 2019-20 to 2024-25. It was may be due to the fact that these countries were able to retain their shares in India's coffee export. Markov chain predict export quantity of the future years based on past data, this may be the reason for predicting increasing trend for these countries' shares in the export of Indian coffee.

Determinants of Coffee Exports from India

In Table 9 the factors determining coffee exports from India were studied by using multiple regression of log-log form where quantity exported was regressed against international price of coffee (own price), exchange rate, per capita consumption of coffee and lagged production of coffee. The data used for regression analysis were for 23 years (1995-96 to 2018-19).

TABLE 7. ACTUAL AND ESTIMATED SHARES OF COFFEE EXPORT FROM INDIADURING 2009-10 to 2018-19

	Russian fed		Italy		Germany		Poland		Belgium		Spain		Other countries	
Year	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
2009-10	27482	-	47065	-	13171	-	1426	-	6680	-	6169	-	94010	-
	(14.02)		(24.01)		(6.72)		(0.73)		(3.41)		(3.15)		(47.96)	
2010-11	29978	28464	80653	68814	33371	34232	2747	4046	18236	17039	11043	8534	123750	138665
	(10.00)	(9.49)	(26.90)	(22.96)	(11.13)	(11.42)	(0.92)	(1.35)	(6.08)	(5.68)	(3.68)	(2.85)	(41.28)	(46.26)
2011-12	33112	27618	71010	79174	38138	31647	4492	5977	18919	19883	13451	7849	154100	161093
	(9.94)	(8.29)	(21.31)	(23.76)	(11.45)	(9.50)	(1.35)	(1.79)	(5.68)	(5.97)	(4.04)	(2.36)	(46.25)	(48.34)
2012-13	24814	24637	75748	72014	24874	31271	3485	4453	19907	15343	6650	7848	143810	143736
	(8.29)	(8.23)	(25.31)	(24.06)	(8.31)	(10.45)	(1.16)	(1.49)	(6.65)	(5.13)	(2.22)	(2.62)	(48.05)	(48.03)
2013-14	16103	23007	75456	69581	21507	29489	2516	3743	17895	14460	5799	7388	150603	152227
	(5.37)	(7.67)	(25.16)	(23.20)	(10.51)	(9.83)	(0.84)	(1.25)	(5.97)	(4.82)	(1.93)	(2.46)	(50.22)	(50.76)
2014-15	21135	19845	60173	68686	25222	25119	4805	5787	12092	14141	5464	6306	146499	135522
	(7.67)	(7.21)	(21.85)	(24.94)	(9.16)	(9.12)	(1.74)	(2.10)	(4.39)	(5.13)	(1.98)	(2.29)	(53.20)	(49.21)
2015-16	25306	24938	77361	74751	28286	31896	6493	7594	15909	15620	6295	8013	150554	147407
	(8.16)	(8.04)	(24.94)	(24.10)	(9.12)	(10.28)	(2.09)	(2.45)	(5.13)	(5.04)	(2.03)	(2.58)	(48.53)	(47.52)
2016-17	27808	28473	84789	80928	32554	35151	9907	11174	19561	18214	9460	8787	161852	163237
	(8.04)	(8.23)	(24.51)	(23.39)	(9.41)	(10.16)	(2.86)	(3.23)	(5.65)	(5.27)	(2.73)	(2.54)	(46.79)	(47.19)
2017-18	26345	27098	79024	93815	39128	32917	13709	15232	18106	20506	9960	8210	205524	194039
	(6.72)	(6.92)	(20.17)	(23.94)	(9.99)	(8.40)	(3.50)	(3.89)	(4.62)	(5.23)	(2.54)	(2.10)	(52.46)	(49.53)
2018-19	22292	24911	76452	83730	31818	31115	14056	15295	18486	17711	7663	7784	182809	173048
	(6.30)	(7.05)	(21.62)	(23.68)	(9.00)	(8.80)	(3.98)	(4.33)	(5.23)	(5.01)	(2.17)	(2.20)	(51.70)	(48.94)

TABLE 8. PROJECTIONOF INDIAN COFFEE EXPORTS TO MAJOR COUNTRIES DURING 2019-20 to 2024-25

Years (1)	Russian Fed (2)	Italy (3)	Germany (4)	Poland (5)	Belgium (6)	Spain (7)	Others (8)
2019-20	27,082	82,940	34,128	16,506	17,689	8,550	1,66,717
	(7.66)	(23.46)	(9.65)	(4.67)	(5.00)	(2.42)	(47.15)
2020-21	27,524	81,879	34,311	17,835	17,909	8,589	1,65,583
	(7.78)	(23.15)	(9.70)	(5.04)	(5.06)	(2.43)	(46.82)
2021-22	27,344	81,584	34,029	19,171	17,881	8,518	1,65,121
	(7.73)	(23.07)	(9.62)	(5.42)	(5.06)	(2.41)	(46.69)
2022-23	27,217	81,292	33,889	20,496	17,796	8,484	1,64,492
	(7.70)	(22.99)	(9.58)	(5.80)	(5.03)	(2.40)	(46.51)
2023-24	27,114	80,973	33,762	21,815	17,726	8,452	1,63,842
	(7.67)	(22.89)	(9.55)	(6.17)	(5.01)	(2.39)	(46.32)
2024-25	27,009	80,656	33,630	23,130	17,657	8,419	1,63,202
	(7.64)	(22.80)	(9.51)	(6.54)	(4.99)	(2.38)	(46.14)

TABLE 9. DETERMINANTS OF COFFEE EXPORTS FROM INDIA

Particulars (1)	Coefficients (2)	Standard error (3)
Constant	-8.32***	3.59
International price of coffee	0.122*	0.072
Exchange rate	0.438*	0.237
Per capita consumption	-0.225	0.304
Lagged Production of coffee	1.005***	0.369
R-squared	0.815	
F statistics	19.81	

Note: ***, **,* showed significance at 1, 5 and 10 per cent level, respectively.

The study revealed that the international prices of coffee are significant with high positive elasticity, which indicates that international price has a positive impact on exports of coffee from India. This may be due to the fact that when international price of coffee increases, the importer shifts towards Indian coffee due to price advantage, indicating the role of government to set price just below international price of coffee, in sucha way that price becomes competitive in the international markets.

The exchange rate has a positive impact on coffee export from India and is significant at 5 per cent level. When the exchange rate of rupee with dollar increases (devaluation of rupee occurs), then the exports from India become cheaper for the importing countries, and hence export increases. Thus, a positive impact of exchange rate is assumed on the coffee exports from India. Haleem *et al.* (2005), Kumar *et al.* (2008), Shende *et al.* (1999) and Adhikari *et al.* (2016) have also revealed the positive and significant effect of exchange rate.

The coefficient of lagged production has been found positive and statistically significant. This means that coffee export is more influenced by the previous year's production. The positive and significant influence of lagged production has been observed not only on the export of rice (Gangwar and Rai, 1995; Sekhar, 2003) but also on the exports of onion, banana and black pepper (Hema and Kumar, 2007), indicating increase in the export earnings with increase in production.

IV

CONCLUSION

About seventy per cent of coffee produced in India is exported to different countries around the world. India accounts for 3.26 per cent of world's coffee production and 3.02 per cent of world's coffee export and ranks seventh and fifth in coffee production and export, respectively. Due to increasing number of export of commodities other than coffee, the share of coffee in total agricultural export is decreasing. During Period I, export quantity increased at a higher rate than value of export, which caused negative growth rate in unit value of export. However the trend was reversed as growth rate of export quantity turned into negative during period II, while value of export and unit export value of coffee showed a positive and significant growth rate. Higher instability of value of export and unit value of export was due to volatility in world prices and political situation in international markets.

Italy, Russian Federation, Germany, Poland, Belgium and Spain are the major export destinations for Indian coffee. The study indicated that Italy had the maximum percentage of retention of export share of Indian coffee throughout the study periods. During period I, II and III major gainer were Spain, Germany and Russian Federation respectively. It was predicted that Russian Federation, Germany and Poland has showed increasing trend in percentage share of India's coffee exports during 2019-20 to 2024-25. This was mainly attributed to the fact that these countries were able to retain their shares in India's coffee export.

Positive and significant coefficient of international price of coffee indicated the proactive role of government to set price just below the international price of coffee to make the price competitive in the international markets. Positive and significant coefficient of exchange rate depict the fact that as the exchange rate of rupee with dollar increases (devaluation of rupee occurs), then the exports from India would become cheaper for the importing countries, and hence export increases. Finally positive and significant coefficient of lagged production of coffee means that coffee export is more influenced by the previous year's production.

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Revealed Comparative Advantage, Competitiveness and Growth Performance: Evidences from India's Foreign Trade of Agricultural Commodities

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ABSTRACT

Agricultural sector has played an important role in economic development of the country by earning sizable amount of foreign exchange by exporting agricultural commodities. The export of agricultural commodities can reduce the current account deficit of the country because the values of exports of agricultural commodities are more than the import value of agricultural produces. After agreement under world trade organisation, agricultural commodities are moving from one country to another country realising the benefits of comparative advantage in the international economy. The present study is an attempt to study the growth trend, variability and trade specification coefficient index for various agricultural commodities and to study the comparative advantage of spices export from India using revealed comparative advantage, trade specification coefficient, revealed symmetric comparative advantages and revealed competitive advantage indices. For the purpose secondary data was collected from various government published sources and websites. The compound growth trend, coefficient of variation, Revealed comparative advantage (RCA), Revealed symmetric comparative advantage (RSCA), Revealed competitive advantage (RC) and trade specification coefficient (TSC) was used to achieve the objectives. Growth trend analysis for value of export and import suggests that all the agricultural commodities showed positive trend with high inter-annual variability during the study period except for import value of jute hessian and guar gum meal import. The TSC analysis suggests that value of export was more than the value of import for all the crops except pulses, vegetable oils, fresh fruits, cashew, cocoa products and raw jute during the study period. The analysis of competitiveness of spices export showed a favourable competitive scenario, whereas the export-import balance was found slight decrease from high dominance of export over import.

Key Words: Spices, Revealed comparative advantage, Trade specification coefficient, Revealed symmetric comparative advantages, Revealed competitive advantage

JEL.: F31, F40, P59, Q17

I

INTRODUCTION

Indian agricultural sector has played an important role in the economic development of the country. The gross value added from agricultural sector at current prices was Rs.27559.92 billion accounting for 14.46 per cent of the gross domestic product at market price (Government of India, 2019). The total exports of agricultural commodities from India was Rs.2515.64 billion and agricultural imports was Rs.1520.95 billion during 2017-18 with a net trade balance of Rs.994.69 billion during the same period (Government of India, 2019).The exports of agricultural

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commodities may be considered as gainful in improving the health of economic and financial scenario balance of the country (Singh and Vasisht 1996; Coote *et al*., 2000; Ghosh 2005; Johnson 2009). India's current account deficit is US$ 1.2 billion, accounting for about 0.9 per cent of the gross domestic product in 2019-20.Augmentation in agricultural commodities exports may be helpful in mitigating the current account deficit. The agreement under World Trade Organisation (WTO) allows all countries to take the benefits from realising the comparative advantage in the international economy and augmentation of competition would trigger the efficient use of available and allocated resources. The trade policies of the country have influenced its comparative advantage (Mirzaei *et al*., 2012).

Trade competitiveness of commodities holds a unique role in policy making. The classical trade models says that a country has an ability to produce a commodity at lower cost in which the country has comparative advantage and export that commodity, while other country import that particular commodity, because the importing country has the comparative disadvantage in producing that commodity (Ahmed *et al*., 2017). Many economists tried to define and measure comparative advantage- like Revealed Comparative Advantage (RCA) measurement by Balassa (1965) to recent development of Normalised Revealed Comparative Advantage (NRCA) by Yu *et al*., (2009). The comparative advantage theory of Balassa's (1995) identify trade pattern of any country with its limitation. Other new indices have been introduced on the basis of trade-cum-production such as Lafey index (Lafey, 1992) that cover export, Dalum *et al*., (1998) index and weighted RCA index by Proudman and Reading (1998), additive index developed by Hoen and Oosterhaven (2000) and normalised index NRCA by Yu *et al*., (2009) covers comparison among countries, products over time with neutral point.

India exports a large number of agricultural commodities to a number of overseas countries. These export products include processed foods, frozen or dried food, fresh foods, prompt foods and ready to eat food. This has empowered the Indian food industries to occupy a significant position in the world market. The agro-based products are broadly classified into two groups, viz., plant based and animal based products. Some of the important plant based commodities which are exported from India to overseas market include tea, coffee, basmati rice, tobacco, spices, cashew, sesame seed, niger seed, groundnut, oil meal, guargum, castor oil, molasse, fresh and processed vegetables, processed juice, milled products, jute, cotton, floricultural products etc. The animal-based products are animal casings, buffalo meat, sheep and goat meat, processed meat, dairy and poultry products and marine products. To promote the agro-based products, various measures have been adopted by the government to provide financial enticements to endorse the exporting agro-food products (Barik and Anand, 2017). India also imports lot of the food items from the overseas countries and sold in the domestic market and this has benefited many Indian consumers who prefer to eat frozen foods instead of spending hours in the kitchen by the imported ones at affordable price. Looking into the importance of exports, the present study attempts to analyse and understand the revealed comparative advantage, competitiveness and growth performance in trade of Indian agricultural commodities. The objectives of the present study are: (1) to estimate the trade specification coefficient index, trend analysis and variability of agricultural commodities; and (2) to study the comparative advantage of spices exports from India using revealed comparative advantage, trade specification coefficient, revealed symmetric comparative advantages and revealed comparative advantage indices.

II

METHODOLOGY

The study is based on secondary data collected from the various published sources of government publications like *Agricultural Statistics at a Glance, Handbook of Horticulture*, data from *Spices Board of India*, etc.

The exponential function ($Y = a*b^t$) was used to study the temporal growth in agricultural import and export. Where, Y is the dependent variable (it may be export or import data), t is the independent variable (it is rank given to the year concerned). Ranking of the year was done in ascending order, a is the functional coefficient used in exponential function and b is the compounding coefficient (Singh and Singh, 1997).

The coefficient of variation [$CV = (\sigma/\mu) \times 100$] was used to measure the variability in agricultural import and export. Here, $\sigma$is the standard deviation and μ is the mean (Singh and Singh, 1997).

To measure the Revealed Comparative Advantage (RCA) of a country's trade pattern for any spices, Balassa (1965) method was used. The mathematical expression is denoted as:

$$RCA_{ij}=\{(X_{ij} / \Sigma X_{ij}) /(\Sigma j\Sigma iX_{ij})\}$$

where, X_{ij} denotes the exports of commodity i in country j; ΣiX_{ij} is the total agri-exports of country j; $\Sigma j\ X_{ij}$ is the Asia's exports of commodity i; and $\Sigma j\ \Sigma I\ X_{ij}$ is the total agri exports of Asia. If RCA index < 1, it indicates that the share of Indian exports in the country's overall export trade is lower than its share in Asia's trade. If RCA >1 it means the share of imports, export in different products is more than Asia's shares hence it has a comparative advantage in that particular commodity.

Vollrath (1991) and Dalum *et al*. (1998) suggested another alternative method to measure the competitiveness of a particular country to avoid the problem of double counting like Revealed Symmetric Comparative Advantages (RSCA). The RSCA can be expressed as:

$$RSCA_{ij} = [\{(X_{ij} / \Sigma X_{ij}) / (\Sigma j\ X_{ij} / \Sigma j\ \Sigma iX_{ij})\}-1] / [\{(X_{ij} / \Sigma X_{ij}) / (\Sigma j\ X_{ij} / \Sigma j\ \Sigma iX_{ij})\}+1]$$

where, Xij is the exports of commodity iin country j; ΣiX_{ij} is total agri-export of country j; $\Sigma j\ X_{ij}$ denotes the Asia's export of commodity i and $\Sigma j\ \Sigma iX_{ij}$ signifies

Asia's total agri export. The value of RSCA index ranges between -1 to +1 to avoid the problem of zero. Positive values of the index indicate the stability as well as the competitiveness of a particular country. Hence, RSCA also measures the permanency of the particular product.

Revealed Competitive Advantage (RC) index measures the balances in supply and trade by using the values of export and it was developed by Vollrath (1991). It also used to know the distinctions between specific commodity and all other commodity as well as among specific country with rest of the world/ a set of countries. The RC index can be expressed as:

$$RC_{ij} = \{(X_{ij} / \Sigma X_{ij}) / (\Sigma j\ X_{ij} / \Sigma j\ \Sigma i X_{ij})\} - \{(M_{ij} / \Sigma M_{ij}) / (\Sigma j\ M_{ij} / \Sigma j\ \Sigma i M_{ij})\}$$

where, X_{ij} represents the exports of commodity i in country j; $\Sigma i X_{ij}$ is total agri-exports of country j; $\Sigma j\ X_{ij}$ implies Asia's exports of commodity i and $\Sigma j\ \Sigma i X_{ij}$is total agri-exports of Asia; M_{ij} represent the imports of commodity i in country j; $\Sigma i M_{ij}$ is the total agri-import of country j; $\Sigma j\ M_{ij}$ implies Asia's imports of commodity i and $\Sigma j \Sigma i M_{ij}$ is the total agri imports of Asia. The values of index must be either positive or negative. If the values depicts positive, the commodity of the country is competitive and if the index value is negative means it will not competitive internationally in that commodity trade. Therefore, value of RC is a perfect measure to show the balances in supply and demand as well as competitiveness and edges in comparative advantages.

Trade specification coefficient index (TSC Index) also known as Lafay's (1992) Index has been employed to understand the export competitiveness of Indian exports during the study periods. The mathematical model of the TSC index is represented as follows:

$$\mathrm{TSC} = \frac{(X_{ij} - M_{ij})}{(X_{ij} + M_{ij})}$$

This index represents the ratio of the trade balance (changes between exports and imports) of a particular commodity in a country to the total value of the trade (cumulative value of exports and imports) for that particular commodity. In the above equation, X_{ij}represents the total exports of the commodity while M_{ij}represents the total imports of the commodity. The value of the index ranges between -1 and +1. The value of this index equals 'zero' when a commodity's exports are equal to its imports. A positive index indicates that the country's exports of a particular commodity are higher than the imports of the commodity. Hence this measure indicates the degree of equilibrium between exports and imports of a particular commodity and is a suitable method for comparing the trends over a longer period of time.

III

RESULTS AND DISCUSSION

3.1 *Growth Performance of Agricultural Import and Export*

Total value of India's imports was 431.71 billion in 1990-91 and it increased to the level of Rs.30010.33 billion by the year 2017-18. The contribution of agricultural import to India's total imports was 2.79 per cent during 1990-91 and the share of agricultural imports increased to the level of 5.07 per cent by the year 2017-18. In case of national export, it was Rs.325.27 billion during 1990-91 and it was reached to the level of Rs.19565.15 billion by the year 2017-18. The contribution of agricultural exports indicated a declining trend, i.e., 18.49 per cent in 1990-91 to 12.86 per cent during 2017-18. But in absolute terms, value of agricultural exports was found to have increased.

Total agricultural imports in India was Rs.12.06 billion in 1990-91and it was increased to the level of Rs.1520.95 billion by the year 2017-18 (Figure 1). The growth trend analysis of agricultural import showed a compound growth rate of 16.50 per cent per annum during same period of time. Total value of agricultural export from India was Rs.60.13 billion and it increased to the level of Rs.2515.64 billion by the year 2018-19 and registered a compound growth rate of 13.74 per cent per annum during the same period. The inter-annual variability of the value of agricultural import during 1990-91 to 2017-18 was estimated to be 117.34 and 103.57 per cent.

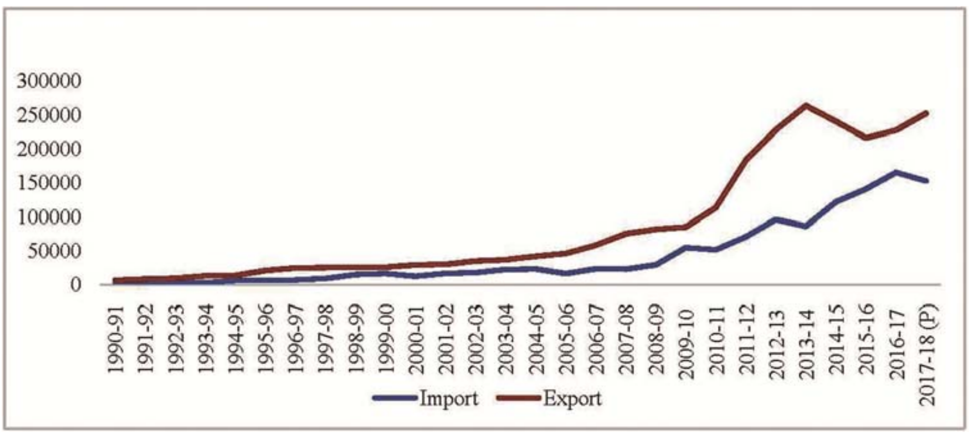

Figure 1. Growth of Agricultural Imports and Exports.

3.2 *Export Performance of Agricultural Commodities*

The export performance of agricultural commodities in terms of growth, instability and trade specialisation coefficient for all the crops/agricultural products was carried out and the results are presented in Table 1 and Table 2 respectively.

TABLE 1. GROWTH AND INSTABILITY OF CROP/PRODUCTS

Groups of commodities (1)	Crops/Product (2)	Growth Export (3)	Growth Import (4)	Instability Export (5)	Instability Import (6)
A. Cereals and Pulses	1. Rice Basmati	20.25*	-	76.26	-
	2. Rice (other than Basmati)	15.25**	38.28*	86.65	120.02
	3. Wheat	13.17	-	154.36	191.28
	4. Other cereals	16.72*	35.35*	86.29	139.95
	5. Pulses	9.45*	17.81*	49.19	79.88
	6. Cereal preparations	15.88*	15.47*	38.30	38.89
B. Oil seeds	1. Sesame seeds	14.03*	33.43	60.06	96.57
	2. Niger seeds	4.03**	-	37.59	142.36
	3. Other oilseeds	30.88*	19.47*	66.03	61.79
	4. Vegetable oils	19.69*	24.14*	50.86	104.67
	5. Oil meals	7.08*	31.25*	58.54	91.48
	6. Castor oil	16.18*	13.31*	65.47	43.94
	7. Groundnut	22.31*	-	78.97	208.16
C. Sugar products	1. Sugar	17.94*	35.97*	69.65	102.53
	2. Molasses	18.05*	11.15	98.26	110.07
D. Fruits and vegetables	1. Fruits and vegetable seeds	16.33*	13.15*	74.25	34.87
	2. Fresh vegetables	15.14*	14.45	61.87	205.16
	3. Processed vegetables	13.24*	2.97	57.57	21.93
	4. Fresh fruits	14.16*	19.27*	64.89	46.62
	5. Processed fruits and juices	17.96*	15.43*	70.62	41.49
E. Plantation crops	1. Cashew	8.13*	14.19*	40.19	67.66
	2. Cashew nut shell liquid	13.52*	19.36	58.52	112.53
	3. Cocoa products	35.54*	15.95*	75.75	38.37
	4. Spices	19.32*	18.42*	72.86	84.26
	5. Tea	9.15*	10.09*	42.05	46.29
	6. Coffee	13.21*	15.83*	56.69	39.21
F. Fibre products	1. Cotton raw incld. Waste	27.04*	11.28*	75.01	84.76
	2. Jute raw	2.67	11.85*	24.34	78.72
	3. Jute hessian	7.14*	-8.39	38.36	40.84
G. Narcotics products	1. Tobacco unmanufactured	13.28*	16.16	53.62	52.67
	2. Tobacco manufactured	16.03*	13.18*	72.78	34.55
H. Other products	3. Guar gam meal	2.18	-0.21	86.37	101.95

*: Significant at 5 per cent level of significance, **: Significant at 10 per cent level of significance.

3.2.1*Cereals and Pulses*

The export of basmati rice was Rs.20.59 billion in 2002-03 and it increased to the level of Rs.268.77 billion by the year 2017-18 registering a compound growth rate of 20.25 per cent per annum during the same period. There was no import of basmati rice during the study period. The inter-annual variation in export of basmati rice was 76.26 per cent during same period of time. Trade Specialisation Coefficient (TSC) which represents the ratio balance between exports and imports indicate positive trend. It was observed that the value of TSC index for basmati rice during the entire period of study was one, indicating that the India's exports of basmati rice was higher than the value of imports.

TABLE 2. TRADE SPECIALISATION CO-EFFICIENT (TSC) FOR CEREALS, PULSES, OILSEEDS AND SUGAR

Crop groups (1)	Name of the crops (2)	2002-03 (3)	2003-04 (4)	2004-05 (5)	2005-06 (6)	2006-07 (7)	2007-08 (8)	2008-09 (9)	2009-10 (10)	2010-11 (11)	2011-12 (12)	2012-13 (13)	2013-14 (14)	2014-15 (15)	2015-16 (16)	2006-17 (17)	2017-18 (18)
A. Cereals	1. Rice Basmati	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
and Pulses	2. Rice (other than Basmati)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	3. Wheat	1.00	1.00	1.00	1.00	0.03	-0.16	-0.16	-0.17	-0.18	-0.11	0.33	0.50	0.56	0.54	0.29	0.24
	4. Other cereals	0.99	0.99	0.99	0.96	0.96	0.97	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.96	0.94	0.92
	5. Pulses	-0.78	-0.76	-0.68	-0.59	-0.61	-0.67	-0.71	-0.77	-0.77	-0.78	-0.79	-0.78	-0.79	-0.81	-0.83	-0.83
	6. Cereal preparations	-	-	-	-	-	-	-	0.69	0.68	0.70	0.71	0.72	0.71	0.71	0.71	0.71
B. Oil seeds	1. Sesame seeds	-	-	-	-	-	-	-	0.99	0.98	0.99	0.95	0.88	0.88	0.88	0.86	0.87
	2. Niger seeds	-	-	-	-	-	-	-	0.95	0.95	0.96	0.96	0.96	0.96	0.89	0.78	0.76
	3. Other oilseeds	-	-	-	-	-	-	-	0.08	0.13	0.23	0.38	0.53	0.61	0.61	0.56	0.55
	4. Vegetable oils	-	-	-	-	-	-	-	-0.98	-0.99	-0.99	-0.99	-0.99	-0.98	-0.98	-0.98	-0.99
	5. Oil meals	-	-	-	-	-	-	-	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.96	0.95
	6. Castor oil	-	-	-	-	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	7. Groundnut	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C. Sugar	1. Sugar	0.96	0.94	0.49	0.37	0.60	0.75	0.76	0.34	0.34	0.46	0.46	0.47	0.44	0.43	0.39	0.34
Products	2. Molasses	-	-	-	-	-	-	-	0.90	0.91	0.92	0.92	0.92	0.89	0.92	0.92	0.88
A. Fruits and	1. Fruits and vegetable seeds	-	-	-	-	-	-	-	0.49	0.28	0.16	0.08	0.05	0.00	-0.03	-0.04	-0.04
Vegetables	2. Fresh vegetables	-	-	-	-	-	-	-	1.00	0.99	0.99	0.99	0.99	0.99	0.97	0.98	0.98
	3. Processed vegetables	-	-	-	-	-	-	-	0.96	0.92	0.90	0.88	0.86	0.86	0.86	0.86	0.86
	4. Fresh fruits	-	-	-	-	-	-	-	0.54	0.26	0.08	-0.05	-0.13	-0.21	-0.26	-0.29	-0.31
	5. Processed fruits and juices	-	-	-	-	-	-	-	0.94	0.90	0.87	0.83	0.82	0.81	0.80	0.79	0.78
B. Plantation	1. Cashew	0.25	0.18	0.17	0.15	0.14	0.14	0.12	0.09	0.09	0.05	0.02	0.02	0.01	-0.03	-0.06	-0.08
Crops	2. Cashew nut shell liquid	-	-	-	-	-	-	-	1.00	1.00	1.00	0.99	0.98	0.93	0.91	0.91	0.89
	3. Cocoa products	-	-	-	-	-	-	-	-0.59	-0.62	-0.65	-0.62	-0.52	-0.45	-0.35	-0.31	-0.28
	4. Spices	0.48	0.47	0.49	0.49	0.53	0.56	0.60	0.60	0.62	0.64	0.65	0.65	0.63	0.61	0.60	0.59
	5. Tea	0.86	0.89	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.87	0.88	0.88	0.87	0.87	0.87	0.87
	6. Coffee	-	-	-	-	-	-	-	0.96	0.93	0.90	0.86	0.84	0.82	0.81	0.79	0.79
A. Fibre	1. Cotton raw incld. waste	-0.92	-0.48	-0.47	-0.04	0.33	0.51	0.47	0.55	0.64	0.72	0.73	0.75	0.73	0.72	0.68	0.64
products	2. Jute, raw	-	-	-	-	-	-	-	-0.88	-0.72	-0.72	-0.69	-0.63	-0.58	-0.57	-0.62	-0.61
	3. Jute hessian	-	-	-	-	-	-	-	0.87	0.82	0.79	0.79	0.80	0.78	0.76	0.78	0.77
B. Narcotics	1. Tobacco unmanufactured	-	-	-	-	-	-	-	0.99	0.99	0.99	0.98	0.98	0.98	0.97	0.97	0.97
products	2. Tobacco manufactured	-	-	-	-	-	-	-	0.95	0.92	0.90	0.87	0.86	0.84	0.84	0.84	0.84
C. Others	3. Guar gam meal	-	-	-	-	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The rice (other than basmati) exports from India was Rs.37.73 billion during 2002-03 and it was augmented to the level of Rs.234.37 billion by the year 2017-18 showing a compound annual growth of 15.25 per cent per annum. The import value of rice (other than basmati) was Rs.0.001 billion during 2002-03 and it reached up to 0.12 billion by the year 2017-18. But the import of other rice was not a common phenomenon in the country and import value was expanding with compound growth rate of 38.28 per cent per annum. The coefficient of variation for import and export of rice (other than basmati) was estimated to be 86.65 and 120.02 per cent respectively. The value of Trade Specialisation Coefficient (TSC) index for rice (other than basmati) during entire period of study was one, which indicates that the India's value of exports of rice was higher than the value of imports.

In 2002-03, the value of wheat exports was Rs.17.60 billion and it was augmenting with compound growth rate of 13.17 per cent per annum, it reached to Rs.105.29 billion in 2012-13 and again it was found declined to Rs.6.25 during 2017-18. The export of wheat was not a common phenomenon and some year it was zero and another year it was Rs.23.58 billion. Very high fluctuation was observed for value of export and import of wheat with 154.36 and 191.28 per cent respectively. The results of TSC index for wheat shows positive value throughout the study period except during 2007-08 to 2011-12. It implies that during 2007-08 to 2011-12, value of wheat export was less than import, whereas during the rest of the period, value of wheat export was more than the value of import.

The export and import value of other cereals was Rs.0.91 and Rs.0.007 billion respectively in 2002-03 and it was increased to Rs.16.04 and 4.34 billion respectively during 2017-18. Growth trend analysis for value of other cereals export and import suggest that it was growing with compound growth rate of 16.72 and 35.35 per cent respectively. The inter-annual variability of value of exports and imports were found to be 49.19 and 79.88 per cent respectively. The positive results of Lafay's (1992) Trade Specialisation Coefficient index value for other cereals was positive and ranged between 0.92 to 0.99. India's exports value of other cereals was higher than the value of imports.

The value of export and import of pulses in India was Rs.3.45 and Rs.27.37 billion respectively in 2002-03 and it accelerated to Rs.14.70 and Rs.187.49 billion respectively by the year 2017-18. The value of import and exports of pulses in the country was expanding with compound growth rate of 9.45 and 17.81 per cent per annum respectively during the study period. Instability for export and import of pulses was found to be 49.19 and 79.88 per cent respectively. Trade Specialisation Coefficient (TSC) showed negative value during the study period for pulses, indicating that the country's export of pulses was less than the imports.

The value of exports and imports of cereal preparation was Rs.10.30 billion and Rs.1.89 billion respectively during 2009-10 and it was augmented to Rs.35.62 billion and Rs.6.60 billion respectively by 2017-18. The growth trend analysis for value of export and import of cereal preparation was found to be 15.88 and 15.47 per cent per annum respectively during same period of time. The coefficient of variation in value of export and import of cereal preparation was estimated to be 38.30 and 38.89 per cent respectively. The results of Lafay's Trade Specialisation Coefficient (TSC) shows positive and highest TSC index for cereal preparation was 0.72 in 2013-14 and did not display negative values indicating that India's export value of cereal preparation was higher than the import value during the study period.

3.2.2 *Oil Seeds*

The export value of sesame seed was Rs.3.73 billion in 2002-03 and it increased to Rs.29.91 billion by the year 2017-18 and registered compound growth rate of 14.03 per cent per annum during the same period. The value of import of sesame seed was Rs.0.53 billion in 2009-10 which increased to Rs.1.77 billion during 2017-18 registering a compound growth rate of 33.43 per cent per annum. The very high fluctuation of instability for value was observed for sesame seed import and export, i.e., 60.06 and 96.57 per cent respectively. Trade Specialisation Coefficient index shows positive trend throughout the study period for sesame seed. The highest TSC index value 0.99 was observed during 2009-10 and 2011-12 and no negative index value was observed. This shows India's export value of sesame seed was higher than the value of import during the study period.

In case of nigerseed, the value of export was Rs.0.78 billion in 2002-03 and it increased to Rs.1.17 billion in 2016-17 and again declined to Rs.0.70 billion. The value of exports indicated with compound growth rate of 4.03 per cent per annum during the same period. Niger seed import in the country was not prominent. The nigerseed was imported in certain years while in some years there were no imports at all. The inter-annual variability in value of export and import was estimated to be 37.59 and 142.36 per cent during the study period. The results of Lafay's Trade Specialisation Coefficient index show positive value for Nigerseed during the study period. The highest positive index value was 0.96. The positive index value indicating that the India's value of exports of Niger seed was higher than the value of imports.

The value of export and import of other oilseeds in the country was Rs.1.39 and Rs.1.18 billion respectively in 2009-10 and it was expanded to Rs.11.26 and 3.65 billion respectively by the year 2017-18. The value of export and import of other oilseeds was expanding with compound growth rate of 30.88 and 19.47 per cent per annum respectively. The coefficient of variation of export and import value of other oilseeds was found to be 66.03 and 61.79 per cent respectively. The results of Lafay's TSC index for other oilseeds depict positive value during the study period. The highest positive TSC index value was 0.61. The positive index value indicated that the India's value of exports of other oilseeds was higher than the value of imports.

The value of export and import of vegetable oils in the country was Rs.1.83 and Rs.223.17 billion respectively in 2009-10 and it was augmented to Rs.5.66 and

2749.96 billion respectively by 2017-18. The value of export and import of vegetable oils was growing with compound growth rate of 19.69 and 24.14 per cent per annum respectively. The instability of value of export and import of vegetable oils was found to be 50.86 and 104.67 per cent respectively. The results of Trade Specialisation Coefficient (TSC) indicate negative value throughout the study period for vegetable oils and no positive value was observed. This implies that the value of vegetable oil export was lower than value of import during the study period.

Export value of oil meals in India was Rs.14.87 billion in 2002-03 and it was increased to Rs.70.43 billion by 2017-18 registering a compound growth rate of 7.08 per cent per annum. Whereas import value of oil meals was Rs.1.05 billion in 2009-10 and it was increased to Rs.7.47 billion by 2017-18 augmenting with compound growth rate of 31.25 per cent per annum. Inter-annual variation in oil meal export and import was found to be 58.54 and 91.48 per cent respectively. Trade Specialisation Coefficient (TSC) index depicts positive value for oil meals during entire period of study and it was highest (1.0) during 2009-10, which represents the ratio balance between exports and imports. It reflects that the value of export for oil meals was higher than the value of import.

Value of castor oil export was Rs.6.10 billion in 2002-03 and it was increased to Rs.67.30 billion by 2017-18 recording a compound growth rate of 16.18 per cent per annum during same period of time. Whereas, import was Rs.0.004 billion in 2009-10 and it expanded to 0.03 billion by 2017-18 registering a compound growth rate of 13.31 per cent per annum. The variability in value of export and import was 65.47 and 43.94 per cent respectively. The highest value of Lafay's (1992) Trade Specialisation Coefficient for castor oil was 1.0 throughout the study period. The positive index value represents that the India's exports value of castor oil was higher than the value of imports.

The growth trend analysis for groundnut export was found to be 22.31 per cent per annum, the value of export was increased from Rs.1.78 billion in 2002-03 to Rs.33.86 billion by 2017-18 while, import of groundnut remain very small and irregular. The instability of export and import was found to be 78.97 and 208.16 per cent respectively. Trade Specialisation Coefficient index for groundnut were found positive 1.0 during the study period. It implies that the India's exports value for groundnut was higher than the value of groundnut import during the study period.

3.2.3 *Sugar Products*

The value of export and import of sugar was Rs.17.70 billion and 0.33 billion respectively in 2002-03 and it was augmented to the level of Rs.52.26 billion and Rs.60.36 billion respectively, depicting compound growth rate of 17.94 and 35.97 per cent per annum respectively. The inter-annual variability in value of sugar export and import was 69.65 and 102.53 per cent respectively. The Lafay's (1992) Trade Specialisation Coefficient (TSC) was carried out to find the trade balance for sugar.

The highest TSC index value for sugar was found to be 0.96 in 2002-03, indicating that the India's exports value of sugar was higher than the value of imports.

The value of molasses export was Rs.0.45 billion in 2002-03 and it was increased to Rs.0.98 billion by 2017-18 recording a compound growth rate of 18.05 per cent per annum during same period of study. Whereas import value of molasses was Rs.0.32 billion in 2009-10 and it expanded to Rs.0.69 billion by 2017-18 registering a compound growth rate of 11.15 per cent per annum. The variability in value of export and import was 98.26 and 110.07 per cent respectively. The highest value of TSC index for molasses was found to be 0.92 and no negative value was observed. This indicates that the India's value of exports of molasses was higher than the value of imports.

3.2.4 *Fruits and Vegetables*

In 2002-03, export value of fruits and vegetables seed was 0.98 billion and it was growing with compound growth rate of 16.33 per cent per annum, it reached to Rs.6.71 billion by 2017-18, while value of import for fruits and vegetable seeds was Rs.2.84 billion and it was increasing with compound growth rate of 13.15 per cent per annum reached to Rs.7.68 billion by 2017-18. The value of export and import instability was found to be 74.25 and 34.87 per cent respectively. The results of Lafay's (1992) TSC index indicate both positive and negative values for fruits and vegetables seed during the study period. These results suggest that during 2009-10 to 2013-14, the value of export was higher than the import value. The export value was equal to import value was observed in 2015-16. During 2015-16 to 2017-18, the TSC index value was negative suggesting the value of export of fruits and vegetable seed export from India was lower than the value of import.

Fresh vegetable export value was 6.43 billion in 2003-04 and it was growing with compound growth rate of 15.14 per cent per annum. It reached to Rs.52.98 billion by 2017-18, while value of imports for fresh vegetable was Rs.0.08 billion in 2009-10 and it was increasing with compound growth rate of 14.45 per cent per annum reached to Rs.0.26 billion by 2017-18. The coefficient of variation in the value of export and import was estimated to be 61.87 and 205.16 per cent respectively. The value of Lafay's (1992) Trade Specialisation Coefficient (TSC) index for fresh vegetables shows positive during study period. The highest value of index was found to be 1.0 with positive sign in 2009-10, suggests that India's exports value for fresh vegetables were higher than the value of imports.

Value of export of processed vegetables was Rs.2.57 billion in 2002-03 and it increased to Rs.18.23 billion by the year 2017-18. The value of export was growing with compound growth rate of 13.24 per cent per annum. Import value of processed vegetables was Rs.0.78 billion in 2009-10 and it augmented to Rs.1.35 billion with compound growth rate of 2.97 per cent per annum. The analysis of inter-annual variability in value of exports and imports was found to be 57.57 and 21.93 per cent respectively. In case of fresh fruits, the Lafay's (1992) TSC index value shows positive throughout the study period and it was highest (0.96) during 2009-10, which represents the ratio balance between exports and imports. The analysis suggests that India's value of exports of processed vegetables was higher than the value of imports.

In 2002-03, export value of fresh fruits was 4.47 billion and it was growing with compound growth rate of 14.16 per cent per annum. It reached to Rs.49.13 billion by 2017-18, while value of import for fresh fruits was Rs.28.43 billion and it was increasing with compound growth rate of 19.27 per cent per annum reached to Rs.125.25 billion by 2017-18. The instability in value of export and import was found to be 64.89 and 46.62 per cent respectively. The Lafay's (1992) Trade Specialisation Coefficient (TSC) for fresh fruits was estimated and it was found both positive and negative values. The results suggests that value of export was lower than the value of import of fresh fruits during 2012-13 to 2017-18, whereas value of import of fresh vegetable was lower than the export value during 2009-10 to 2011-12.

Processed fruits and juices export value was 2.57 billion in 2003-04 and it was growing with compound growth rate of 17.96 per cent per annum. It reached to Rs.41.69 billion by 2017-18, while the value of export for processed fruits and juices was Rs.1.91 billion in 2009-10 and it was increasing with compound growth rate of 15.43 per cent per annum reached to Rs.8.04 billion by 2017-18. The coefficient of variation in the value of export and import was estimated to be 70.62 and 41.49 per cent respectively. Trade Specialisation Coefficient (TSC) showed positive values for processed fruits and juices. The highest TSC index value for processed fruits and juices was observed 0.94 in 2009-10. It indicates that, India's exports value of processed fruits and juices was higher than the value of imports.

3.2.5 *Plantation Crops*

In 2002-03, total value of export and import of cashew was Rs.20.53 and Rs.12.36 billion respectively and it increased to the level of Rs.59.45 and Rs.91.34 billion respectively by 2017-18. The growth trend analysis suggests that value of cashew export and import was expanding with a compound growth rate of 8.13 and 14.19 per cent respectively during the same period of time. The coefficient of variation in value of export and import of cashew was 40.19 and 67.66 per cent respectively. The results of Lafay's Trade Specialisation Coefficient (TSC) indicated both positive and negative sign for cashew. The results suggest that, India's export value for cashew was higher than the import value during 2002-03 to 2014-15. During 2015-16 to 2017-18, the country's export value of cashew was lower than the import value.

In case of cashew nut shell liquid, value of export was 0.09 billion in 2002-03 and it was augmenting with compound growth rate of 13.52 per cent per annum. Its value increased to Rs.0.33 billion during 2017-18. The import of cashew nut shell liquid was very erratic in the country. The value of imports was 0.001 billion in 2010-

11 and it increased to 0.06 billion by the year 2017-18 showing a compound growth rate of 19.36 per cent per annum. The inter-annual variability in value of export and import was found to be 58.52 and 112.53 per cent respectively. The results of TSC shows positive values for cashew nut shell liquid for the study period and highest value was observed for 1.0 during 2009-10. The results indicate that the India's exports of cashew nut shell liquid were higher than its value of import.

In 2009-10, value of export and import of cocoa products was Rs.0.97 and Rs.3.76 billion respectively and it was augmenting with compound growth rate of 35.54 and 15.95 per cent per annum respectively, it reached to the level of Rs.11.44 and Rs.14.73 billion respectively by 2017-18. The instability in value of export and import of cashew was 75.75 and 38.37 per cent respectively. The trade balance analysis for cocoa products was carried out using Lafay's Trade Specialisation Coefficient (TSC) and negative values were obtained for the entire period of study. The results suggest that India's value of exports of cocoa products was lower than the value of imports.

Value of export and import of spices in the country was Rs.16.55 and Rs.5.86 billion in 2002-03 respectively and it was increased to Rs.200.85 and Rs.63.85 billion respectively by 2017-18. The growth trend analysis for spices export and import found that it accelerated with a compound growth rate of 19.32 and 18.42 per cent per annum. The high variability in value of export and import of spices was observed. The Lafay's Trade Specialisation Coefficient was implied to find out the trade balance between export and import for spices and highest TSC value was 0.65. The results of TSC suggest that export value of Indian spices was higher than the import value during the study period.

India's export and import value of tea was Rs.16.52 and Rs.1.25 billion in 2002-03 and it was expanded to Rs.53.97 and 3.57 billion during 2017-18. The compound growth trend for value of export and import of tea was estimated and it expanding with 9.15 and 10.09 per cent respectively. The variability of tea export and import was estimated and it was found to be 42.05 and 46.29 per cent respectively. The results of Lafay's (1992) Trade Specialisation Coefficient (TSC) for tea shows positive and highest TSC index for tea was observed to be 0.89 in 2003-04 and did not display any negative values. The results of TSC suggest that India's export value of tea was more than the import value during the study period.

During 2003-04, the total value of coffee export from India was Rs.9.94 billion and it was increased to the level of Rs.62.45 billion by the year 2017-18 registering a compound growth rate of 13.21 per cent per annum. In 2009-10, total value of coffee import was 2.97 billion and it was enlarging with compound growth rate of 15.83 per cent per annum it reached to the level of Rs.9.97 billion. The instability analysis found that variability in value of export and import was 56.67 and 39.21 per cent respectively. The Lafay's (1992) Trade Specialisation Coefficient (TSC) was used to find out the ratio balance between exports and imports for coffee. The highest TSC index value was found to be 0.96 in 2009-10. It implies that export value of coffee was more than the import value of the coffee during the study period.

3.2.6 *Fibre Products*

In 2002-03, total value of export and import of cotton raw including waste was Rs.0.50 and Rs.12.38 billion respectively and increased to the level of Rs.122.00 and Rs.63.07 billion respectively by 2017-18. The growth trend analysis suggest that value of cotton raw including waste export and import expanded with a compound growth rate of 27.04 and 11.28 per cent respectively during the same period.. The coefficient of variation in value of export and import was 75.01 and 84.76 per cent respectively. The value of TSC for cotton raw including waste was found to be both positive and negative values. The results suggest that, the value of export of cotton raw including waste was lower than the import value during 2002-03 to 2005-06, whereas rest of the study period India's value of export was more than the import value.

In case of jute raw, value of export was 0.54 billion in 2009-10 and it was augmenting with compound growth rate of 2.67 per cent per annum, its value increased to Rs.0.95 billion during 2017-18. The value of import was 1.35 billion in 2002-03 and it was increased to 2.80 billion by the year 2017-18 showing a compound growth rate of 11.85 per cent per annum. The inter-annual variability in value of export and import was found to be 24.34 and 78.72 per cent respectively. The Trade Specialisation Coefficient for jute raw was found negative values for entire period of study. The results suggest that value of raw jute export from India was lower than the import value during the study period.

In 2002-03, value of export of jute hessian was Rs.3.49 and it was augmenting with compound growth rate of 7.14 per cent per annum, it reached to the level of Rs.9.10 billion by 2017-18. Whereas in case of value of jute hessian export was Rs.2.31 billion in 2009-10 and it reached a level of Rs.1.22 billion by 2017-18 registering a compound growth rate of -8.39 per cent per annum. The instability in value of export and import of jute hessian was 38.36 and 40.84 per cent respectively. The TSC results for jute hessian depict positive sign throughout the study period and highest value was observed to be 0.87 during 2009-10. The TSC value indicates that the India's export value of jute hessian was higher than the value of imports.

3.2.7 *Narcotics Products*

Value of export of tobacco unmanufactured in the country was Rs.7.34 and it was increased to Rs.38.28 billion by 2017-18. The growth trend analysis for tobacco unmanufactured value of export was accelerating with a compound growth rate of 13.28 per cent per annum. While, the value of import of tobacco unmanufactured was Rs.0.38 billion in 2009-10 and it was increased to level of Rs.0.69 billion in 2017-18 with compound growth rate of 16.16 per cent per year during same period of time. The variability in value of export and import was found to be 53.62 and 52.67 per cent. The result of TSC value shows positive sign ranging between 0.99 to 0.97 and no negative value was observed during the study period. The results implied that value of export of tobacco unmanufactured was higher than the value of import during the study period.

India’s export value of tobacco manufactured was Rs.2.89 and it was increased to the level of Rs.21.94 billion in 2017-18 recording a compound growth rate of 16.03 per cent per annum. India’s value of import of tobacco manufactured in 2009-10 was Rs.0.79 billion and it was augmented to Rs.1.86 billion by the year 2017-18 with compound growth rate of 13.18 per cent per annum. The variability of tobacco manufactured export and import was estimated and it was found to be 72.78 and 34.55 per cent respectively. The value of all TSC index was found positive during the study period. The value of TSC ranging between 0.95 to 0.84, reflects that export value of tobacco manufacture was more than the value of import during the study period.

3.2.8 *Other Products*

During 2003-04, total value of guar gam meal export and import was Rs.11.33 and Rs.0.02 billion, respectively and it was increased to the level of Rs.41.70 and 0.03 billion respectively by the year 2017-18 registering a compound growth rate of 2.18 and -0.21 per cent per annum respectively. The instability analysis indicated variability in value of export and import to be 86.37 and 101.95 per cent respectively. The Lafay’s (1992) Trade Specialisation Coefficient (TSC) was estimated for the guar gum meal. The value of TSC was found to be 1.0 with positive sign during the study period. The results suggests that the value of export of guar gum meal from India was more than its import value.

3.3 *India’s Spices Export and Its Competitiveness over Time*

India is the world’s largest spice producer, exporter and consumer. India is often called as the home of spices, and the glory of Indian spice products is well known across the globe from ancient times onwards. Being the leader in production and export, India accounts for almost half of the global trading in spices. The value of spices export from India during 2019-20 was Rs.21000 crore, with a record growth of 10 per cent. The major export destinations of Indian spices are China, USA, Bangladesh, UAE and Thailand. The major spices that contribute maximum to the total export of spices from India are chilli, mint products, cumin, spice oils and oleoresins and turmeric. Vietnam, China, Indonesia, Netherlands and Madagascar are the major competitors for India in the global market for spice export.

Though India is the leader, competition from other major producing countries can't be ruled out. It is important to have proper understanding on the competitiveness of India's spice export over time so as to take proper policy measures. Trade competitiveness of export of spices from India was analysed using various indices like Revealed Comparative Advantage (RCA), Trade Specialisation Co-efficient (TSC), Revealed Symmetric Comparative Advantage (RSCA) and Revealed Competitive Advantage (RC). From the results (Table 3) it can be seen that throughout the years spices remained as an efficient export commodity with better competitiveness. RCA values were found to be more than one throughout the years, which indicates that the share of spice export to total agricultural export in India is more than that of Asia's combined data. This clearly shows the high competitiveness of India's spice export. Throughout the years the index values did not see much fluctuation except in few years like 2013 (1.61). It slightly increased in the beginning of the study period, but found slow decline in the later stages. In the most recent year (2018) the value was found to have improved over the previous years' values.

TABLE 3. REVEALED COMPARATIVE ADVANTAGES AND COMPETITIVENESS INDICES OF SPICES

Year (1)	Revealed comparative advantage (RCA) (2)	Trade specification coefficient (TSC) (3)_	Revealed symmetric comparative advantages (RSCA) (4)	Revealed comparative advantage (RC) (5)
1990	2.977700	0.999020	0.497197	2.969313
1991	4.766695	0.999857	0.653181	4.764222
1992	3.738148	0.998358	0.577894	3.724307
1993	4.756691	0.983209	0.652578	4.522405
1994	4.379714	0.997986	0.628233	4.367806
1995	3.417904	0.992061	0.547297	3.364741
1996	2.868971	0.976026	0.483067	2.677072
1997	4.066022	0.994958	0.605213	4.009277
1998	4.647628	0.994460	0.645869	4.599809
1999	4.672405	0.960496	0.647416	4.298509
2000	4.670416	0.987952	0.647292	4.525974
2001	3.905363	0.984400	0.592283	3.788857
2002	4.011184	0.976684	0.600893	3.818757
2003	3.590821	0.936546	0.564348	3.079341
2004	3.172826	0.903434	0.520709	2.559748
2005	3.250592	0.836886	0.529477	1.746039
2006	3.270015	0.843710	0.531618	2.195328
2007	3.431525	0.881358	0.548688	2.222279
2008	4.079266	0.911473	0.606242	2.912708
2009	3.908667	0.848594	0.592557	2.429830
2010	3.680599	0.907589	0.572704	2.350034
2011	3.648641	0.902680	0.569767	2.498573
2012	2.168865	0.917707	0.368859	1.405987
2013	1.610958	0.882137	0.233998	0.381494
2014	2.568403	0.818477	0.439525	1.206500
2015	3.084981	0.789613	0.510402	1.620514
2016	3.452104	0.754435	0.550774	1.736292
2017	3.116034	0.750233	0.514095	1.552994
2018	4.356384	0.685249	0.626614	1.534839

Data source: http://www.fao.org.

Similar results were found from the values of other indices also. TSC values were positive in all the years in the entire study period. Values did not show much fluctuation over the years. But in the most recent years – from 2013 onwards the TSC values were found to be continuously decreasing. RSCA values also were positive throughout the period. Trend in the values were found almost similar to that in the RCA values, indicating favourable competitive scenario for India’s spice export. RC values also were found positive for all the years. But, compared to the values in 990s, RC values were found decreasing from 2000 onwards. Value became even less than one in 2013. Slight unfavourable movement in the balance between export and import of spices in the recent years can be seen from these values. Similar inference can be made from the TSC values also. Policy interventions are therefore needed to better utilise the competitiveness of spice export from India and to improve the export-import balance.

IV

CONCLUSION

The Government of India has been giving several export incentives to promote the agricultural exports, despite the restrictions imposed by the WTO regime and other trade agreements. This includes price measures and non-price measures. The price measures are directed towards enhancing competitiveness at the price front while non-price measures provide competitive edge in areas other than price (Gupta, 2010). These export promotion measures are being directed to the exporters through several institutions and under various Acts (Ahuja, 2001). The export incentives are basically provided by the Ministry of Commerce and Industry through its Directorate General of Foreign Trade and through Ministry of Finance. Growth trend analysis for value of export and import suggests that all the agricultural commodities showed positive growth trend with high inter-annual variability during the study period except for import value of jute hessian and guar gum meal import. The TSC analysis for the analysis suggests that value of export was more than the value of import for all the crops except pulses, vegetable oils, fresh fruits, cashew, cocoa products and raw jute during the study period. In case of pulses, vegetable oils, fresh fruits, cashew, cocoa products and raw jute, value of export is less than value of import during the study period. The values of RCA, TSC, RSCA and RC showed the competitive scenario of India’s spice exports; throughout the study period it was found to maintain its competitive position. However in terms of the balance between export and import of spices there has been a slight deterioration in the recent years. Proper policy interventions are utmost necessary to address this issue.

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Dynamics of Palm Oil Import on Prices, Income and Trade of Indian Edible Oil Sector

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ABSTRACT

The present study aims to capture the implications of palm oil import on the Indian edible oil sector in terms of price, income and international trade. Being the net importer of edible oil over a long period, import tariff simulations on palm oil, which constitute a major share of our import basket on the domestic producer price, consumer price, income of the domestic edible oil processing industry and government revenue were studied under by partial equilibrium setting. The domestic edible oils considered for the study were palm oil, soybean oil, rapeseed and mustard oil, sunflower oil and other major traditional oils viz., coconut oil, groundnut oil and cotton seed oil - categorised as other edible oils. The import of palm oil had significant influence on the domestic edible oil sector indicating the higher substitutability of palm oil owing to its low price and compatibility to blend with domestic edible oils. The variation in domestic production, consumer price, industry income and government revenue were in the same direction as that of tariff and import price of palm oil. Domestic consumers are the major beneficiaries of reduction in tariff and import price of palm oil, while processors benefitted more than the producers of domestic oils from hike in tariff and import price. The import policy must aim at protecting the welfare of all the stakeholder of edible oil sector, viz., producers, processors and consumers.

Keywords: Palm oil imports, Price, Income, Trade effects, Indian edible oil sector.

JEL: F14, F47, F61, Q17

I

INTRODUCTION

India is one of the largest consumers of edible oil in the world with a total domestic consumption of 21.69 million MT in 2019-20. However, the country is not able to meet its raising demand with lower domestic production. The low yield of oilseeds and declining prices of edible oils due to increasing import have made the oilseed production in India highly unattractive resulting in stagnation of oilseed production (Srinivasan, 2005). Though India attained self-sufficiency in production of oilseeds and edible oil in the early 1990s due to Yellow Revolution and Technology Mission on Oilseeds (TMO), the low price of oils in the international market in mid-1990s and liberalisation of trade increased the edible oil imports considerably. In the edible oil complex, edible oils from India were not competitive, while the oil cakes/meals were highly competitive (Reddy *et al*., 2011).

During 1993-94, import of palmolein and subsequently, the import of other edible oils had been placed under Open General Licence (OGL) list. This made a

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drastic change in the import of edible oils, which shifted from negative list of import to one of the most imported commodities in India. As seen from Figure 1, the import duty was high up to 80 per cent on crude oil and 90 per cent on refined oil during early 2000s, which was in 2008 reduced to zero per cent and 7.5 per cent on crude and refined oils, respectively. Thereafter, the import duty was increased and decreased depending on the demand and price situations. By 2018, the Indian government increased the import duty on palm oil to 44 per cent on crude and 54 per cent on refined oil as there was a steep fall in the world prices and domestic prices of the oil. With the ASEAN trade agreement and ASEAN-India Free Trade Agreement (AIFTA), India is bound to reduce tariff on palm oil imports further, as the major source of India's palm oil import is the ASEAN countries – Indonesia and Malaysia.

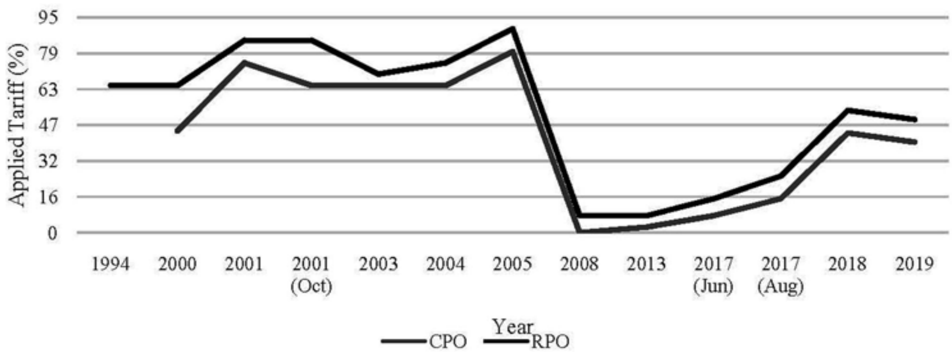

Figure 1. Applied Rate of Import Tariff for Palm Oil to India.

The constant increase in consumption, low productivity of oilseeds and high price of traditional oils in India and low price in international market and liberalisation of trade policies resulted in the shift from self-sufficiency to highly import dependent in edible oils. In 2019-20, India imported nearly 15.08 million MT of vegetable oils out of which palm oil occupied the major share of 59 per cent. Besides the lower price and tariff reduction, compatibility of the palm oil to be blended with other edible oils contributes to the high demand for imported palm oil. There was a drastic increase in the import of palm oil from 2000 MT in 1971 to 165000 MT in 1991 and to 2.7 million MT in 2001 and 9 million MT in 2019.

Owing to the widening price gap between the traditional oils and imported oils, the domestic consumption pattern of edible oil changed considerably over the period. The palm and soybean oils which once contributed less than 4 per cent in the total edible oil consumption emerged to be the major oils consumed in the past decade. Currently, the major edible oils consumed in India are palm oil (40 per cent), soybean oil (22 per cent), sunflower oil (13 per cent) and rapeseed oil (12 per cent).

Being a major importer of edible oil in the world, the domestic edible oil sector of India is highly responsive to the import policies. The price and quantity of imported palm oil has considerable impact on the domestic edible oil prices and consumption. This can be captured in the model for trade policy analysis through estimates of the elasticity of substitution between the imported and domestic goods, i.e., Armington elasticity. These models employ the price and demand shift for the imported goods in determining the impact of trade policies on the prices, demand, trade and profitability of the domestically produced goods. More than the producers of oilseeds, it is the oil processing industry that is highly influenced by the import tariff and price of the palm oil, as the oil is mostly imported in the crude form. Apart from the domestic demand and international price, geopolitics situations bring about dynamics in the import of palm oil in India.

In this regard, an attempt has been made to study (i) the influence of dynamics of palm oil import on the major edible oils consumed in India, viz., domestic palm oil, soybean oil, rapeseed and mustard oil, sunflower oil and other edible oils and (ii)The impact of changes in import tariff and import price of palm oil on the domestic production, price, income of the domestic edible oil industry and government revenue.

II

METHODOLOGY

Data on production, consumption, import, export, demand, supply, prices and import tariff of edible oils were collected from various sources, viz., Index-Mundi, Ministry of Commerce and Industry, Government of India, Central Board of Indirect Taxes and Customs and UN - COMTRADE for the year 2015 and 2019. Data on palm oil imports included both crude and refined form whereas the wholesale price of the edible oil was assumed to be the producer/processor price, while retail price as the consumer price. Based on domestic consumption, palm oil (PO), soybean oil (SO), rapeseed and mustard oil (RO), sunflower oil (SF) were selected for the study (Figure 2). Other major traditional oils, viz., coconut oil, groundnut oil and cotton seed oil were aggregated under the category of other edible oils (EO).

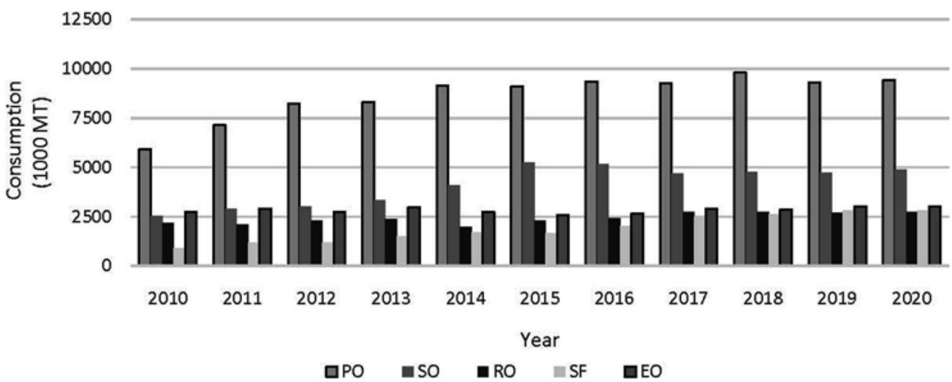

Figure 2. Consumption of Edible Oils in India.

Model-based simulations are suitable for trade policy analysis to project the economic effects of policy changes that have not yet occurred (Hallren and Riker, 2017). In the present study, the influence of import tariff and import price of palm oil and their combined effect on domestic edible oil sector are studied using the partial equilibrium model.

The model assumed perfect substitution between the imported palm oil and domestically produced edible oils. The elasticity of substitution between imported palm oil and domestic edible oils are modelled using Armington elasticity of substitution as incorporated in the model. It represented the elasticity of substitution between the commodities of different countries or regions, and is based on the assumption made that commodities traded internationally are differentiated by country of origin (Armington, 1969).

The simulation-model can be specified as

$$q_d^p = q_{cd}^p + \sigma\, S_m(p_m^p - p_d^p)$$

The superscript 'p' in the model indicates the proportionate change. The proportionate change in the demand for domestic edible oils is represented by q_d^p, whileq_{cd}^pdenotes the proportionate change in the demand for the composite of domestic edible oil and imported palm oil. The share of imported palm oil in consumer expenditure is represented by Sm = 1 - Sd, where Sd is the share of domestic edible oil in expenditure, and the term σ denotes the Armington elasticity of substitution between the imported palm oil and domestically produced oils. The proportionate change in the consumer price of imported palm oil and domestic edible oil is denoted by p_m^p and p_d^prespectively.

The consumer price of imported palm oil is arrived at from world price and the import tax on palm oil import, where import tax is obtained from world price and tariff rate,

$$p_m = PW + MTAX$$
$$MTAX = IP \times MTAR$$

where, p_m - Consumer price of imported palm oil;

PW = World price of palm oil;

IP = Import Prices;

MTAX = Import tariff on palm oil;

MTAR = Applied tariff on palm oil import (percentage)

The model was simulated for the impact of 25 per cent and 50 per cent increase and decrease in the import tariff and also the import price of palm oil on domestic edible oil sector of India.

III

RESULTS AND DISCUSSION

The changes in domestic production, price, income and government revenue indicated the variation from base value which considered all the variables at 2019 level. In 2019, the applied tariff rate was fixed at 44 per cent and 54 per cent for the import of crude and refined palm oil, respectively. As the study has been conducted by aggregating crude and refined oils, the import tariff on palm oil has been taken as an average of the tariff on crude and refined palm oil i.e., 49 per cent. Reduction in tariff by 25 per cent and 50 per cent arrived at the tariff rate of 36.75 per cent and 24.5 per cent respectively, while 25 per cent and 50 per cent increase denoted 61.25 per cent and 73.5 per cent of import tariff that would fall within the WTO's bound tariff rate of 300 per cent.

Impact of Tariff and Import Price of Palm Oil on Domestic Price of Edible Oils

India being the largest importer of palm oil in the world, and imported palm oil occupying major share of its domestic edible oil consumption, any change in the tariff rate and import price is directly reflected in the domestic oil price. As seen from Table 1, reduction and increase in import tariff and price of palm oil has led to reduction and increase in the domestic price of edible oils, respectively. Thus, the changes in import policy and price of palm oil has direct influence on the entire edible oil sector owing to the major share of imported palm oil in edible oil consumption in India and palm oil being highly substituted and blended with other major edible oils. The changes in domestic prices of edible oils due to change in import price of palm oil was more than that of the impact caused by the change

TABLE 1. IMPACT OF TARIFF AND IMPORT PRICE OF PALM OIL ON DOMESTIC PRICE OF EDIBLE OILS

(₹ / *mt*)

Commodity (1)	(2)	PO (3)	SO (4)	RO (5)	SF (6)	EO (7)
Base		71489	82922	109176	102181	128310
Import tariff	25 per cent reduction	63683	73980	97559	90944	116768
	50 per cent reduction	55877	65038	85943	79707	105226
	25 per cent increase	79295	91863	120792	113418	139852
	50 per cent increase	87101	100805	132408	124655	151394
Import price	25 per cent reduction	47752	55731	73852	68011	93213
	50 per cent reduction	24015	28540	38528	33842	58115
	25 per cent increase	95226	110112	144499	136351	163407
	50 per cent increase	118963	137303	179823	170520	198505
Import tariff and price	25 per cent reduction	41897	49024	65140	59584	84556
	50 per cent reduction	16209	19598	26912	22605	46573
	25 per cent increase	104984	121289	159020	150397	177835
	50 per cent increase	142382	164128	214672	204231	233131

Notes: PO – Palm oil, SO – Soybean oil, RO – Rapeseed and Mustard oil, SF – Sunflower oil, EO – Other edible oils.

in tariff rate, while the combined effect of tariff and import price was more than the individual effect (Figure 3). This indicated that trade liberalisation has benefitted the consumers of edible oil by reducing the tariff rate and increasing the import of low-priced oils and any increase in tariff would reduce the consumer surplus as suggested by Ghosh (2009).

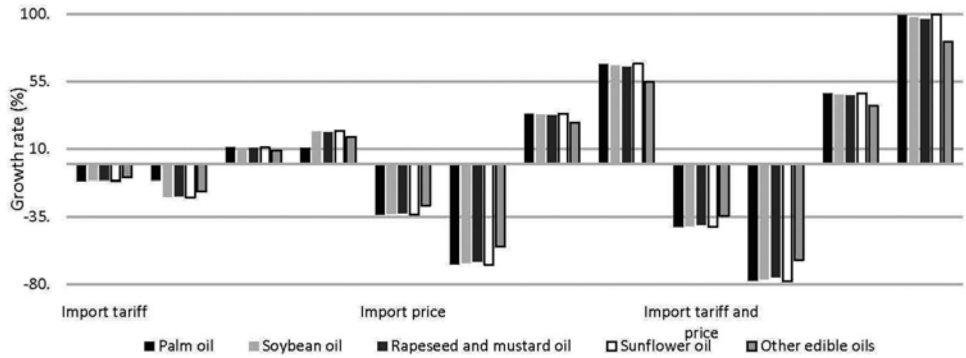

Figure 3.Growth Rate in Domestic Price of Edible Oils.

Effect of Tariff and Import Price of Palm Oil on Domestic Production of Edible Oils

Reduction in import tariff and price of palm oil led to reduction in the edible oil production in India as any reduction in tariff and import price is likely to increase the import of palm oil and in turn make domestic production unattractive. Similarly, when the tariff and import price of palm oil increased, the domestic production of edible oils also increased. This suggests that increase in import tariff and price palm oil benefitted the domestic producers of oilseeds. The changes in the soybean oil and other edible oil production are comparatively more implying that production of soybean oil and other traditional oils are highly influenced by tariff and import price of palm oil.

Compared to domestic price, the changes in domestic production due to change in import price of palm oil was more than that caused by the change in tariff rate and, the combined effect of tariff and import price was more than the individual effects indicated in Table 2. But the changes in production were less than the changes in domestic price of edible oils except for soybean oil and other edible oils (Figure 4). For soybean oil, the changes in domestic production and price are almost on par, while for other edible oils the changes in production was more than the changes in domestic consumer price.

Impact of Tariff and Import Price of Palm Oil on Income of the Edible Oil Industry

The income of the domestic edible oil industry has been computed by multiplying the total domestic consumption by consumer price. Thus, any changes in the consumer price is directly reflected in the industry income and, changes in tariff and

TABLE 2. IMPACT OF TARIFF AND IMPORT PRICE OF PALM OIL ON DOMESTIC PRODUCTION OF EDIBLE OILS

('000 MT)

Commodity (1)	(2)	PO (3)	SO (4)	RO (5)	SF (6)	EO (7)
Base		310	1507	2665	100	3022
Import tariff	25 per cent reduction	289	1348	2445	92	2723
	50 per cent reduction	267	1189	2225	83	2423
	25 per cent increase	331	1666	2885	108	3321
	50 per cent increase	353	1825	3105	117	3621
Import price	25 per cent reduction	245	1023	1996	75	2112
	50 per cent reduction	180	540	1328	49	1202
	25 per cent increase	375	1991	3334	125	3932
	50 per cent increase	440	2474	4002	151	4842
Import tariff and price	25 per cent reduction	229	904	1832	68	1888
	50 per cent reduction	158	381	1108	41	903
	25 per cent increase	402	2189	3608	136	4306
	50 per cent increase	505	2951	4662	176	5740

Note: PO – Palm oil, SO – Soybean oil, RO – Rapeseed and Mustard oil, SF – Sunflower oil, EO – Other edible oils.

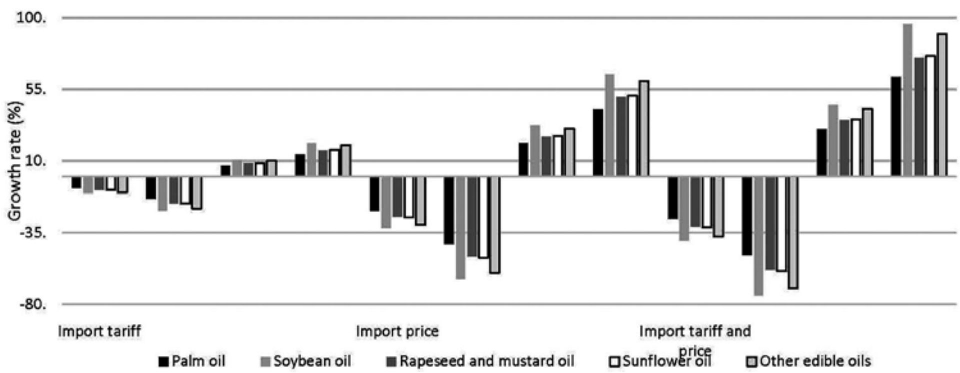

Figure 4. Growth Rate in Domestic Production of Edible Oils.

import price of palm oil have similar effect on income as that on domestic price of edible oils. The income changes in the same direction as that of tariff and import price of palm oil owing to the similar direction of change in domestic price of edible oils as that of tariff and import price of palm oils given in Table 3.

Influence of Tariff and Import Price of Palm Oil on Government Revenue

The government revenue has been estimated by multiplying the total value of imports by the tariff rate and thus, any changes in the tariff and import price of palm oil alters the government revenue proportionately. In Table 4, it is found that the increase in government revenue as a result of combined effect of increase in tariff and import price is more than the decline in revenue due to reduction in tariff and import price.

TABLE 3. IMPACT OF TARIFF AND IMPORT PRICE OF PALM OIL ON INCOME OF EDIBLE OILS FIRM

(₹ *'million*)

Commodity		PO	SO	RO	SF	EO
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Base		665563	390312	295320	286107	388138
Import tariff	25 per cent reduction	592888	348222	263897	254643	353223
	50 per cent reduction	520212	306133	232475	223180	318308
	25 per cent increase	738239	432401	326742	317570	423053
	50 per cent increase	810914	474490	358165	349034	457967
Import price	25 per cent reduction	444571	262325	199769	190432	281968
	50 per cent reduction	223578	134339	104219	94757	175799
	25 per cent increase	886556	518298	390870	381782	494307
	50 per cent increase	1107549	646284	486420	477457	600477
Import tariff and price	25 per cent reduction	390064	230758	176203	166834	255782
	50 per cent reduction	150902	92250	72797	63293	140884
	25 per cent increase	977401	570909	430148	421111	537951
	50 per cent increase	1325576	772552	580688	571847	705221

Note: PO – Palm oil, SO – Soybean oil, RO – Rapeseed and Mustard oil, SF – Sunflower oil, EO – Other edible oils.

TABLE 4. IMPACT OF TARIFF AND IMPORT PRICE OF PALM OIL ON GOVERNMENT REVENUE

(₹ *'million*)

(1)	(2)	(3)
Base		292210
Import tariff	25 per cent reduction	219157
	50 per cent reduction	146105
	25 per cent increase	365262
	50 per cent increase	438315
Import price	25 per cent reduction	219157
	50 per cent reduction	146105
	25 per cent increase	365262
	50 per cent increase	438315
Import tariff and price	25 per cent reduction	164368
	50 per cent reduction	73052
	25 per cent increase	456578
	50 per cent increase	657472

Note: PO – Palm oil, SO – Soybean oil, RO – Rapeseed and Mustard oil, SF – Sunflower oil, EO – Other edible oils.

IV

CONCLUSION

The dynamics of imported palm oil prices and tariffs have significant impact on the domestic edible oil sector of India in terms of price, income, trade and revenue effects on the edible oil stakeholders and institutions. The import dependence on palm oil and its influence revealed that the higher substitutability of palm oil owing to its low price and compatibility to blend with other edible oils of domestic origin. Though the increase in tariff and import price of palm oil benefitted the oil processors, it increased the burden on the consumers by increasing the domestic edible oil price. The processors gain more than the producers of oilseeds in India from tariff and import price hike as they are the direct beneficiaries of increase in consumer price. In order to study the real influence of trade liberalisation and the subsequent edible oil imports, segregation of imported edible oil basket of India in terms of palm oil (crude and refined), soya oil (crude and refined) and sunflower oil under general equilibrium framework is a must.

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Trade Competitiveness and Market Access Issues in India's Coconut and Cashew Nut Trade

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ABSTRACT

The study examines the changing patterns of international trade in coconut and cashew nut (HS 0801) in India at a macro level and analyses their trade competitiveness. It also examines the market access issues like tariff and non-tariff barriers (NTBs) faced by exports in major markets. The study has found that the share of cashew nut has decreased from 1995-2006 to 2007-2018 and it is a matter of concern. The empirical findings on India's comparative advantage in the export of fresh coconut and cashew nut kernels revealed that among the five major competitors, India had a significant comparative advantage over all the four competitors except Thailand in the EU market for fresh coconuts and Vietnam in the EU market (for cashew nut kernels) during both the periods. However, Vietnam and Cote d'Ivoire had a significant comparative advantage over India in the Asia and US market. Tariffs are zero in major importing markets like the US and EU except in Asia where the tariffs are still imposed and found to be high. Among major importing countries, Japan has imposed the highest number of notifications (167 NTMs) on India's total imports since 2003 while US has imposed a total of "123" NTMs and EU have imposed 69 notifications but it has imposed more of TBT measures (29). SPS measures in agricultural goods do not involve technological prowess but it only takes into account consumer health and safety issues which can be harmonized as it is good for trading partners. For TBT measures which are mostly driven by technology, India needs to be careful in following the same approach. Future research should concentrate on the impact of NTMs in depth by taking all the stakeholders into consideration and traceability should be brought under the whole process.

Keywords: Revealed comparative advantage (RCA), Unit price, Tariff, Sanitary and phyto-sanitary (SPS), Technical barriers to trade (TBT) measures.

JEL.: F14, F47, Q02, Q17

I

INTRODUCTION

During 1970s and 1980s, Indian plantation crops attained special prominence because of their export orientation and foreign exchange earnings. Since then the share of plantation sector in the export basket of India has decreased drastically and reached a less than one per cent in recent years (Deepika, 2017: Gulati, 1994). It has lost its market share to low cost producers from Asia, Africa and Latin America (Idris *et al*. 2015). In recent years, the European countries started exporting value added products which is also considered as a threat to plantation commodity exports from India. After WTO formation, the tariff barriers have reduced and trade in value added and high quality products have increased but exports are facing risk in terms of

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meeting the required certifications and also compliance with national and international food safety standards (Aarati *et al.*,2012: Idris *et al.*, 2015: Deepika, 2015). The recent increase in regional trade agreements or bilateral trade agreements has also brought additional challenges in terms of changes in the direction of trade of food products.

In this context, the study examines the changing patterns of international trade in plantation commodities like coconut and cashew nut (HS 0801) in India at a macro level and identifies the key markets and the major competitors for India's four selected plantation commodities – desiccated coconut (HS 080111), fresh coconut (HS 080119), raw cashew nut (HS 080131)and cashew nut kernels (HS 080132) in the major markets, analyses the trade competitiveness, and also examines the market access issues like tariff and non-tariff barriers (NTBs) faced by Indian plantation commodity (HS 801) exports in major markets.

II

DATA AND METHODOLOGY

The study is based on the database published by FAO (www.fao.org/statistics/en), WITS database for data on exports of select plantation commodities from India and other competing countries. Information on domestic trade policies are obtained from documents produced by Ministry of Commerce and Industry, Government of India, and also from the Commodity Boards of India and that of other countries. The data on production and export quantity from FAO collected for 1995 to 2018 period and from WITS database data was collected from 2007 to 2019.

Trade competitiveness is analysed using revealed comparative advantage (RCA) index.

Revealed Comparative Advantage (RCA) Index

RCA was introduced and popularised by Balassa (1965) to identify a country's weak and strong export sectors. The index measures normalised export shares, with respect to the exports of the same industry in a group of reference countries. The revealed comparative advantage (RCA $_{iw}$) is calculated as follows:

$$\text{RCA} = \ln\left[\left(\frac{x_{iA}}{X_A}\right) / \left(\frac{x_{iB}}{X_B}\right)\right]$$

where, x_{iA} and x_{iB} = values of India's exports of product 'i' and rival country's exports of product 'i' to a particular country group

X_A and X_B = India's total merchandise exports and rival country's total merchandise exports to a particular country group.

A positive value of RCA is an indication of country's comparative advantage in a particular commodity against the rival country in a selected market.

The study also examines the market access issues like tariff and non-tariff barriers (NTBs) faced by Indian plantation commodity (HS 0801) exports. Data on tariffs is accessed from the WTO website and non-tariff measures (NTMs) like sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) measures were collected from SPS and TBT measures web portal of the Centre for WTO Studies, Indian Institute of Foreign Trade (IIFT), New Delhi.

III

RESULTS AND DISCUSSION

Changing Pattern in Exports of Coconut and Cashew Nut of India: An Overview

The share of plantation commodities exports to total exports of India decreased from 6 per cent in the 1980s to less than one per cent in recent years. Hence it can be observed from the Table 1 that the share of cashew (both shelled and with shell) has decreased from 1995-2006 to 2007-2018. The fall in the share of Cashew is a matter of concern because India is a leading producer, processor, and exporter of shelled cashew nuts in the world. However, exports of fresh coconut and desiccated coconuts showed impressive growth of 41 and 21 per cent from 1995 to 2018 period. Of these two commodities, cashew is both export and import dependent, while coconut is the least export intensive with 0.3 per cent therefore dependent on the domestic markets (Table 2). India has a prominent place in world production for its plantation commodities, as India ranks 2nd and 3rd in cashew and coconut world production. India is a top exporter of fresh coconuts (4th) and shelled cashew nuts (2nd) with a market share of above 10 per cent in the world market. Desiccated coconut and cashew nut with shell have a very minimal presence in the world market which is also a matter of concern (Table 3).

TABLE 1. COMPOSITION OF COCONUT AND CASHEW NUT EXPORTS AND INDIA'S SHARE IN WORLD EXPORTS

	1995-2006 average (tonnes) and per cent to total exports			2007-2018 average (tonnes) and per cent to total exports			
Commodities (1)	Exports from India (2)	World exports (3)	Per cent (4)	Exports from India (5)	World exports (6)	Per cent (7)	CAGR (1995-2018) per cent (8)
Coconuts, desiccated	294.7	265375.1	0.1	4731.67	357987.58	1.32	41.2
Coconuts	984.4	234984.6	0.4	54175.67	710637.92	7.62	21.1
Cashew nuts, with shell	4252.9	371486.4	1.1	5126.17	1142139.58	0.45	1.2
Cashew nuts, shelled	92670.3	216258.7	42.8	105478.67	452879.75	23.29	2.6

TABLE 2. EXPORTS AND IMPORTS OF COCONUT AND CASHEW NUT TO DOMESTIC PRODUCTION AND SHARE OF INDIA IN WORLD EXPORTS

(*per cent*)

(1)	Exports to domestic Production (1995-2018) (2)	Imports to domestic Production(1995-2018) (3)	India's exports to world Exports (1995-2018) (4)
Coconut	0.3	0.007	2.1
Cashew	17.8	93.5	21.6

TABLE 3. INDIA'S POSITION IN WORLD PRODUCTION AND PRESENCE IN THE MAJOR MARKETS FOR COCONUT AND CASHEWNUT

HS Code	Product	India's share in world production (average of 2014-18)	Per cent	India's position in world exports (average of 2015-19)	Per cent	Presence in major import markets (Nos.) with at least 10 per cent of the share (2015-19)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80111	Coconuts desiccated	11301187 (3rd)	18.5	10th	1.4	3	UAE, Saudi Arabia, and Iran
80119	Fresh Coconuts			4th	14.2	6	USA, UK, UAE, Pakistan, Kuwait and Iran
80131	Cashew nuts, with shell	739985	15.5	10th	0.8	1	Nepal
80132	Cashew nut shelled	(2nd)		2nd	16.3	7	Netherlands, UAE, France, Japan, Belgium, Spain, Saudi Arabia, and South Korea

Average Price Realisation and Direction of India's Exports of Coconut and Cashew Nut

In the case of desiccated coconut, Iran, and UAE but unit price realised is very low and it has experienced better unit price realisation from countries like Kuwait and Egypt (Table 4). Therefore better export opportunities have to be explored in these countries.UAE is the major trading partner of India's fresh coconut but unit price realised was the lowest. The country has experienced better unit price realisation from its neighbouring countries like Afghanistan and Pakistan. Similarly, the Vietnam is the major trading partner of India's cashew nut with shell but the unit price realised was the lowest. Contrary to this it has better price realisation by exporting to Algeria and Nepal. In the case of shelled cashew nut, UAE and USA are the major importers but unit price realisation is low and exports to Japan have experienced better unit price realisation and the highest with 8719 USD per tonne (Table 4).

Competitiveness and Market Access Issues of Coconut and Cashew Nut in Major World Markets: Coconut Desiccated (HS 80111)

India ranks third in the world production of coconut with 18.5 per cent of world production share but has only 1.4 per cent of exports of desiccated coconut and ranks 10th among the world's largest exporters (Table 5). India's exports are concentrated in the Middle Eastern countries and hence its export share among major importers is minimal especially in US, and EU. Philippines, Indonesia, Sri Lanka, and Vietnam are the major competitors for India. Those countries that do not grow coconuts are also among the major exporters, which reflects the amount of value addition and branding that makes a country a major exporter in the world. The RCA index, a measure of trade competitiveness, has shown that in the export of desiccated coconut all the five major competitors had a significant comparative advantage over India in the EU, Asia, and US markets during 2015-19 (Table 7).

TABLE 4. DIRECTION AND PRICE REALISATION OF COCONUT AND CASHEW NUT EXPORTS OF INDIA

Commodity (1)	Country 1 (2)	Country 2 (3)	Country 3 (4)	Country 4 (5)	Country 5 (6)
Coconut desiccated (HS 80111)	Iran	UAE	Saudi Arabia	Egypt	Kuwait
Per cent share in export (2015-19)	22.6	20.1	10.7	5.3	5.2
Unit price realisation (USD/ton) (2019)	2077	659	2100*	2379	2611
Fresh Coconut (HS 80119)	UAE	Pakistan	Iran	Afghanistan	UK
Per cent share in export (2015-19)	25.9	15.2	11.8	8.1	4.3
Unit price realisation (USD/ton) (2019)	759	1720	681	1596	1083
Cashew nut with shell(HS 80131)	Vietnam	Cote d'Ivoire	Nepal	Sri Lanka	Algeria
Per cent share in export (2015-19)	96.31	1.28	0.98	0.61	0.17
Unit price realisation (USD/ton) (2019)	1265	1900*	2333	1625*	9600*
Cashew nut shelled(HS 80132)	UAE	USA	Japan	Saudi Arabia	Netherlands
Per cent share in export (2015-19)	21.39	16.55	9.62	9.18	9.16
Unit price realisation (USD/ton) (2019)	8143	7798	8719	8393	8117

Note: *indicates 2017 prices.

TABLE 5. GLOBAL TRADE AND DIRECTION OF DESICCATED COCONUT TRADE OF INDIA

Major exporting countries (per cent share)		Major importing countries		Per cent share of India among major importers value (Average in 000 $) (per cent)
Country (1)	Value (Average in 000 $) (per cent) (2)	Country (3)	Value (Average in 000 $) (per cent) (4)	(5)
Philippines	245719.7(36.8)	United States	115447.5(15.7)	217.2(0.2)
Indonesia	142190.3(21.3)	Netherlands	54020.5(7.4)	0.1(0)
Sri Lanka	57405.6(8.6)	Germany	43148.1(5.9)	17.4(0)
Vietnam	43743.4(6.55)	United Kingdom	32411.5(4.4)	96.1(0.3)
Netherlands	40242.3(6.03)	Belgium	31058.3(4.2)	14.4(0)
Singapore	31542.1(4.72)	Russian Federation	30128.9(4.1)	7.7(0)
Germany	21361.5(3.2)	Singapore	29003.9(3.9)	6.5(0)
Malaysia	14521.7(2.17)	Canada	28469.2(3.9)	32.2(0.1)
Belgium	14299.3(2.14)	Australia	25612.3(3.5)	30.8(0.1)
India	9612.8(1.44)	Egypt, Arab Rep.	25299.9(3.4)	507.1(2)
Dominican Republic	4965.9(0.74)	Turkey	24831.8(3.4)	90(0.4)
France	4848.1(0.73)	Brazil	24494(3.3)	303.2(1.2)
Cote d'Ivoire	4579(0.69)	France	22306(3)	62.4(0.3)
United Kingdom	3699.9(0.55)	Poland	19429.7(2.6)	127.1(0.7)
United States	3269.9(0.49)	Spain	14782.8(2)	244.7(1.7)
Thailand	2698.4(0.4)	China	13914(1.9)	9(0.1)
Mexico	2660.3(0.4)	Malaysia	11574(1.6)	0.4(0)
Austria	2625.7(0.39)	South Africa	9864.9(1.3)	75.2(0.8)
Czech Republic	1767.7(0.26)	Pakistan	9647.2(1.3)	20.6(0.2)
Poland	1722.6(0.26)	Japan	9510.6(1.3)	93.3(1)

Fresh Coconut (HS 80119): Unlike the exports of desiccated coconut, fresh coconut ranks4thamong the world's largest exporters with a 14 per cent of world exports. It has significant presence in the major importing markets like USA, EU and Middle East countries. However, India is losing position in the world markets for fresh coconut to its major competitors like Indonesia, Thailand, and Vietnam in recent years (Table 6). In the exports of fresh coconut, among the five major competitors, India had a significant comparative advantage over all the four competitors except Thailand in the EU market during 2015-19, whereas in Asia market, India has a comparative advantage over Thailand, Malaysia and Singapore. India has gained a comparative advantage only over Mexico during the 2015-19 period and lost comparative advantage over Vietnam in the 2015-19 period in US market (Table 7).

TABLE 6. GLOBAL TRADE AND DIRECTION OF FRESH COCONUT TRADE OF INDIA

Major exporting countries (per cent share)		Major importing countries (per cent share)		Per cent share of India among major importers
Country (1)	Value (Average in 000 $)(per cent) (2)	Country (3)	Value (Average in 000 $)(per cent) (4)	Value (Average in 000 $) (per cent) (5)
Indonesia	123533.9(27.7)	China	124735.2(28.1)	2074.9(1.7)
Thailand	99433.1(22.3)	Thailand	63018.3(14.2)	0.9(0)
Vietnam	66288.9(14.8)	United States	49671.7(11.2)	2366.2(4.8)
India	64213.9(14.4)	Malaysia	33515.7(7.5)	1874.6(5.6)
Netherlands	15790.2(3.5)	Hong Kong, China	21937.9(4.9)	541(2.5)
Hong Kong, China	11543.4(2.6)	United Kingdom	15939.4(3.6)	2750.4(17.3)
Mexico	9350.8(2.1)	Singapore	14179.7(3.2)	426(3)
Sri Lanka	7200.5(1.6)	Netherlands	13658.3(3.1)	203.2(1.5)
Cote d'Ivoire	6630.7(1.5)	United Arab Emirates	11582.6(2.6)	9473.6 (81.8)
Guyana	5952.8(1.3)	Germany	11262.3(2.5)	36.9(0.3)
Spain	5886.8(1.3)	Canada	8504.7(1.9)	622.9(7.3)
Malaysia	5188.9(1.2)	Australia	7409.6(1.7)	419.5(5.7)
United Kingdom	2806(0.6)	Italy	5861.6(1.3)	170.9(2.9)
United States	2284(0.5)	Spain	4998.9(1.1)	261.6(5.2)
Philippines	2166.4(0.5)	France	4842(1.1)	17.6(0.4)
France	2140.4(0.5)	Russian Federation	3508.7(0.8)	70(2)
Belgium	1952.9(0.4)	Saudi Arabia	3413.3(0.8)	1257.8(36.9)
Singapore	1738.1(0.4)	Pakistan	3252.2(0.7)	973.2(29.9)
Nigeria	1669.5(0.4)	Kuwait	2618(0.6)	991.1(37.9)
Germany	1461.4(0.3)	Belgium	2591.2(0.6)	93.2(3.6)

Cashew Nut with Shell/Raw Cashew Nut (HS 80131)

India ranks second in the world production of cashew nuts having 15.5 per cent of share of world production and but exports are 0.8 per cent (10th largest exporter). India is also the second largest importer of raw cashew nut mainly from West African countries like Tanzania and Ghana the two largest exporters of the world for further processing and re-exports. India has significant presence only in Nepal and in major importer like Vietnam has only a minor and negligible presence (Table 8). In the export of raw cashew nut, all the five major competitors had a significant comparative advantage over India in the EU, Asia, and USA markets during 2015-19. However, it can be observed that India had lost comparative advantage over the Netherlands and Italy in the EU market from 2010-14 to the 2015-19 period (Table 10).

TABLE 7. INDIA'S REVEALED COMPARATIVE ADVANTAGE INDICES OF DESICCATED AND FRESH COCONUT CONCERNING ITS COMPETITORS IN DIFFERENT MARKETS

Competitors	RCA index 2010-14	RCA index 2015-19	Competitors	RCA index 2010-14	RCA index 2015-19
(1)	(2)	(3)	(4)	(5)	(6)
Exports of desiccated coconut to EU 27			Exports of fresh coconuts to EU 27		
Philippines	NA	-6.8	Netherlands	0.1	0.8
Indonesia	-6.6	-5.5	Thailand	-0.2	-1.3
Netherlands	-3.4	-2.2	Spain	0.4	1.0
Germany	-1.8	-0.7	United Kingdom	1.5	1.8
Belgium	-3.4	-1.4	France	2.7	2.3
Exports of desiccated coconut to Asia			Exports of fresh coconuts to Asia		
Indonesia	-2.2	-2.2	Indonesia	-0.4	-0.2
Philippines	NA	-3.04	Vietnam	-3.3	-0.1
Sri Lanka	-6.2	-5.34	Thailand	1.9	0.3
Vietnam	-4.0	-1.06	Malaysia	1.8	2.44
Malaysia	-0.1	-0.24	Singapore	2.3	2.91
Exports of desiccated coconut to US			Exports of fresh coconuts to US		
Philippines	NA	-7.5	Thailand	-3.6	-3.43
Sri Lanka	-7.1	-7.2	Mexico	-0.4	0.10
Dominican Republic	-5.9	-5.5	Vietnam	0.1	-0.34
Mexico	-1.2	-0.6	Philippines	NA	-2.00
Vietnam	-1.9	-1.9	Spain	10.3	-0.93

TABLE 8. GLOBAL TRADE AND DIRECTION OF RAW CASHEW NUT TRADE OF INDIA

Major exporting countries (per cent share)		Major importing countries		Per cent share of India among major importers
Country	Value (Average in 000 $) (per cent)	Country	Value (Average in 000 $) (per cent)	Value (Average in 000 $) (per cent)
(1)	(2)	(3)	(4)	(5)
Cote d'Ivoire	867030.6(44)	Vietnam	1764737(54.5)	15987.8(0.91)
Ghana	439540.3(22.3)	India	1404087.7(43.4)	NA
Tanzania	221236.3(11.2)	Brazil	18567.9(0.6)	0(0)
Indonesia	107297.7(5.4)	Saudi Arabia	13298.4(0.4)	0.6(0)
Burkina Faso	105806.6(5.4)	China	5183(0.2)	0 (0)
Benin	76112.8(3.9)	Belgium	4590.4(0.1)	0(0)
Nigeria	57422.6(2.9)	Afghanistan	2972.7(0.1)	0(0)
Senegal	21362.5(1.1)	Indonesia	2692.4(0.1)	0(0)
Netherlands	18324.4(0.9)	Canada	2423.1(0.1)	1.3(0.1)
India	16600.3(0.8)	Sri Lanka	2309.8(0.1)	101(4.4)
Mozambique	12392.6(0.6)	United Kingdom	1848.5(0.1)	0.1 (0.01)
Myanmar	5162.3(0.3)	United States	1688.2(0.1)	9.7(0.6)
Togo	4562.9(0.2)	Singapore	1244.3(0.04)	20.4(1.6)
Guinea	3384.3(0.2)	Belarus	1181(0.04)	0(0)
Thailand	2716.7(0.1)	South Africa	922.3(0.03)	0(0)
Madagascar	1772(0.1)	Nepal	793(0.02)	162.8(20.5)
Gambia, The	1756.2(0.1)	Spain	615.6(0.02)	0(0)
Mali	1743.5(0.1)	Malaysia	580.7(0.02)	1.7(0.3)
Vietnam	1269.9(0.1)	Netherlands	576.4(0.02)	0(0)
United States	1246.1(0.1)	Bahrain	556.4(0.02)	0(0)

Cashew Nut Shelled/ Cashew Nut Kernels (HS 80132)

Unlike the exports of raw cashew nut, cashew nut kernels exports are the 2nd largest exporter in the world with 16.3 per cent of the total world exports. More than 80 per cent of cashew nut produced is consumed within and only 18 per cent of the produce is currently exported. India has presence in major import markets like USA, EU and UAE. European countries like Germany and Netherlands are the re-exporters of the commodity (Table 9). In the exports of cashew nut kernels or shelled cashew nuts, the country has depicted comparative advantage over all the four major competitors except Vietnam in the EU market during both the periods. However, Vietnam and Cote d'Ivoire had a significant comparative advantage over India in the Asia market. In the US market, again Vietnam and Cote d'Ivoire had a significant comparative advantage over its main competitors like India, Brazil, and Thailand. However, India lost a comparative advantage over Indonesia from 2010-14 to the 2015-19 period in the US market (Table 10).

TABLE 9. GLOBAL TRADE AND DIRECTION OF CASHEW NUT KERNELS TRADE OF INDIA

Major exporting countries (per cent share)		Major importing countries (per cent share)		Per cent share of India among major importers
Country (1)	Value (Average in 000 $) (per cent) (2)	Country (3)	Value (Average in 000 $) (per cent) (4)	Value (Average in 000 $) (per cent) (5)
Vietnam	2900755.2(64)	United States	1329689.6(32.7)	122659.5(9.2)
India	741367.8(16.3)	Germany	450699.1(11.1)	24050.1(5.3)
Netherlands	263020.7(5.8)	Netherlands	360800(8.9)	67909.9(18.8)
Germany	151757.2(3.3)	United Kingdom	184777.5(4.5)	14386.8(7.8)
Brazil	116733.3(2.6)	UAE	160889.5(3.3)	14386.8(98.6)
Cote d'Ivoire	67114(1.5)	Australia	129760.7(3.2)	1329.8(1)
Indonesia	58205.2(1.3)	Canada	113310.2(2.8)	3870(3.4)
Belgium	49060.8(1.1)	France	104132.9(2.6)	18080.2(17.4)
Ghana	39287.4(0.9)	Japan	91412.3(2.3)	71303.7(78)
United Kingdom	18453.1(0.4)	Belgium	91079.8(2.2)	20964.3(23)
Italy	11194.9(0.2)	Thailand	75091.1(1.8)	38(0.1)
Thailand	11069.3(0.2)	Vietnam	64777.6(1.6)	2742.8(4.2)
Singapore	8591.9(0.2)	Spain	62538.2(1.5)	25607.6(40.9)
Myanmar	7755.6(0.2)	Italy	61756.9(1.5)	4146.4(6.7)
Lithuania	7585.2(0.2)	Saudi Arabia	51481(0.8)	2870.6(89.6)
United States	7569.9(0.2)	Russian Federation	49577.8(1.2)	1322.6(2.7)
Burkina Faso	7331.4(0.2)	Poland	45235.4(1.1)	2870.6(6.3)
Nigeria	6877.2(0.2)	China	39279.5(1)	396.1(1)
Tanzania	6788.9(0.1)	Israel	36638.4(0.9)	3620.5(9.9)
Austria	6690.7(0.1)	India	35595.2(0.9)	0(0)

Market Access Issues (Tariff and NTMs):

Tariffs are zero in major importing markets like USA and EU except in Asia where the tariffs are still imposed (Table 11). The plantation commodities in raw form from the less developed countries were allowed free access to the markets of the developed countries but if the exporting countries are attempting to upgrade their

TABLE 10. INDIA'S REVEALED COMPARATIVE ADVANTAGE INDICES OF RAW CASHEW NUT WITH RESPECT TO ITS COMPETITORS IN DIFFERENT MARKETS

Competitors	RCA index		Competitors	RCA index	
	2010-14	2015-19		2010-14	2015-19
(1)	(2)	(3)	(4)	(5)	(6)
Exports of raw cashew nut to EU 27			Exports of Cashew nut kernels to EU 27		
Burkina Faso	-8.7	-11.1	Vietnam	-1.5	-1.8
Ghana	-5.7	-9.0	Netherlands	2.3	1.1
Netherlands	0.8	-3.4	Germany	2.8	2.8
United Kingdom	-2.0	-2.6	Belgium	3.4	2.1
Italy	0.7	-1.6	Brazil	2.0	1.0
Exports of raw cashew nut to Asia			Exports of Cashew nut kernels to Asia		
Cote d'Ivoire	-8.6	-2.2	Vietnam	-3.6	-0.9
Ghana	-7.2	-3.04	Cote d'Ivoire	-4.7	-4.0
Tanzania	-7.7	-5.34	Indonesia	5.9	2.4
Indonesia	-2.1	-1.06	Ghana	0.1	0.3
Burkina Faso	-7.1	-0.24	Singapore	2.5	3.9
Exports of raw cashew nut to US			Exports of Cashew nut kernels to US		
Ghana	-10.2	-7.5	Vietnam	-1.2	-2.1
Indonesia	-4.1	-7.2	Brazil	0.6	0.3
Mexico	-1.0	-5.5	Indonesia	0.1	-0.2
Nigeria	-5.5	-0.6	Cote d'Ivoire	-0.3	-2.2
Vietnam	-1.8	-1.9	Thailand	2.7	1.4

TABLE 11. TARIFF RATES IMPOSED BY MAJOR IMPORTERS ON COCONUT AND CASHEW NUT PRODUCTS FOR THE YEAR 2019

Competitor/Importer/ products	European Union				Asia				United States (US)			
	DC	FC	RCN	CNK	DC	FC	RCN	CNK	DC	FC	RCN	CNK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Belgium	0	0	0	0	0	5	30	5	0	0	0	0
Brazil	0	0	0	0	22.5	17.5	2.5	5	0	0	0	0
Burkina Faso	0	0	0	0	0	NA	30	5	0	0	0	0
Cote d'Ivoire	0	0	0	0	5	8.8	21.2	10	0	0	0	0
Dominican Republic	0	0	0	0	5	5	NA	NA	0	0	0	0
France	0	0	0	0	3.6	5	0	9	0	0	0	0
Germany	0	0	0	0	2.5	4	2.5	8.6	0	0	0	0
Ghana	0	0	0	0	4	5	17.5	5	0	0	0	0
India	0	0	0	0	6.6	12.1	9.5	6.5	0	0	0	0
Indonesia	0	0	0	0	8.4	11.9	17	7.2	0	0	0	0
Italy	0	0	0	0	23	5	0	10	0	0	0	0
Malaysia	0	0	0	0	10.4	3.6	18.3	6	0	0	0	0
Mexico	0	0	0	0	0	3	0	NA	0	0	0	0
Netherlands	0	0	0	0	0	4.3	1.7	10.8	0	0	0	0
Nigeria	0	0	0	0	0	7	12.7	10.7	0	0	0	0
Philippines	0	0	0	0	8.4	10.7	0	1.7	0	0	0	0
Singapore	0	0	0	0	21	11.7	14.4	14	0	0	0	0
Spain	0	0	0	0	3.3	3.7	0	10	0	0	0	0
Sri Lanka	0	0	0	0	12.9	15.9	12.5	7	0	0	0	0
Tanzania	0	0	0	0	NA	5	21.7	12.1	0	0	0	0
Thailand	0	0	0	0	13.8	9.67	1.7	9.7	0	0	0	0
United Kingdom	0	0	0	0	8.6	11	13	5	0	0	0	0
Vietnam	0	0	0	0	14	12	10.9	7.7	0	0	0	0

Note: DC-desiccated coconut: FC-fresh coconut: RCN-raw cashew nut: CNK-cashew nut kernel.

position in the value addition chains, they regularly face tariff escalations from developed countries markets (Yeats, 1979). After the formation of WTO and Agreement on Agriculture, the tariff as a trade barrier has lost its importance but there is proliferation of NTMs in developed countries. The non-tariff barriers (NTBs) or Non-tariff measures (NTMs) refer to those measures not related to a tariff. The terms non-tariff barriers (NTBs) or non-tariff measures are usually used interchangeably. Among major importing countries, Japan has imposed the highest number of notifications (167 NTMs) on India’s total imports since 2003 while USA has imposed a total of “123” NTMs and EU has imposed 69 notifications but it has imposed more of TBT measures (29) (Table 12). Majority of the SPS measures are imposed with an objective of food safety and plant protection by major trading partners and TBT measures were imposed with an objective of human health and safety, consumer protection, and technical regulation (Tables 13 and 14), these results are in consonance with Kallummal (2012). SPS measures in agricultural goods do not

TABLE 12. NUMBER OF NON-TARIFF MEASURES (NTMS) IMPOSED BY DIFFERENT COUNTRIES ON COCONUT AND CASHEW NUT EXPORTS OF INDIA FROM 2003 TO 2018

	SPS	TBT	Total
(1)	(2)	(3)	(4)
European Union	40(58)	29(42)	69
GCC Countries	4(67)	2(33)	6
Japan	158(95)	9(5)	167
Singapore	2(67)	1(33)	3
Sri Lanka	3(100)	0(0)	3
United States	103(84)	20(16)	123
Vietnam	21(91)	2(9)	23

Note: Figures in parentheses indicate percentage to the total.

TABLE 13. NUMBER OF SPS MEASURES IMPOSED BY DIFFERENT COUNTRIES ON COCONUT AND CASHEW NUT EXPORTS OF INDIA FROM 2003 TO 2018

Country/SPS measure	Number of notification from 2003 to 2018
(1)	(2)
European Union	40
Food safety	35
Plant protection	5
GCC Countries	4
Food safety	4
Japan	158
Food safety	150
Plant protection	8
Singapore	2
Food safety	2
Sri Lanka	3
Food safety	2
Plant protection	1
United States	103
Food safety	85
Plant protection	18
Vietnam	21
Food safety	11
Plant protection	10

TABLE 14. NUMBER OF TBT MEASURES IMPOSED BY DIFFERENT COUNTRIES ON COCONUT AND CASHEW NUT EXPORTS OF INDIA FROM 2003 TO 2018

Country/TBT measure (1)	Number of notification from 2003 to 2018 (2)
European Union	29
Conformity assessment procedures	1
Consumer and environmental protection	1
Consumer protection	2
Food safety	2
Harmonisation with International standards	1
Human health	2
Human health and safety	11
Labelling	1
Quality standards	2
Regulating market	1
Technical regulations/standards	5
GCC Countries	2
Consumer protection	1
Food safety	1
Japan	9
Consumer protection	2
Consumer protection and harmonisation with international standards	1
Consumer protection and Safety	3
Human Health and safety	1
Labelling	1
Technical regulations/standards	1
Singapore	1
Human health	1
United States	20
Consumer protection	7
Consumer protection and human health	1
Environmental protection	2
Human health and safety	10
Vietnam	2
Food safety	1
Human health and safety	1

involve technological prowess but it only takes into account consumer health and safety issues which can be harmonised as it is good for trading partners. For TBT measures which are mostly driven by technology, India needs to be careful in following the same approach. Future research should concentrate on the impact of NTMs in depth by taking all the stakeholders into consideration and traceability should be brought under the whole process.

IV

CONCLUSION

India ranks third in the world production of coconut with 18.5 per cent of world production share but has only 1.4 per cent of exports of desiccated coconut and ranks tenth among the world's largest exporters and exports of fresh coconut ranks fourth among the world's largest exporters with a 14 per cent of world exports. India ranks second in the world production of cashew nuts having 15.5 per cent of the share of world production and but exports are 0.8 per cent (10th largest exporter). India has a significant presence in the major importing markets like US, EU and Middle East countries for fresh coconut and cashew nut kernels. However, India is losing position in the world markets for fresh coconut to its major competitors like Indonesia, Thailand, and Vietnam in recent years. The product-wise analysis of coconut and cashew nut export has shown that India's major importing partners for most of the products are the neighbouring countries, like Asian and Middle East countries. The unit price realisation from these product exports to these countries has been found much lower as compared to the European countries, the US and UAE.

The empirical findings on India's comparative advantage in the export of coconut and cashew nut to selected markets reveal that for fresh coconut, among the five major competitors, India had a significant comparative advantage over all the four competitors except Thailand in the EU market during 2015-19. In the Asia market, India has a comparative advantage over Thailand, Malaysia, and Singapore. India has gained a comparative advantage only over Mexico during the 2015-19 period and lost comparative advantage over Vietnam in the 2015-19 period in the US market. In the exports of cashew nut kernels, the country has depicted comparative advantage over all the four major competitors except Vietnam in the EU market during both the periods. However, Vietnam and Cote d'Ivoire had a significant comparative advantage over India in the Asia and US market. India lost a comparative advantage over Indonesia from 2010-14 to the 2015-19 period in the US market. Tariffs are zero in the major importing markets like the US and EU except in Asia where the tariffs are still imposed and found to be high. Among major importing countries, Japan has imposed the highest number of notifications (167 NTMs) on India's total imports since 2003 while the US has imposed a total of "123" NTMs and EU have imposed 69 notifications but it has imposed more of TBT measures (29). SPS measures in agricultural goods do not involve technological prowess but it only takes into account consumer health and safety issues which can be harmonised as it is good for trading partners. For TBT measures which are mostly driven by technology, India needs to be careful in following the same approach. There is a need of higher investment to develop infrastructure for testing and certification in terms of international standards. Future research should concentrate on the impact of NTMs in depth by taking all the stakeholders into consideration and traceability should be brought under the whole process.

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Summaries

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Are the Indian Arabica and Robusta Coffee Prices Cointegrated? A Vector Error Correction Approach

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The study attempts to examine whether the prices of Arabica and Robusta coffee are in long run equilibrium as a result of 1990s market liberalisation policies of Government of India. The prices paid to the growers are flat in this decade and at the present level of growth, consumption would overtake production by 2050. Thus the paper aims to investigate the seasonality, cointegration, transmission and speed of adjustment of prices to shocks in the post-liberalisation period. Johansen's cointegration tests, Granger causality tests and Vector error correction method (VECM) are employed for the analysis. Secondary data for the period 1990-2018 is collected from International Coffee Organization and Coffee Board databases. The results indicated that storing of produce would generate a maximum return of around 7 per cent in Robusta. Cointegration and causality estimates revealed that the Arabica and Robusta prices were cointegrated and Robust a prices affected Arabica prices. The price shocks as a result of high variation in production (10 per cent)and price from Robusta markets transmits to Arabica markets. VECM estimates suggested that Arabica prices adjusted 18 per cent and 5 per cent to converge towards long run equilibrium. Thus, the market liberalisation has borne positive results in terms of market integration and price transmission, however there is lot of scope to make markets more efficient as the speed of adjustment is still low. Policies to ensure remunerative and stable prices will ensure the growth of coffee industry in India and prevent the country from becoming a net importer by 2050.

Free Trade Agreements and Malabar Pepper

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The states of Kerala, Karnataka, and Tamil Nadu account for a major share in the area and production of Malabar pepper. In the recent years, the economic integration through free trade agreements facilitates cheaper imports because of the preferential trade duty concessions extended to the trading partners on agreed trade items. This paper discusses the recent scenario in production, imports and exports of pepper in India in general and particularly with Sri Lanka and Vietnam. Vietnam with a huge

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production capacity is exporting directly and through Sri Lanka, taking advantage of the preferential tariff rates. The study relies on both primary and secondary data. For the purpose primary survey was conducted among pepper cultivators during December 2018 in Idukki district of Kerala, one of the major production areas of Malabar pepper. Besides the secondary in order to check the cheaper imports data was compiled by the Spices Board of India and the International Pepper Community (IPC) and analysed using compound annual growth rates and linear regression analysis. As the imports are rising at a faster rate than the production and exports, it could lead to farmers moving away from cultivation of the famous Malabar pepper. The results of the study indicate that India has been losing its competitiveness in pepper trade due to volatile prices, imports and the falling productivity. Pests and natural factors contribute to the woes of farmers. New varieties of pepper vines would help in increasing production and productivity. On the trade front, the concessional duties offered to Sri Lanka are allegedly facilitating imports from Vietnam, where productivity is the highest and the domestic consumption is least in comparison with other producing countries. The government should therefore review the tariff rates of pepper with the trading partners. As the imports are rising at a faster rate than the production and exports, it could lead to farmers moving away from cultivation of the famous Malabar pepper.

Trade Performance of Plantation Commodities in India – Markov Chain Approach

M. Areef*, **Y. Radha**** **and S. Rajeswari*****

An attempt has been made to analyse the growth rates and instability indices of area, production, yield and exports of three selected plantation commodities, namely cashew, coffee and tea from India to major importing countries. The secondary time series data on area, production, yield and export value of selected plantation commodities are collected for the period 1995-96 to 2018-19 from various reports of Directorate of Economics and Statistics, Agricultural Statistics at a Glance, Horticultural Statistics at a Glance, Agricultural Research Data Books, RBI Annual reports and India stat website. Markov chain analysis was employed to analyse the direction of trade of cashew, coffee and tea for the time period. The results of the study exhibited positive and significant growth rates in terms of area, production, yield and export shares of selected commodities for the selected reference period but registered a decline in the percentage share of plantation commodities in the agricultural export and the total exports of India. The most stable importers of cashew commodity are Saudi Arabia and U.S.A, for coffee Russia followed by U.S.A, for tea Russia and Iran. In India, there is a need to take measures to retain the market share

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in the unstable importers like Japan, Netherlands, Belgium, Germany, Italy and U.K, focus on branding and exploring global markets for plantation commodities, globalisation of agricultural trade and production of export-oriented crops.

Export of Major Spices from India: Growth and Stability Analysis

Deepika Joshi and H.P. Singh†

India has monopolised its position in the production and export of spices for a very long period but due to increase in demand for spices in Europe and North America, due to change in consumer taste and preferences for spices, the situation is fast changing and new destinations are fast sprouting and now, India is facing extreme competition from many spices producing countries. In this context it becomes imperative to analyse the growth, stability and retention of export of spices from India. For the purpose of the export trends were calculated for 21 years from 1993-94 to 2013-14 for seven spices which were further divided into two sub-periods, viz. 1993-94 to 2002-03 and 2003-04 to 2013-14 to find out whether growth in export (quantity and value terms) has shown any change. The pattern of trade in major spices suggests that very few markets have retained their share in export and have maintained their loyalty with the country. These markets are Canada, maintaining its share for black pepper, UK for chilli, Bangladesh for turmeric, UAE for cumin and Malaysia for coriander. India is likely to lose most of its export share of black pepper to Germany and USA, Chilli to Bangladesh, turmeric to UAE and UK, cumin to Japan, Nepal and Malaysia and coriander to Singapore and UK. There is a need to explore new markets along with maintaining the share in traditional markets also. With increase in the competitiveness and various new regulatory scenarios across the major export destination economies, it becomes pertinent to bring sharp changes in policy and planning for the development process in spices export sector.

Trends in Production and Trade of Bamboo and Its Products in North Eastern India using Markov Chain Analysis

Jeemoni Gogoi*, **Ram Singh**** **and A. Boopathi Raja*****

Bamboo is the fastest growing plant and worldwide more than two billion people depend on it for their livelihood as well as for other need. Value-added bamboo has

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the potential share in environment and economy. Its trade has played a vital role in uplift of socio-economic status of rural communities globally. Secondary data on export of different bamboo products were collected for ten years (2009 to 2018). Trend analysis, Instability index and Markov chain analysis were applied for drawing logical inferences of the study. The results revealed that, there was an incremental trend in area, production and productivity of bamboo resources in the country. The export was also recorded in increasing trend of 8.59 per cent, although the growth in import of bamboo was recorded twice of the export value. India is a net importer of bamboo products and value added bamboo products contributed more to the total share to external trade. The transitional probability matrix indicated that New Zealand was the stable importer of bamboo shoots with retention capacity of 72 per cent, USA (63 per cent) for bamboo-made seats and Netherlands (76 per cent) for bamboo mats. Other countries considered were also importers of these products from India. Hence, the export potential must be tapped by engaging unemployed youth for producing value added bamboo products. There is need for commercial knowledge and training for new tools, designs and market-oriented products needs tobe provided to potential stakeholders engaged in bamboo business.

Production Scenario and Performance of Indian Spices Trade – An Economic Analysis

Vinayak S. Hosamani and C.M. Thyagaraj[†]

The study aims to analyse the production scenario and performance of Indian spices trade to provide a basis for policy formulation. The specific objectives of the study are (1) To analyse the production scenario of Indian spices. (2) To estimate growth and instability in export of spices from India. (3) To estimate growth and instability in import of spices from India and (4) To suggest appropriate policy measures. Based on secondary data the production and trade scenarios were estimated using percentages to indicate the quantum of production and trade in the country. To estimate growth and instability in export and imports of spices from India, time series data was collected from the Spice Board and Indiastat.com website. The percent change in production was found to be the highest for coriander with 36.68 percent followed by pepper, fenugreek, cardamom, chillies and ginger. As far as the exports are concerned Vietnam emerged to be importing majority of the spices from India with 10.78 per cent followed by Indonesia, U.S.A., Malaysia, U.A.E, United Kingdom and Saudi Arabia. However India imported the spices mainly from Nigeria to the extent of 18.00 per cent followed by Afghanistan, Indonesia, Burma, Nepal, Pakistan, Vietnam, Ethiopia, China, France and Turkey. Poor soil fertility, use of low level of inputs like manures, fertilisers and crop protection measures, high labour cost

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and crop loss due to diseases, lack of resistant varieties and post-harvest losses are the major reasons for the low productivity. The serious problems faced by the Indian spices in the international market are the high cost of the product and high level of microbial contaminants including myco-toxin in the finished product. Considerable efforts are therefore required to improve the present post-harvest processing and storage systems and in educating the farmers and traders in handling/process the produce hygienically and promotion of spices in consumer packs, ethnic foods or ethnic medicine would boost up production. Suitable steps and policy measures have to be designed by the stake holders to increase the trade of Spices with other countries.

To What Extent Non–Tariff Measures Affect Exports of Indian Beverages?

M. Uma Gowri*

The study attempts to analyse the impact of non-tariff measures on the domestic and export prices of Beverages like tea and coffee and the loss in revenue to the beverage industry of India under partial equilibrium setting. The data on production, consumption, export, import, supply, tariff and non tariff barriers, production price, consumption price, export price and international prices of tea and coffee were obtained from their respective commodity boards and also from FAO, UNCTAD and APEDA, WTO, Ministry of Commerce and Industry, GOI, UN-COMTRADE for the year 2016.The results showed that the variability in prices and exports has increased after reduction of non-tariff measures. Plantation economy is the main stay for most of the developing and emerging economics which are mostly tropical countries vulnerable to production and market risks. Non-tariff measures further aggravate the crisis of these countries to have a proper access to the world markets. The developed capital economies are the major importers of these beverages often distorting the global trade in plantation crops which affect the livelihood and the economy adversely. Indian coffee trade is complained about traceability issues and adulteration with powdered coffee husk and Indian tea is rejected mostly due to the misconception of presence of Anthraquinon. But proper trade negotiation with the importing countries, adopting WTO standards and proper awareness about the traceability issues of global order would save millions of rupees to Indian beverages industry.

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World Trading Prices of Date (*Phoenix dactyliferaLnn.*) Palm: Trade Price Elasticities, Terms of Trade and Export-Import Trends

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The study examines the international trade of date palm of total 52countries distributed across six continents from 2000-01 to 2015-16. It aims to analyse the international trading prices growth rates, Instability index, EUV, IUV, TOT, trade price elasticities and trends of date palm. The study found that the annual growth of exports and imports of dates hovered around 4.80 per cent and 4.78 per cent in the world, respectively. The results of the study indicate that more than 85 per cent of the dates were exported by only six countries, viz., UAE, Iraq, Iran, Pakistan, Tunisia and Saudi Arabia in the world. Whereas, more than 60 per cent of dates were imported by India, UAE, Morocco, France and Yemen during study period. The export price elasticity for Tunisia, Egypt, Germany, Netherlands, Iraq, Jordan, USA, Pakistan and Saudi Arabia was elastic in nature, whereas for UAE, Iran, France and Oman were inelastic. The export price elastic countries may gain extra foreign exchange revenue if they reduce their exports prices of dates. The USA, Israel, Netherlands, Germany, France, Jordan, Saudi Arabia, Egypt, Pakistan and Niger have comparative advantage in exports of dates and enjoy's better TOT whereas UAE, Tunisia and Iran have comparative disadvantage in exports might be due to more import price than export. TOT of all importing countries improved except UAE and Malaysia. It revealed that the largest exporters such as UAE and Iran market share is less in terms of values; both showed a deterioration TOT may be due to more imports price than exports. The study suggested that dates exporting countries have to establish a multilateral trade relationship with high value European markets to improve their terms of trade and to capture high market share in terms of value.

Eco-System Services Valuation of Tree Plantation

V. Karthick*

An attempt is made to quantify the monetary value of nine years old Melia plantation in Forest College and Research Institute, Mettupalayam which is situated at the foothills of the Kotagiri hills of the Western Ghats sprawling over an area of 200 ha. Traditionally tree plantations have been valued only for the tangible benefits like timber and non-timber products. The intangible benefits provided by the tree

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plantation such as regulating climate, nutrient cycling, water purification, soil protection, habitat for birds have been undervalued since these services are not traded commercially in the convention market and it is difficult to value these services. The monetary value of the provisioning service (timber yield) was calculated as Rs. 6,25,870/hectare. The total monetary value of carbon sequestrated was Rs.38,052.67. The total oxygen released by the trees was 24.93 tonnes of oxygen/ha/year. The total monetary value of water regulating services was calculated as Rs.62.4.The total monetary value of nutrient recycling service was Rs.6510.95.The total economic value provided by the plantation is Rs.6,70,496. If these values could be captured helpsto conserve the plantation for non-commercial use. Thus the study stresses that there is an essential need to quantify the monetary values of non-marketed products to reliably account for resource accessibility and usage to further sound policy decisions. What this study makes abundantly clear is that ecosystem services provide an important portion of the total contribution to human welfare on this planet. The natural capital stock that produces these services may be given adequate weightage in the decision-making process, otherwise the current and continued future human welfare may drastically suffer.

Impulse Response of Price Shocks and Export Competitiveness of Potato

Rohit Kumar† Snehal Mishra‡ and Yash Gautam††

The primary objective of the paper is to examine the potato price shocks transmission and time to adjust the shocks from other markets. The study also explores the export performance of major potato exporting countries. These implications would be helpful in identifying critical markets and phases in generating price shocks. It can helpful to make the strategies to control potato price shocks in India and built an export oriented approach. The analysis is based on time series monthly data on prices of potato for four major potatoes namely Agra, Allahabad, Farrukhabad and Kanpur markets of Uttar Pradesh. Vector auto regression (VAR) and VAR impulse response analysis was undertaken to examine the potato price shock response between the markets. To analyse the export performance of potato exports, data on yearly export of vegetables and potatoes collected from International Trade Centre website. The study revealed that shock is given to any market, the responses of all other markets disappear between 6 to 10 months. Agra market emerges as a prominent market which influences the price of potato in other markets. Comparative export advantage exploration has shown that India Potato export is not competitive and far behind from major exporters of potatoes except china, though India is

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increasing its competitiveness but still need of focusing the potato export as we are major producers of it.

Trade Policy and the Edible Oilseed Sector in India: Problems and Prospects

Jayanti Kajale*

The paper attempts an analysis of the performance of the edible oilseed/ oil sector in the context of trade policy followed in the post liberalization (1994) in order to examine the relationship between performance of the oilseed sector and trade flows and trade policies governing the same. It firstly presents a brief overview of the edible oilseed and oil sector in India in the post-1985 period. Secondly, it makes an attempt to observe the impact of the trade policy changes relating to this sector and the import flows of edible oil in the post liberalisation (i.e. post 1994) period. It also discusses profitability of oilseed cultivation based on the secondary data. Thirdly, for observing the relationship between tariff rate changes and performance of the oilseed sector, correlation between tariff rate changes and changes in various indicators of performance of the oilseed sector is found out for the period between 1994-95 and 2017-18. The analysis indicate that trade policy in terms of tariff rate changes may not be the best policy to for supporting oilseed prices as well as production and protecting interests of the oilseed farmers. It is felt that focus on domestic factors and policies would play a major role in development of the oilseed sector. Reducing the yield gap by provision of adequate irrigation facilities, improving availability of quality seeds, study farming practices of the benchmarking countries and states, integrating oilseed cultivators to the global supply chain by promotion of exports of the oilseed sector, are the major policies that need to be implemented for supporting the oilseed cultivators. Thus, with demand increasing, suitable domestic policies are needed to take advantage of benefits arising out of trade.

India's Oil Palm Trade Restrictions: Beneficial or Harmful?

E. Revathi[†], P. Padmaja[‡] and Jadhav Chakradhar[‡]

The paper intends to analyse the impact of India's oil palm import restrictions on trade policy decisions in the short run as well as in the long run. The two primary exporters of refined palm oil to India are Indonesia and Malaysia. The trade patterns and trade policies between these trading partners are analysed. This analysis has been done for the recent period from 2010 to 2019 (long term) and short-term analysis is done taking monthly time series data from Jan-2020 to August 2020.Tariff on palm

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oil imports was raised in 2018 from around 15 per cent to 100 percent resulting in a decline in its imports. Further in January 2020 it was moved from ‘free’ to ‘restricted’ list. Moreover the ‘binding overhang’ is high. The short-term implication of such a move may not be as much as the medium to long term impact. Decreased demand due to COVID 19 effect has a low impact but in the long-term trade restrictions may affect consumer surplus adversely along with downward impact on economy. Moreover, raising domestic supply of edible oil in the short run or even in the medium run is a difficult proposition given the structural issues. Increased protectionism decreased trade intensity. Shifts in trade partnerships and trade complementarity are observed, terms of trade declined due to increased restrictions. Decreasing trade barriers and allowing free trade increases overall welfare gains. India being the largest market for oil palm has to carefully frame its trade policies in order to maintain good trade relations with its partners. Improving trade relations by negotiations in place of restrictions is a good strategy to capitalise the principle of comparative advantage. This will put India in good position in world market as well as satisfy its domestic consumption needs.

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RAPPORTEURS' REPORTS

Institutions and Efficiency in Supply Chain Management for Agricultural Development

Rapporteur: Brajesh Jha*

It is now widely recognised that institutions, along with factors of production and technology are important determinants of economic growth and development. This is more for the agricultural economy in India which is dominated by smallholders. Their accessibility to factor and product market is often constrained because of tiny holdings and factors associated with it. Therefore the role of institutions in improving the supply chain for agricultural development has been the subject for discussion of the Eightieth Conference of the Indian Society of Agricultural Economics. This has attracted a good number of papers for discussion. These papers largely relate to the issue of transaction costs, property rights, and co-operative solution of collectives. The contributors to this topic have provided observations and research output on a large variety of issues connected with agriculture and agricultural development in India. Accordingly, these contributions are summarised here under various headings that represent major activity areas in agricultural development.

I

INSTITUTIONS IN COMMON POOL RESOURCES INCLUDING WATER

The management of resources is a major challenge for sustainable agricultural development. The standard neo-classical theory often fails to solve the problem of allocation of resources since the right price for the water hardly solves the problem; it is more about the implementation of the price of water. The issue has not attracted many contributions.

The issue of groundwater was discussed by two contributions. Surajit Haldar *et al.*, based on a primary survey of 20 water users associations (WUA) from 12 villages of Cuttack and Jagatsinghpur of Odisha found that with increased share of water, land use pattern of small landholders have changed. The changes in land-use patterns were also influenced by the accessibility of the market. They found that community irrigation sharing arrangement in groundwater (cluster tubewells, individual well sponsored by government subsidy) with water users association (WUA) has improved farm economics. This, along with accessibility to the market, influences the land use pattern of farmers in the village.

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Achiransu Acharyya, through a field-level study in three agricultural districts of West Bengal studied the distribution of groundwater. He found that owners of groundwater extraction machines (WEM) form a collective monopoly amongst themselves. To economise their scale of water usage and maximise profit, they divide the cultivable land of the village to sell water. He also observed that the WEM owners consolidate on surrounding land for economies of scale of machine. Though this leads to higher growth and productivity of agriculture, it may result in an increase of landlessness in the village.

The contribution of Subhash Chand and R.C. Srivastava based on their study of the Eastern Yamuna Canal reported that *warabandi* system of irrigation has slowly faded and Panchayati Raj Institution (PRI) have played an important role in channel maintenance, conflict resolution, and management of common water. Many of these works were earlier performed by the irrigation department. However, of late farmers have started facing problems with the irrigation department. Its control over farmers in the upper reach has diminished. Similarly, the department has lesser control on encroachment and stealing of canal water.

Though the above research area has not invited many papers for discussion, the message is amply clear that community institutions are not only important for the maintenance of irrigation canal and its peripheral, but also for the equitable distribution of water and better economics of farmers. The absence of community institutions can, however, turn farmers landless.

II

INSTITUTIONS IN AGRICULTURAL INPUT MARKET INCLUDING CREDIT

Considering transaction costs involved in viably providing agriculture input and service to scattered small farmers, many institutional arrangements have been tried. These arrangements differ as per the agricultural inputs involved in the production. The contributions on agricultural inputs are not many; they have been aggregated and presented as per the inputs: land, seed, and credit.

The paper by M.K. Gana Shruthy and Parmod Kumar assessed the effect of land tenure (redeemed and unredeemed) on coffee productivity, agroforestry system, and shift in cultivation from Arabica to Robusta variety of coffee. The study uses primary information from 120 coffee growers from the Kodagu district of Karnataka in the year 2015-16. They found that the impact of land tenure has been diametrically opposite in two varieties of coffee and suggested that the government should execute a formal revenue survey that could provide tenure security to local coffee growers. It would also halt illegal encroachment of land for commercial coffee cultivation. Further, this would be a reply to the proposal of the forest department and certain environmentalists who argue for the conversion of the private coffee plantation into state-controlled forests by re-assigning them as “deemed forest”.

Soham Bhattacharya with the NSS unit-level data on Land and Livestock Holdings (SLLH) in Andhra Pradesh found that small farmers leased land and paid high rent to have an economic size of their farms. He found that fixed rent (in cash) prevailed in coastal regions of rural Andhra Pradesh. The tenant households with marginal operational holdings continue to engage with share produce as rents. Bhattacharya found that an exorbitant amount of rent, which deprived tenants of economic gains from cultivation, was an institutional barrier for them.

The paper by Bhag Chandra Jain and Naveen Tirkey discussed the supply chain of paddy seeds in the Jashpur district of Chhattisgarh. The region witnessed sufficient competition among dealers of seed, yet timely availability of seed has been a constraint. Interestingly price of seed is less important. Most of the sample farmers were unaware of various measures used in seed marketing like field demonstrations, farmers' visits to research plots, slide shows, and television. Sher Singh Sangwan concerning wheat cultivation in Haryana observed total replacement of manual labour (in operations of weeding, spraying of pesticides, harvesting, preparation of dry fodder) with machines. Thus all cost of cultivation of wheat is the paid out cost for farmers and custom hiring service has become important.

The paper by R. Sudha and K.R. Ashok reported that micro-credit through bank linkage self-help groups (SHGs) has been a source of credit to small and marginal farmers in Western Tamil Nadu. They assessed the impact of micro-finance on farm income of small farmers with panel data analysis of the difference in difference approach. It assessed income differences before and after the implementation of bank linkage SHGs in members and non-members. The study found that the average annual income of farmers in the SHGs has increased significantly for both tribals and non-tribals. Hence they argue that government should formulate strategies and programmes to extend technical and financial interventions for the benefits of the marginal, small, and tenant farmers. B.B. Barik highlighted the importance of joint liability groups (JLGs) for the asset-less farmers in accessing institutional credit.

B. Kavitha found that co-operative banks followed by commercial banks, and micro-finance, were the institutional sources of credit in the Krishnagiri District of Tamilnadu. The concerned processers, besides relatives and friends, were the informal sources of credit in the district. Kavitha worked out the effect of institutional credit on the farm investment in mango production. She used three-stage least square method for determinants of farm investment and return to investment of sample farmers. The institutional credit along with the size of farm holding, owned capital, lagged returns to investment, labour usage, and non-farm income has influenced farm investment positively. The investment return was significantly higher for borrowers rather than for non-borrower farmers. The investment returns were positively influenced by the farm investment, institutional credit or owned capital, labour usage, and non-farm income of farmers. Institutional credit played a vital role in farm profitability.

One of the submitted contributions relates to the seed market. The land and credit markets have two contributions on each of the issues. The important findings of these papers that have implications for discussions are the impact of land tenure on production and productivity in agriculture, frequent lease of land by marginal landholders to increase the viability of their holdings, high land rents for tenants, and their other disadvantages in production.

III

INSTITUTIONS IN PRODUCTION, PROCESSING, AND OUTPUT MARKETING

Interestingly production is in the hands of individual farmers, but what the farmer earns depends substantially on institutional arrangements in output marketing. The case of dairy co-operatives demonstrates the important role that institutional arrangements in procurement, processing, and output marketing can play. The issue becomes more important when it is being attempted that farmer's income be doubled. The farm laws to increase marketing options for farmers have been enacted. The topic received some attention from the contributors, their observations are presented below.

Pooja Pastore Shukla and Kanhaiya Ahuja stressed the need for a shift in orientation from production to demand in agriculture. This will make farming more sustainable and growth-oriented. Madhya Pradesh is one of the first states to amend its APMC Act to allow private, single license yards outside the mandi yard. As a result, the "e-choupal" of ITC could write its success story. There are now more than 2000 e-choupals spread across 6000 villages covering 600,000 farmers. This has promoted the direct purchase of farmers' produce outside the market yard (by private companies) and encouraged innovative initiatives like contract farming. The post-harvest facilities have been tried to be augmented by different kind of incentives like engaging private investors through the state Agro Industries Development Corporations, encouraging medium and small enterprises with the land allotment and similar concessions, subsidising power for its use in the post-harvest operation, undertaking investment for suitable infrastructure (state of the art logistics) and creating branding of produce.

Sher Singh Sangwan presented a different picture from the state of Haryana. In a paper on the Agri-value chain, he argued that the state APMC Act has been the biggest barrier for any purchase outside the APMC market till the recent ordinance in July 2020. The *Apni Mandi* for fruits and vegetables has been an exception. A majority of millers are however willing to purchase directly from farmers as it will reduce their cost of procurement by more than 5 per cent (*arhatia* fee, handling, and transportation expenses). Contract farming was allowed in the state (as per section 43 of APMC Act 2018 and 2006), but the private market by companies dealing in contract farming has not come up due to strict conditions of APMC, Haryana Marketing Board (www. Hsamb.gov.in). A few private companies have experimented with contract farming but successful examples are limited (agmarketnet.nic.in). He wished for different kinds of incentives including the one through farmers' producers' organisations (FPOs) for wheat and paddy on the lines of the vegetables and fruit growers.

Ram Singh *et al.*, presented a value chain analysis of turmeric in the selected North Eastern states (Mizoram, Meghalaya, Manipur and Sikkim). They found that while turmeric was profitable in all states, it was more profitable in Sikkim where the commodity was recognised as organic. The value chain analysis showed that processed (powder) and semi-processed (slice/flakes) turmeric earned good returns, and enhance their share in consumers' price of turmeric produce. However, there is a shortage of small machines (slice/flakes maker, dryers, grinder) in the region.

Shailza *et al.*, highlighted the role of alternate institutions: private processing units and farmer producer company (FPC) in the development of the value chain for custard apple in a tribal setting of Southern Rajasthan. They found that the operational and marketing efficiency of private processing units was higher than the FPC. However, in FPC, the employment and entrepreneurship development of tribal women was better than the private processing unit. They reported a significant reduction in the post-harvest loss in custard apple with the introduction of "browning free technology" and pulp extraction machines by the Agricultural University of Udaipur.

Deepak Shah analysed the price behavior of grapes in certain important markets of Maharashtra. The seasonal indices of both, the wholesale and retail price of grape, exhibited a peak in December and May. The lowest price of grape was observed in March. He underscores cyclical fluctuations in annual and monthly prices of the grape as the reason for the low share of a producer in consumer's price for grape. He argued to check practices of various market functionaries, besides creation of post-harvest infrastructure. P. Prakash *et al.*, worked out the economics of protected cultivation of rose and its supply chain in Pune and Nashik districts of Maharashtra. They found that cultivation of rose is feasible under the poly house, though the cost of establishing the same is high. The government subsidy helps in the adoption of such technology. The institutions that provide the required information to cultivators are the horticulture training centre, Krishi Vigyan Kendra, private agencies, and fellow farmers.

Jyoti Chaudhary and H.P. Singh argued for diversification of agriculture towards high-value crops (horticulture, off-season vegetables) for increasing farmers' income in Himachal Pradesh (HP). Such diversification has become lucrative with better price realisation of these crops following the expansion of market infrastructure. T. Rajendran analysed the value chain of Bhendi (lady's finger) in the Tirunelveli district of Tamil Nadu. He found that direct marketing between producer and consumer has a higher efficiency of all market channels that were analysed.

In sum, many studies discuss the value chain analysis of numerous crops in specific regions of the country. Some of them highlighted local level constraints in the supply chain of the commodities. A few papers discussed different kinds of state-level incentives to improve the post-harvest infrastructure of agricultural commodities. One paper discussed the possible merits of new farm bills in the improvement of post-harvest operation of the same.

IV

INSTITUTIONS IN TECHNOLOGY, RESEARCH, EXTENSION, AND INNOVATION

The institutional framework plays a crucial role in the research and extension for agriculture as in developing countries, social profitability is frequently higher than its perceived private profitability. Technology and research often require large investments that have long gestation periods and at times involve significant risks. These also have substantial positive externalities and it is often difficult to privately capture all the gains that accrue from them. The institutional framework substantially determines the necessary research extension and innovation needed for an efficient supply chain in agriculture. The response on this topic has largely been inadequate. Although, some papers discussed in other sub-section tangentially remark about likely research in a commodity, only a few exclusively discuss issues of technology, research, startup and related issues.

Prakash *et al*. in the context of cultivation of rose in Pune and Nashik districts of Maharashtra highlighted the role of institution (incentive) in adoption of specific technologies. They highlighted the role of institutions (horticulture training centres, KVK, dealers of farm input, fellow farmers) in the protected cultivation of rose. Similarly, Shailza *et al*. highlighted the role of the agricultural university in developing a technology for “brownfree pulp” of custard apple. D.V. Subbarao reported about the digital platform (Farmer.Live, launched by Tara Blooms Private Ltd) with the social perspective that presented an online market to help farmers, exporters, and buyers.

With digitalisation the flow of knowledge has become easy and less costly. The accelerated knowledge flows across disparate actors in value chains, lead to faster diffusion of innovations. This has resulted in emergence of startups, created to profit from new technologies. The interconnections between the startups themselves and their business partnerships (which include input companies, processors, aggregators, traders, hotel and restaurants, supermarkets, commerce companies, crop associations, research organisations, various government, and international institutions), constitute a complex web of the flow of information.

To nurture these startups, the Government has initiated Agribusiness Incubation Centers in different Agricultural Universities, ICAR institutes, Management, and technology institutions. The centres include technical support of 5 knowledge partners, and financial support of Rashtriya Krishi Vikas Yojana. In addition, many other government organizations have been designated to support startups and agri-startups. The Startup India, Atal Innovation Mission, New Generation Innovation and Entrepreneurship Development Centre under National Science & Technology

Entrepreneurship Development Board, Dairy Entrepreneurship Development Scheme promoted by NABARD, Venture Capital Finance Assistance scheme promoted by Small Farmers Agribusiness Consortium, ASPIRE promoted by Government of India are some examples.

In the above context, one paper of Deepak Pal and Laveena Sharma, and another by Sunil Nahatkar and Suresh Kapse highlighted the case of Jawahar R-ABI, in Madhya Pradesh in the promotion of innovation-led entrepreneurship (startups). The Jawahar R-ABI has nurtured a cohort of 23 startups. These startups are for wide and varied purposes ranging from agri-solution service through a mobile app, to organic milk production. Some of these start-ups are in the pre-seed (idea) stage supported by a grant in aid of up to 5 lakh while many are the seed-stage startups with a grant in aid of 25 lakh from the Ministry of Agriculture and Farmers Welfare of the Government of India.

Chandra S.R. Nuthalapati *et al.*, with a large database of startups in India, examined the nature of innovation of startups in an open innovation framework. The six broad categories of startup innovation identified are those providing output market linkages, facilitating input supply, enabling mechanisation, providing irrigation control and financial support, helping in quality maintenance, monitoring, traceability and output predictions, and farming as a service and post-harvest management, and those supporting animal husbandry farmers. They reported that most of the funding is in the seed and pre-seed stage; the late-stage funding is negligible. They also reported that the startup has largely bypassed the smallholders.

Some papers have provided passing remarks to research and extension in the supply chain of the commodity. Only a few of them exclusively discuss innovation and startups in India. Two of these papers highlighted the role of a particular incubator whereas one discussed in detail startups in India.

V

INSTITUTIONS FOR DEVELOPMENT OF FARMERS INCL. ALLIED ACTIVITIES

Farmers' needs often extend beyond farm inputs and outputs to the general welfare and it influences efficiency in the supply chain of agricultural commodities. The institutions targeted for the overall welfare of farmers have been presented separately; this subsection presented a brief of papers that cannot be compartmentalised in either of the above subsections.

Shubhi Patel *et al.*, highlighted the role of institutions in removing disruption of supply chain through timely interventions of Non-Government Organization (NGOs) through Farmers Producer Organisations (FPO). The authors documented a case study of an NGO named Integrated Rural and Agricultural Development Agency which has organized around 2000 farmers into a FPO for the supply of fruits and vegetables in Barabanki and Lucknow districts of Uttar Pradesh. Direct selling through FPO has reduced the price spread of fruits and vegetables. The business of

FPOs has increased during Covid-19, it may increase further with the recent reforms related to direct marketing of produce. In addition, the NGO is also organising farmers for receipt of subsidies from the government, arranging training, and helping farmers in dissemination of information about farming.

Rooba Hasan presented the performance of some non-government institutions, in different parts of the country during the Covid 19 pandemic. She has enlisted works of Agakhan Support Programme in Samastipur, Muzzafarpur and Vaishali districts of Bihar; Indian Red cross Society supported by Azimji Premji Foundation in Bageshwar district of Uttaranchal; Pragati foundation in Navrangpur and Koraput district of Orissa; Kutch Mahila Vikas Sangathan in Kutch district of Gujarat. Their endeavour ranges from marketing of perishables to cash support through SHGs. She emphasised coordination between government and non-government institutions for development.

The development activities of NGOs are at times supported by corporates. The latter are mandated to participate in development through Corporate Social Responsibility (CSR). Anushka Awasthi *et al.*, presented a case of development through CSR of Cybage Asha through a partnership with BAIF Development Research Foundation, in Pune. They presented results of improvement in agriculture, livestock and high-value farming with the one-tailed Wilcox on signed-rank test for paired data (pre and post-intervention). They found increased crop diversification with an increase in vegetable area, improvement in the fertility of the soil with the manure provided by BAIF, an increase in milk production as a result of increased availability of fodder due to cultivation of maize.

Ashok Dalwai sought for practice of agriculture as a profit-centric vocation that necessitates demand and market-led operation all along the agriculture value chain that comprises pre-production, production and post-production activities. It suggests for creation of a "National Agri-value System Platform (NAVP)" at the national level as a public-private platform (PPP). He advises for the private sector to shoulder operational responsibility with government and government agencies right down to the district level, all the while playing a facilitative role from behind. He argued that NAVP can trigger single or multi-commodity agri-value chains at the district level.

Vijayachandra Reddy and Vasudeva Naik K. reviewed the Union Government's efforts to double farm income. These efforts broadly aggregated as strategies to double farm income, were an increase in production, effective use of input, increase in cropping intensity, reduction in post-harvest losses, and value addition within the ambit of agriculture. The other two strategies, which include shift of cultivators from farm to non-farm occupations, and improvement in terms of trade for farmers are not exactly in the domain of agriculture. They report increase in irrigation budget (PM Krishi Sinchai Yojana) and Government effort at increasing irrigation and irrigation efficiency with the motto of "*Har Khet Ko Pani*" and "per drop more crop", in rainfed areas. The government aimed to popularise micro-irrigation, though it remained largely unadopted in states other than Andhra Pradesh, Maharashtra and

Tamil Nadu. Similar efforts are being undertaken to accomplish other strategies to double farmers' income.

In sum, corporates are mandated to work for societal development with CSR, one presents a case study of such an initiative. Two contributions highlighted the role of NGOs in removing different kinds of bottlenecks in the supply chain of commodities. Two contributions emphasised the need for increasing farmers' income and highlighted governments' efforts in undertaking activities for the same.

VI

CO-OPERATIVES, COLLECTIVES AND FARMERS GROUPS

The necessity of a co-operative kind of collective has always been important in India, the rationale further increases with smallholdings and rural stagnation in the different parts of the country. While traditional cooperative have been failing all around in the country, new kinds of cooperatives (farmers' interest group, commodity interest group) with a non-formal, self-managed, small group of farmers have emerged. The Union Government has come up with the Farmer Producer Company (FPC) to have the goodness of both co-operatives and companies. The GOI is promoting FPC through various government and non-government organisations, and schemes. The FPC provides hope for the small and scattered production units with low bargaining power. In supply chain of a commodity, farmers can be benefitted from a reduction of transaction cost and enhanced social capital built with the representation of members in FPC. Efficiency in the supply chain can lead to the economic and environmental sustainability of the company and agricultural development of the country.

The contribution of N. Sivaramane *et al.*, argued that FPC is structurally different and superior to other institutional alternatives, such as farmer and commodity interest groups (FIG and CIG), farmers association, and farmers clubs. They assess the business potential of FPC with some sweeping assumptions and assert that there is huge untapped business potential. They present the structure and performance of FPC with four case studies. They found that two of the FPCs in the case study were dealing with more than one crop, while the remaining two were mono-crop FPCs. The important challenges faced by the FPCs were low capital base, over-reliance on government funds, and an inability to access external funds. The surveyed FPCs were overcautious in investing paid-up capital leading to a low volume of business.

The contribution of D.V. Subbarao found that Parimala Flower Producer Company (an FPC) mentored by 'Search' (an NGO in Bapatla of Andhra Pradesh) and supported by NABARD provides an institutional framework for sustainable innovative production and supply model for substantial improvement in net income and employment. Technological measures like biological control with the application of Trichoderma in Jasmine and institutional options like training in vermicompost and similar practices have reduced the cost of farmers.

Arifa Sultana argued that FPCs can increase the income of farmers by reducing their transaction cost at every step of the supply chain. The author has presented it with a case of Chetna Organic Agriculture Producer Company, which was promoted by regional co-operatives of three states- Telangana, Maharashtra and Odisha. She reports that the involvement of Chetna has reduced transaction cost in the supply chain by extending research and support practices (seed varietal trial and seed multiplication) and providing training to farmers on soil fertility, pest management, organic and fair trade certification practices.

Rajani Adikarla through case studies of zero budget natural farming (ZBNF) and non-ZBNF farmers, report that farmers' collectives were highly beneficial for non-ZBNF farmers. These collectives can link up with supermarkets and open up their channels of reaching consumers directly from APMC premises. The farmers' collective have strong bargaining power to negotiate with all corporate sector companies. However, they require to be nurtured in the initial phase.

B.B. Barik in his theoretical contribution highlighted the importance of joint liability groups (JLGs) for asset-less farmers. He says that the institution (NABARD) should promote JLG of farmers. The JLGs can be aggregated into Farmer Producers Company (FPC). To generate resources the FPC can increase its activities by obtaining the license of dealership of different agricultural inputs. Such collectives can also make timely availability of quality seeds, fertilisers, pesticides, farm advisory services, and provide custom hire service at an affordable cost. This also helps farmers to realise better price of their produce.

The discussion in the sub-section argued that FPC is superior to other institutional alternatives. The FPCs can increase the income of farmers by reducing their transaction costs. They have also been instrumental for assetless farmers to connect with formal institutions. Agricultural development in the Indian context requires many, independent and viable FPCs.

VII

ISSUES FOR DISCUSSION

The topic attracted 32 contributions, all of which were accepted for discussion. These papers largely provide evidence of benefits from reduction in transaction cost, merits in security of property rights, importance of property rights for equitable distribution of benefits, and incentives favouring a co-operative solution. The messages from these papers and the possible issues for discussion are as under.

With the weakening of government organisation (in specified areas), local level community institutions of public nature, have become important. However, in this regard evidence from other regions and of activities other than irrigation remains an issue.

The sharing of irrigation facilities with community institutions has improved the economics of farming. At the same time the absence of same and shared irrigation facilities have the potential to turn small farmers into landless. With this evidence, it may be asked how institutions can help in more equitable distribution of resources; and how far institutions have helped in influencing the price of water based on scarcity.

The contribution suggests that timely availability of seed to farmers has been a constraint in certain regions. In that context, what may be a probable institutional arrangement for collection and distribution of seed? Can this be improved? What is the basis for the fixation of the price of seed?

Some contributions report the losses to farmers on account of spurious agricultural chemicals from different parts of the country. In that context what is the existing institutional arrangement for agro-chemicals? What can address the problem?

The security of land tenure has a positive effect on production, but it often belies tenant farmers. They face many disadvantages in the factor and product market. What institutional alternative can address the problem?

Various contributions highlight the high rent for a tenant. In that light can there be institutions to statutorily determine the land rent in a region?

Whether the bank credit linked with SHGs and JLGs is an important way to finance asset less small farmers? If it is so, then what constrains the spread of SHGs and JLGs linkage with a bank for institutional finance?

In addition to the above, how can transaction costs of institutions involved in the supply of credit to agriculture (evaluation, monitoring and recovery) be reduced so as to make these services more viable and attractive?

Some studies while discussing value chain analysis of a crop in specific regions have highlighted local level constraints in the supply chain of commodities. Can there be an institutional arrangement at a regional level (Meso level institutions) that addresses certain demand and supply related problems?

Some contributions highlight the various kinds of incentives that state governments provide for improvement in the supply chain of agriculture. What could be the institutional framework to address the specific post-harvest problems (market, storage, processing unit)?

Some contributions agree that new farm legislation will be able to address the concerns in post-harvest operation. Is that so? Whether complementary institutions are desired for their success? What has been the experience?

In addition to the above, what kind of institutional changes in agricultural markets may reduce market imperfections and market failures to augment agricultural development?

Some papers appreciate the role of research in improving supply chain of a commodity at a regional level. However, the question of an institutional framework which encourages the agents towards continuous and strong innovative efforts remains important. How do these efforts address the real needs and constraints of the farmers?

A few papers exclusively discussed the issue of innovation, and agriculture startups in India. They highlight government help for startups and also argue for a continuation of the same. What kind of change (if any) in the present institutional framework is required?

Like many other initiatives in agriculture, startups have also been reported to have bypassed small farmers. What kind of changes in the institutional arrangement is desired to make startups more inclusive?

In addition to the above, in a setting of small farm agriculture, what kind of institutional changes in production, processing and output marketing may lead to a reduction in transactions costs of small farmers?

Some papers argued that FPC is structurally superior to other institutional alternatives. An effective FPC can reduce transaction costs at every step of the supply chain. What should be done for its spread across the country?

How can the institutions for development, including government legal institutions, be made to work with greater efficiency, co-ordination, and co-operation so that they are more effective and efficient in serving the various development needs of the farmers, especially the poor?

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Rapporteur's Report on Agricultural Labour, Skill Development, Labour Productivity and Employment

Rapporteur: S.S. Kalamkar*

BACKGROUND

Agriculture plays an important role in providing livelihood opportunities to a vast majority of population of our country. It employs about half of the work force but contributes to only about 15 per cent of the Gross Domestic Product (GDP). In the economically weaker states, however, its contribution to state domestic product and to employment is much higher. Relatively low productivity in agriculture led to a concentration of the poor in this sector. Theoretically, it is possible to reduce poverty as well as expand domestic market for industry by raising labour productivity in agriculture and spreading its gains among the low-income groups (Radhakrishna, 2019). With economic growth and structural transformation, it is expected that the employment in the economy will shift from agriculture to industry and services. But, agriculture continues to be a dominant activity in rural India with 59.4 per cent of the male workers and 74.9 per cent of the female workers engaged in it in 2011. However, labour is highly differentiated in terms of its own attributes. The average daily wages for casual female workers have generally been around two-thirds of the male wages. Large variations across states have been an important feature of rural wage situation in India. While, agriculture is no longer the major source of income of almost half of the rural households, more and more households have joined the ranks of labour households due to reduction in the size of their landholdings which now employ them only for a minor part of the year. The share of workers in the category of wage and salary earners has increased vis-a-vis that of the self-employed. There are evidences of labour market tightening, but surplus labour continues to be a widespread phenomenon. Government programme like MGNREGA has seen to have added to the tightening of the labour market in rural areas, in general, and in agriculture, in particular; and, contributed to 'secularisation' of the labour market relations with increase in the bargaining power of labour (Papola, 2014). On the labour supply front, it needs to be noted that there is a decline in rate of population growth and thus persons in working age; decline in labour force participation rates, increasingly number of wage labor than cultivators; increase in share of casual category of wage workers; increase in rural to urban migration; constrained labour supply to agriculture; and increase in rural labour getting educated. On demand side,

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the trends are also mixed, as decline in demand for labour due to mechanisation and decline in the size of holdings; diversification within agriculture from food to commercial crops require quality labour; change in demand for labour due to new form of farming (contract and corporate); demand for quantitative and skilled labour due to commercialisation of agriculture; and increase and a change in the nature of demand for labour due to faster expansion of the non-farm activity (Papola, 2014).

The disparity between a farm and non-farm worker in India remains high in the country. Studies report that this wide variation in worker productivity arises due to composition in rural output, over-dependence on agriculture sector and nature of the work performed by different categories of workers. In the year 2011-12 per worker income varied from Rs.33,937 for agricultural labour to Rs.1,71,836 for rural non-farm workers. In the same year a cultivator earned 2.27 times the income earned by a labourer from agriculture (Chand *et al*., 2017). At the same time, per capita income of non-farm workers was more than twice the income of cultivators. These results show that among rural workers, agricultural labour are at the bottom in terms of worker productivity. The NABARD (2018) survey highlighted that wage labour was the most remunerative source of income for all rural households contributing a major proportion of roughly half of the total rural household income, the contribution being higher among non-agricultural households (54 per cent) as compared to the agricultural ones (34 per cent).

Agriculture needs to be made more profitable, attractive and enterprising so that not only the rural to urban migration is reduced but also farmers start taking pride in their profession. For this to happen, there is a need to develop skills among our farmers in various aspects of farming so that the traditional, time and cost consuming methods are replaced by scientific, modern, economic and efficient methods. Rural youth once skilled in farming and related enterprises can choose self-employment in their own villages with Government help instead of migrating to unknown cities leaving their families behind. In agriculture, cognitive skills are required to make better decisions, technical skills required for handling various implements and interpersonal skills required for exchange of farm related information. Government has been implementing various Skill Development Initiatives to provide training to people to develop skilled manpower in various sectors including agriculture, food processing, apiculture, animal husbandry, farm machinery, etc. Agricultural households reflect a greater need for skill building when compared to their non-agricultural counterparts.

The papers on these issues were invited to deliberate and devise better ways to understand issues for suitable policy formulations. The detailed outline of this theme under four sub-themes (agriculture labour, employment, labour productivity and skill development) were circulated to paper writers to enable them to focus on various issues raised and proper policy measures. A total number of 22 papers were received while very few of them were directed at these or related questions. Out of these, five papers were selected for full length, 13 were selected for publication in Summary form. The key findings of accepted papers are summarised under four themes.

1) *Agriculture Labour*

The problem of labour migration from agriculture and its impact on household crop income has been subject of interest of academicians as well as policy makers. This aspect was studied by the two papers. The factors affecting migration of labourer from domestic agriculture and its impact on household crop income was studied by Bodrul Islam and Pradyut Guha by analysing the data collected from 224 farm households in Nagaon and Morigaon districts of Assam. The authors found that that migration in the study area is significantly determined by the factors like household size, total value of assets holding, networking influence, and distance to the commercial bank, exposure of flood in the village. While inflow of remittances towards the farm households is strongly influenced by number of migrants, dependents, and age of migrants. The migration of labourer from domestic agriculture in the study area has negatively influenced the household crop income though it has not reduced crop yield. Authors argue that inflow of remittances sent by migrant labourer partially compensate for the lost labour effects, contributing to household incomes directly and indirectly by stimulating crop production or crop income. Thus, findings of the study highlighted that labour migration adversely affected household crop income, in terms of rising cost of cultivation while remittances received have compensated the households by relaxing credit and insurance constraints. Similarly, another paper by E. Gayathri and C. Prabakar have analysed the impact of migration on the rural livelihoods by covering together 120 migrants and non-migrants households in Pudukkottai district of Tamil Nadu state. It is observed that the migration had an impact on the livelihood diversification pattern and in turn on the socio-economic conditions of the rural poor. The results depicted the reality that majority of the migrant workforce preferred to be absorbed in non-farm activities as their primary occupation. The authors argued that they could diversify their activities mainly due to migration.

Labour use in agriculture has been a subject of research and debate in India. While issues related to agricultural labour differ across regions and across production activities or crops. A.K. Sharma *et al.*, have analysed the trends in labour use and casualisation of workforce in sugarcane cultivation at disintegrated level, across agro-climatic zones and farm sizes, in major sugarcane growing states of India covering the states of Andhra Pradesh Karnataka, Tamil Nadu, Maharashtra, Haryana, Uttarakhand and Uttar Pradesh. This paper has also analysed the technological changes in sugarcane cultivation and its implications for labour and machine use in sugarcane cultivation. Authors have observed that the improvement in labour productivity in sugarcane was found to be associated with labour displacement in sugarcane. The factor share of labour in the value of output has remained almost static at all India level; however, it has increased in Uttar Pradesh as well as in Maharashtra state. Changes in labour factor share in these states depict that labour productivity has increased not only due to mechanisation resulting in displacement of labour, but also due to yield enhancing technological interventions. The study highlights that the technological changes and associated productivity improvement have been able to ensure an increasing share of the output to the labourers during the period under study. The operation of negative employment elasticity in sugarcane intensive zones and positive elasticity in less sugarcane intensive zones highlights that less intensive areas have experienced labour absorption with the technological changes in contrast to already sugarcane intensive areas.

Anup Kumar Das and Limpi Kalita studied the extent, composition and changes of agricultural workers in Assam with the focus on agricultural labours. The study depicts that around half of the workers in Assam are engaged in the agriculture sector and the majority of them are cultivators. However, share of agricultural labours in total workers is rising, it is declining in the case of cultivators. The majority of agricultural workers are main workers and the extent of such type of workers is increasing; shows the increase in the duration of their employment. Despite the higher growth of agricultural labours, the extent and intensity of their use are declining; the spreading of mechanisation is one convincible factor. It is also found that the agricultural wage is increasing in the state but it is still below the all India level. Furthermore, like in the country as a whole, the wage gap between male and female agricultural labours is still continuing in Assam.

2) *Employment*

Employment diversification, though desirable from economic development point of view, has definite implications for agriculture. Number of studies have highlighted that the farm sector in India has shown negative employment elasticity indicating that growth in farm sector is accompanied by reduction in farm employment as more and more people leave this sector and go out for jobs in non-farm sector. This issue was covered by two papers. A study by Ripi Doni and Alka Singh has analysed the determinant of individual's participation in various farm and non-farm sectors in eight states of north-eastern region of India by using secondary data compiled from Periodic Labour Force Survey, NSSO. The study estimated that around 50 per cent of the rural workforce in north-eastern India is still engaged in farm sector. The authors have observed that age, education and training has negative and significant effect on farming while same have positive and significant effect on non-farm activities. The effect of gender, education and training was found insignificant respectively on farming, construction and manufacturing sector. The level of education has positive effect only on service sector. The authors advocate training for skilled workforce. Similar paper by Shaik Muneer *et al.* have also observed from secondary data that the diversification of agricultural labour to other sectors during the last four decades in

India and proportion of rural male labour engaged in the agricultural activities gradually fell by 25.6 per cent points during the period from 1977-78 to 2017-18 while in case of females labours, decline was by 14.9 per cent points during corresponding period. Authors have noted that during 2004-05 to 2011-12, movement of labour away from agriculture was found to be the highest in Kerala (39 per cent) and the lowest in Madhya Pradesh (8 per cent). The major reasons for diversion of agricultural labourer to other sectors cited were low and inadequate wage rates, lack of employment during off season, indebtedness, unfavourable working conditions and marginalisation of agricultural labour. Authors argue that this diversion can be gradually reduced by effective implementation of minimum wage act, provision of alternate employment during off season, providing land to landless labourers and sanctioning of loans to needy agricultural labourers.

Tracking long-run changes in labour supply in agriculture and assessing its effects on farm economy assume significant importance in formulating effective strategies for management of labour use in agriculture by using the evidences from census and NSSO surveys, S.K. Srivastava *et al.* have analysed the changing agricultural labour market and its effects on farm economy in India. Authors have observed the rising trend in employment diversification from agriculture to non-farm sectors while data deviations across sources are reported. NSSO surveys have reported relatively higher rate of decline in participation of agricultural workers as compared to Census, which may be primarily accounted by wide variation and contrary trend in the estimates of agricultural labours from these data sources. Authors argue that the withdrawal of agricultural labour affects farm economy either by creating physical scarcity of labour or through the rise in farm wages. Due to inelastic demand of labour, increase in wages could not bring proportionate decrease in labour use and resulted in increase in labour cost in crop cultivation. Thus, extent of decline in labour use is found to be insufficient to negate the wage-push cost inflation. This warrants concerted efforts to accelerate pace of farm mechanisation and its economic access to farmers to partially substitute labour.

Gummadi Sridevi and Dontha Prashanth examined the trends in the process of casualisation of labour in Rural India and noted that trends of an already increasing rates of unemployment in both rural and urban economies, the rates being higher in urban economy coupled with a greater part of migration from rural to urban areas, has the possibilities for a process of reverse migration to the last place of residence. Author suggested that an in-depth research would be required to study the effects of pandemics and policy paralysis causing situations of unemployment. Harshavardhini *et al.* analysed the impact of non-farm sector on employment and income of rural households in Tamil Nadu and observed that RNFS has served as safety net for landless, marginal and small farmers by providing opportunities for income diversification.

Though MGNREGA is causing serious labour shortages in agriculture as is often claimed, but it has made significant positive impact on wages in rural areas by ‘setting higher benchmark for setting wages’ by guaranteeing the statutory minimum wages to those employed in the works under the guarantee. Is this argument valid that to incase of woman labour?. K. Sita Devi and T. Ponnarasi assessed the economic impact of MGNREGA in terms of employment generation, assets position, savings, income and consumption pattern of the rural women beneficiaries in Cuddalore district of Tamil Nadu by surveying 80 women beneficiaries of MGNREGA scheme. Authors have observed that the rural employment guarantee scheme implemented in rural areas had a positive impact in terms of both economic (such as employment days, asset value, annual savings, loan amount, annual income, and annual consumption expenditure) and social (communication skills- interact and communicate with others confidently, freedom to spend and save the earnings) indicators, on rural women, positive aspects in their social behavior, etc.). It is suggested that the policy planners might redouble their efforts to make MGNREGA programme not only a successful but also a sustainable vehicle in the process of rural development. Further, the authors advocate that this programme should be insulated from the forays of political influence, and non-political movements tend to cater to those who are really in need without any bias irrespective of the social status of rural women.

M.L. Nithyashree and Suresh Pal examined the capital intensity, financial performance and employment potential of the Indian food processing industry (FPI) using the industry-level data for the period from 1980 to 2018. Authors have noted that employment pattern in the industry witnessed contractualisation of the labour force with rising demand for skill-oriented managerial and supervisory employees. This reorientation in the pattern of employment is also reflected in the wage distribution, where workers’ wage share reduced to 52.55 per cent from 60.80 per cent, whereas it increased for the supervisory and managerial category from 16.54 percent to 30.29 per cent in the total emolument. The results of estimated employment function showed the raising potential of FPI in generating employment along with rising capital intensity. Efforts are therefore needed to focus on the high-value commodities such as meat, fish, fruits and vegetables and feed industry to improve the output level which has more potential. Further, being a large contributor to the employment, grain industry can be expanded to the nutri-rich cereals, to absorb surplus labour in the country.

Large variations across states have been an important feature of rural wage situation in India. Have different features and trends in the male and female labour market as noted earlier has any effect on gender difference in wages? A paper by Ch. Gowthami *et al.* presented the income generation of women workers in agriculture by analysing the wages of women workers participating in various agricultural operations in Prakasam district of Andhra Pradesh. The income earned by the women workers vary from crop to crop and also from village to village. The income of the women workers was the highest in those villages with chilli and cotton crop due to high demand of the women workers at the time of harvesting and sowing. Hence, there is a chance of demanding higher wages by the women workers when there is more demand for their work. Another paper by Ritu Rathore and Ravinder Malhotra have analysed the impact of women dairy self-help groups on employment generation of woman by using 320 respondents from Rajasthan. Author observed that average annual days of employment generation through dairy farming was significantly higher than that of non-members. The results indicated that participation in SHG activities significantly increases the employment generation of women in the study area. Author suggested that formal training should be provided on different dairy activities to women members of SHG. Another paper by S. Niyati and Kaushik Bora attempted to analyse the women's labour absorption in rice cultivation in major states of India and found a declining magnitude of labour absorption in rice cultivation in all the States. Authors have observed that farm mechanisation and cropping intensity contributed negatively to the labour absorption in rice cultivation. Arati Priyadarshini *et al.* highlighted the gender inequality in agriculture in Remuna and Baliapal block of Balasore district of Odisha. Authors have observed that despite of high participation of women labour in agriculture activities, they are paid less than the men. Author argued that policies must be adopted to address the inequality. While Basanti Renu Hembram *et al.*, have also observed that there exists gender disparity in wage rates and employment in the irrigated and non-irrigated village in Cuttack district of Odisha. Author concluded that gender disparity in wages and employment still persisting in rural labour market in Odisha, there is a need to enforce pay parity, improve working conditions and empowerment of female agricultural labourers.

3) *Skill Development*

Sagarika Dey evaluated the status and intensity of agricultural commercialisation of small holder rice and wheat growers in India and their determinants with special emphasis on agricultural training and extension. The study finds that agricultural skilling reduces the probability of a worker belonging to small holder household in engaging in casual daily wage based employment and in unpaid family labour in agriculture; on the other hand, the probability of engagement in self-employment activities in agriculture is enhanced by exposure to agricultural training programmes. The findings of the study underscore the need for massive expansion in agricultural skill development and extension services for enabling small holder farmers in India to emerge from the shackles of subsistence farming and in generating sustainable agricultural livelihoods

4) *Labour Productivity*

The farm labour productivity from different crops cultivated under irrigated and rainfed condition by using the cost of cultivation survey data covering period from 1975-76 to 2016-17 was estimated by A. Narayanamoorthy *et al*. They have observed that labour productivity estimated under all four dimensions was higher among the irrigated crops in different states as compared to the rainfed crops. The labour productivity both in terms of value of output and yield (in kg) computed using labour man hours as denominator has increased for all the six irrigated and rainfed crops. However, when estimate is made using total labour cost as denominator, the labour productivity either declines or does not increase appreciably for both irrigated and rainfed crops.

The contributed papers have brought out several issues related to agricultural labour migration and its impact on household income, labour productivity as well as employment. Keeping in view the papers received and issues being raised as well as issues not covered in papers as per outline issued for call of papers, the following pertinent questions are proposed for further discussion and research:

- What has been the impact of the changes in demand and supply of labour in rural India?
- How far have the labour market trends influenced the levels and trends in wages in agriculture and other activities?
- What has been the role of institutional factors such as minimum wages, public works and trade unionism?
- Need to have more insights on the reasons for the withdrawal of female from labour force.
- What are the reasons for high increase in number of agriculture labour and decline in number of cultivators?
- What is the pattern of growth of cultivators and agricultural labourers for the states and its impact on agricultural growth?
- Is there convergence in the productivities of agricultural and non-agricultural workers?
- Whether there is scarcity of labour in agriculture sector and if yes, what is its impact on cost of cultivation of crops?
- Whether there exists gap in requirements and availability of skilled man power for different job roles in view of rapid mechanisation of agriculture in upcoming periods

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Rapporteur's Report on Agricultural Trade with Special Reference to Plantation Crops and International Trade Agreements

Rapporteur: P. Indira Devi*

Agricultural sector being the backbone of Indian economy, is to be viewed as a special sector on account of its social, economic and ecological significance. The food policy of the country underlines, protecting the consumer interests while safeguarding the producers welfare. At the same time India is one among the fifteen leading exporters of agriculture and allied products in the world and export sector gains significance with respect to foreign exchange earnings and employment generation. The current account deficit of the country improves as the value of export of agricultural commodities is more than the import value. However, ever since, India became signatory to WTO global trade pact, the proportion of agricultural exports to total national exports were declining. Plantation commodities which formed a sizable share of exports have also been on the decline since the liberalisation regime. The tariff and non tariff barriers have impacted the domestic price, farm income and export prospects adversely, in the case of the most of the plantation crops. COVID 19 pandemic, climate change, volatile prices, rising costs and several other biotic and abiotic stresses have worsened the performance further. The impacts include social and ecological dimensions apart from the direct economic impacts. The sector employs roughly 25 lakh people directly, and is the major source of livelihood for them. Most of the plantation crops are grown in the ecologically fragile landscapes and the land use and management changes impact the ecosystem. These crops respond in a mixed manner to different policy and stresses, across time and space. For instance, Tea in South India fared comparably better than in N India, where severe short fall in production is reported, in 2019-20. The impacts of COVID 19 pandemic is expected to impact coffee exports, where 75 per cent of domestic production is exported. After a long distress spell for natural rubber growers, the prices show a positive trend, owing to rising demand on health care sector and biotic stresses in major growing centres in Thailand. Generally the pandemic has adversely impacted the plantation sector due to labour supply challenges, supply chain disruptions, skewed consumption and cash flow and logistic issues. The impacts of these on the economy of the South Indian states are much higher. Considering this Government of Kerala have initiated action to revise the laws, thus allowing

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intercropping in plantations, mainly with food crops and promote farm diversification, for risk management. The proposed modification would also permit plantations to diversify into dairy and poultry farming and horticultural crops.

The signing of WTO and several regional and preferential trade agreements over the years have generally acted against the interest of domestic producers, though the magnitude of impact vary across crops and regions. The theme for discussion in the conference was intended to focus on international trade in agriculture products with special emphasis on plantation crops. Twenty papers were received for consideration for discussion in the conference, in response to the call. Four papers were accepted for full length publication. The decision for full length publication was taken basically taking the criteria of appropriateness to the topic, methodological vigor and regional/crop balance. Twelve were accepted in the abstract form. Three papers were rejected as they do not contain any analysis and were describing known facts. One paper was withdrawn by the authors.

The papers dealt with plantation crops like coffee, tea, coconut, cashew, oilseeds and spices, bamboo, date palm and food crops like potato.

Singh *et al.* in their paper on comparative advantage, competitiveness and performance of India`s foreign trade, have analysed the trade in major agricultural commodities focusing on spices export. This paper gives an overview of the country`s global trade behaviour of agricultural commodities. Generally all the agricultural commodities were showing positive trend in trade with high inter-year variability. The growth in value of export was more than that of import for all the crops except pulses, vegetable oils, fresh fruits, cashew, cocoa products and raw jute. The export-import balance in spice sector was found to be slightly unfavourable, i.e., dominance of export over import. A more specific analysis of trade in plantation crops by M. Areef *et al*., to analyse the growth rates and instability indices of area, production, yield and exports of cashew, coffee and tea by employing the Markov Chain Approach on the direction of trade during 1995-96 to 2018-19. The area, production, yield and export share of these commodities show significant and positives growth rates. The most stable importers of cashew are identified as Saudi Arabia and U.S.A, for coffee, Russia and U.S.A; and for tea it is Russia and Iran. The authors suggest policy interventions to retain the market share in the unstable importers like Japan, Netherlands, Belgium, Germany, Italy and U.K.

Spices, that bring flavour and value addition to the food, has been a major attraction of global trade ties with India. Deepika Joshi and O.P. Singh focus on the export of major spices from India. Though most of the spices have registered high growth in export in value terms, the growth in quantity was not impressive in the case of some of the spices. Only very few markets like Canada (black pepper), U.K. (chilli), Bangladesh (turmeric), UAE (cumin) and Malaysia (coriander) have retained their share in imports from India. Surprisingly it is the traditional markets for Indian spices that have come out as the most unstable importers. India is likely to lose most of its traditional markets and hence there is a need to explore new markets while trying to maintain the share in traditional markets. The authors underline the necessity for sharp changes in policy and planning of the development process in spices export sector. Vinayak S. Hosamani and C.M. Thyagaraj also attempt an analysis on the economic performance of spices in India. The paper by N. Lalitha and Soumya Vinayan focuses on black pepper, the King of spices. They analyse the recent trends in production, imports and exports of black pepper in India in general, focussing on Sri Lanka and Vietnam (as a special case of Free Trade Agreements). The crop assumes significance on account of its economic, social, historic political aspects. Malabar Coast of Kerala, parts of Karnataka and Tamil Nadu are the primary producers of pepper, accounting for nearly 94 and 95 per cent of the total area under pepper and production, in the country. Being mainly small holder mixed crop estates, income from black pepper cultivation forms a major source of livelihood for the small and marginal farmers. Besides India, the other main pepper producing countries are Vietnam, Indonesia, Brazil, Malaysia, and Sri Lanka. Black pepper production in India is facing challenges due to biotic and abiotic forces. The economic integration through free trade agreements facilitates cheaper imports because of the preferential trade duty concessions extended to the trading partners. Vietnam with a huge production capacity is exporting through Sri Lanka, taking advantage of the preferential tariff rates. The authors argues for policy interventions, specially on tariff rates, to check cheaper imports, to sustain the farming

Indian beverages, coffee and tea have been occupying a significant position in the export baskets. The paper by Arghyadeep Das *et al.* on performance and determinants of export of coffee from India, post-WTO, have analysed the trade performance of coffee from 1994 to 2019 by employing appropriate statistical tools. Nearly three-fourth of coffee produced in India is exported and the country ranks fifth in total global coffee exports. But, share of coffee export in total agricultural export from India shows a decreasing trend. However, the quantity of export denote positive and significant growth rate (except during 2000-01 to 2008-09). The paper identifies international price, exchange rate and lagged production nature of coffee as the major determinants of coffee exports. The paper on price integration of arabica and robusta coffee analyses the impact of 1990s market liberalisation policies on relative prices. Cointegration and causality estimates revealed that the Arabica and Robusta prices were cointegrated and Robusta prices affected Arabica prices. The price shocks as a result of high variation in production (10 per cent) and price from Robusta markets transmits to Arabica markets. Arabica prices adjusted 18 per cent and 5 per cent to converge towards long run equilibrium. Thus, the study concluded that the fruits of market liberalisation have borne and there is still room for improvement as speed of adjustment was very low.

In recent past, non-tariff measures (Sanitary and Phyto Sanitary measures, Technical Barriers to Trade, Special Safeguard Provisions, Country of Origin) are adversely affecting the trade prospects of many plantation crops, especially food crops. Most of the importing countries impose stringent standards on MRL for chemicals, traceability and food safety standards. There were reports of Small Cardamom being rejected owing to pesticide residues. Though tariff levels on beverages are within the stipulated WTO guidelines, the exports to many countries are affected by the Non-Tariff Measures. Indian coffee is rejected often because of traceability issues and adulteration and Indian tea is rejected mostly due to the misconception of presence of Anthraquinon. The paper analyse the impact of non-tariff measures on the domestic and export prices of beverages and the loss in revenue to the beverage industry of India.

India is one of the largest consumer of edible oil in the world with a total domestic consumption of 21.69 million MT (2019-20), depending heavily on imports. High imports often result in low domestic prices and resultant low domestic production. Jayanti Kajale presents a detailed analysis of the oilseed sector and trade flows and trade policies. While the tariff rates and oil imports have direct relation, domestic production and prices are not correlated with trade policy changes, i.e., tariff rate changes. This therefore indicates important role of domestic factors. The paper therefore suggests domestic policy measures for improving profitability of the oilseed growers and trade performance as well as overall performance of the oilseed sector. But, the paper by A. Indhushree and K.M. Shivakumar that discussed the implications of palm oil import on the Indian edible oil sector in terms of price, income and international trade, focusing on the industry and consumers, reports that palm oil imports had significant influence on the domestic edible oil sector. The responses in domestic production, consumer price, industrial income and government revenue were in the same direction as that of tariff and import price of palm oil. The import policy is mainly consumer friendly. Another paper on the same aspect by E. Revathi *et al.* raises concerns of recent global trade policy on oil palm due to its effects on the long term sustainability of India`s trade prospects on oil palm trade. Tariff on palm oil imports was raised in 2018 from around 15 per cent to 100 per cent resulting in a decline in its imports. Further in January 2020 it was moved from ‘free’ to ‘restricted’ list. As the largest importer of palm oil in the world, decreased demand due to COVID 19 effect has a low impact in the short run, but in the long-term these policies may affect consumer surplus adversely along with downward impact on economy. The authors argue for free trade to improve the overall welfare gains.

Coconut cultivation in South India, is the major source of farm income for the small and marginal farmers, especially in states like Kerala while cashew is promoted as a hardy crop in rainfed conditions and marginal lands. Shaikh Mohd Mouzam in his paper examines the changing patterns of international trade in four selected plantation commodities – desiccated coconut, fresh coconut, raw cashew nut and cashew nut kernels. India enjoys significant comparative advantage over major four competitors of fresh coconuts and Vietnam in the EU market for cashew nut kernels. Among major importing countries, Japan (167), US (12) and EU (69) have imposed non-tariff measures notifications in the recent past, which suggests the need for stakeholder awareness creation on food, ecological and social safety factors in production and post production aspects.

Conventional approach for assessing the economic performance of agricultural crops was based on the direct tradable benefits. Global efforts to minimise the climate change effects have lead to several international agreements and launch of economic policy instruments like carbon trading. The paper by V. Karthick approaches the plantation economy, from an ecosystem approach, highlighting the carbon sequestration level and value of ecosystem services provided by these crops. The prospects of improving the revenue from plantations through carbon trading, while contributing to climate change mitigation efforts is discussed. The paper quantify the monetary value of ecosystem services provided by the species, based on the data collected from nine years old Melia plantations. The total monetary value of carbon sequestrated was Rs. 38,052.67 from one hectare and total oxygen released by the trees was 24.93 tonnes of oxygen/ha/year. The total monetary value of water regulating services was calculated as Rs. 62.4 and the monetary value of nutrient recycling service was Rs. 6510.95. Thus total economic value provided by the plantation is Rs. 6,70,496. The attempts to value the ecosystem benefits from plantations and efforts to generate income through trading opens up way to improve the income from this sector.

Bamboo trade plays a vital role in ensuring the livelihood of two billion of rural people globally and it is a major crop in the NE India. Jeemoni Gogoi *et al.* analyses bamboo trade status and reports steady increase in area, production and productivity and export of bamboo from the country. The growth in value of import was recorded twice that of the export value. India is a net importer of bamboo products. The authors suggests rural capacity building for employment and income generation in products like bamboo shoots, seats of bamboo and bamboo mats.

Dates are preferred world over, as a nutritious fruit. India is a major importer of dates. The paper by S. M. Jainuddin *et al.* examines the international trade of dates, analysing the data from 52 countries distributed across six continents, during the period from 2000-01 to 2015-16. Annual growth of exports and imports of dates was around 4.80 per cent and 4.78 per cent respectively. More than 85 per cent of the dates were exported by only six countries. The USA, Israel, Netherlands, Germany, France, Jordan, Saudi Arabia, Egypt, Pakistan and Niger have comparative advantage in exports of dates whereas UAE, Tunisia and Iran have comparative disadvantage. The study suggests dates exporting countries to establish a multilateral trade relationship with high value European markets to improve their terms of trade.

Potato, accounting for 27 per cent of the total production of vegetables in the country, is one of the most widely consumed tuber. So the high price volatility of the crop often gains public response, either from producers or consumers. The paper by Rohit Kumar *et al.* examines the domestic price behaviour and the export performance of major potato exporting countries and highlights the case of comparatively low export competitiveness of Indian potatoes.

SOME OBSERVATIONS AND SUGGESTIONS

1) Though net export earnings from agricultural products are on the rise, over a period of time, it is to be noted that the share of agri exports to total exports from the country is on the decline. India have the comparative edge in export potential in many of its products, it is important that the opportunities are properly utilised through appropriate policy efforts. It is a matter of concern that we are losing the import share of many commodities of traditional consumers of Indian products. There should be focussed study as to the reasons and remedies to restore the lost glory. Non-tariff barriers, than tariffs, are emerging as major challenge in global trade. There is need for effective designs for creating awareness and ensuring action towards cleaner production and postharvest management protocols.
2) Most of the papers were applying the same tools in analysis of trade performance (growth rates and Markov Chain Analysis) and the policy prescriptions are very general and indicative only. It will be appropriate if the society can organise training workshops on research approaches on market analysis and policy development.
3) Some of the very important plantation crops (natural rubber for example) as well as aspects (plantation labour, legal status, ecological impacts) are not mentioned due to non receipt of papers.

Indian Journal of Agricultural Economics
Vol. 75, No. 4, October-December 2020

OBITUARY

Dr. B.D. Dhawan (1938-2020)

The Indian Society of Agricultural Economics deeply mourns the sad demise of Professor B.D. Dhawan on October 11, 2020 at the age of 82. He was an agricultural economist of national and international eminence and made outstanding contribution in the field of agricultural economics in general and irrigation development in particular. He was educated in Delhi, and did his post-graduate studies in the U.S. He obtained his Ph.D. in Economics from Washington University, St. Louis, U.S.A. in the year 1972. After serving some short stints with Eastern Economist and Institute of Public Opinion, New Delhi in 1960-61, Professor Dhawan joined the Institute of Economic Growth (IEG) in June 1961 and served the Institute with distinction for more than three and half decades. He headed the agricultural unit in IEG for many years. He superannuated in June 1998 at the age of 60. Professor Dhawan was a life member of the Society. He was associated with the society for a long time in one capacity or the other. He was a member of the Editorial Board of the Indian Journal of Agricultural Economics. Professor Dhawan's research is mainly concerned with irrigation development – role of irrigation in India's agricultural development; its potential, stability and equity; major and minor irrigation; surface and groundwater use etc. He raised the critical issues of groundwater depletion and other aspects long before researchers recognised these as potential problems. The range of issues and the depth of his analysis continue to inspire generations of scholars. He presided over the Fifty-seventh Annual Conference of the Society held at G.B. Pant University of Agriculture and Technology, Pantnagar (Uttar Pradesh) in 1997. The theme of his Presidential Address was "India's Irrigation Sector: Myths and Realities". He has published many books on irrigation and contributed numerous articles in national and international journals of prominence. Some of his important contributions include *Big Dams: Claims Counter Claims, Studies in Minor Irrigation* and *Irrigation in India's Agricultural Development: Productivity, Stability, Equity*. The grief of Professor Dhawan's loss is shared by his professional colleagues, office bearers of the Society and his large circle of friends.

Index to Indian Journal of Agricultural Economics, Vol. 75, 2020

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DOCUMENTATION

Errata to Vol. 75, No.2 (April-June 2020 issue of the Journal)

Page 186 under Abstract Last line the word ‘yi6eld’ should read as ‘yield’ and Institutional affiliation of Phanindra Goyari should read as ‘Visiting Scholar at Texas Christian University, U.S.A’. The word ‘Cuttak’ on pp.202,204-205 should read as ‘Cuttack’.

Errata to Vol. 75, No.3 (July-September 2020 issue of the Journal)

In the footnote to page 273 it may be added to read as ‘The above said paper is the outcome of the Major Research Project funded by UGC New Delhi’.

Dr. S.R. Sen Prize Award for the Best Book on Agricultural Economics and Rural Development Published in 2019-2020

The Indian Society of Agricultural Economics has instituted in 1996, under Dr. S.R. Sen Endowment Fund Prize Award Scheme, a biennial prize award of Rs.15,000/- for the best book/monograph on Agricultural Economics and Rural Development published by Indian authors under 45 years of age as on the date of publication of the book(s). Books that have made significant original contribution to theoretical and empirical studies in the field of agricultural economics and rural development are considered for the award. Edited books by authors are not considered for the Prize Award. The selection of the best book for prize award is done by a Screening Committee and the Jury constituted for the purpose.

Books published by Indian authors during the calendar year2019-2020 are being considered for the **Thirtheenth Biennial Prize Award.**

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The Indian Society of Agricultural Economics has instituted Professor Ramesh Chandra Agrawal Award of Excellence for contribution to Agricultural Economics in 2004. The award, to be given biennially, is given to an Indian scholar who has made significant outstanding contributions to theoretical or empirical studies in the field of Agricultural Economics.

The award will consist of a citation and a cash prize of Rs. 25,000. Nominations are being invited for Eighth Biennial Award. A four member jury of eminent scholars will select the awardee. The name of the Eighth awardee will be announced and the presentation will take place at the 81st Annual Conference of the Indian Society of Agricultural Economics to be held in November/December 2021.

The Indian Society of Agricultural Economics will administer the award.

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