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Agri -Tech E- commerce based startups role in enhancing the farmers income in Karnataka (India)

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Abstract

As India's ambition to become an advanced economy Viksit Bharat vision with GDP expanding from $3.4 trillion to $30 trillion by 2047, the centenary of India's independence. This will be achieving through introduction and popularization of digital mode of transactions in general and agriculture in particular. India is an agrarian country and economy is based on the agriculture and this sector will be profitable by using new digital models. In this backdrop a study was carried out in Karnataka state to access the role of startups in enhancing the farmer's income. For purpose of the study 6o startups farmers and 60 APMC farmers were directly interviewed and used various statistical models to know the status. The study reveals that the shortest channels of marketing provide higher price to producer's in consumer's rupee but it was rarely in practiced. However, startups of agri -tech provided higher percentage of producer's share in consumer's rupees due to very less involvement of middlemen and it is confined up to only vegetables crops. The drawback of APMC can be removed by the innovations of e-commerce, e-trading, e- marketing, agri -tech startups in present digital era. The study also finds so many interesting observations and on the basis it is expected to agri-tech model will be most beneficial for the farmers if constraints are addressed. Government supports will be helpful in providing the speed of adoption and increase in economic conditions of the farmers in future.

Keywords: Agritech, E- commerce, Startups, Enhancing, Farmers, Income, Karnataka, India

Introduction

As India's ambition to become advanced economy (Viksit Bharat) vision with GDP expanding from $3.4 trillion to $30 trillion by 2047, the centenary of India's independence. The goal encompasses economic growth, innovation and technology, social progress and environmental sustainability in all the sectors. Where agriculture is India's important sector contributes India's GDP of about 15% in FY23, that has shrunk over time from 35% in 1990-91. Eventhough it is not a minimal number to neglect for a country like India where 47% of the total population (Economic Survey 2022-23) is dependent on agriculture for livelihood where increasing the farmers per capita income is important for prosperous India. According to FAO, the potential of different emerging technologies (AI, big data, satellite technologies, drone technology, IoT, GIS, GPS, remote sensing, cloud computing etc. needs to leverage for solving the existing challenges faced by the agriculture sector. Where startups play a important role in promoting such innovations and technology, they have come to the aid of stressed farmers and answering to the problems of India agriculture. The startups moved have also moved a step forward and now have connected the farmers both backward and forward linkages and solving all the problems exist in the sector with their innovations.

E-commerce Agri-tech startups are an agri-marketing platform that connects farmers to business, solving one the toughest supply chain problems through technology. It connects vegetables and fruits farmers directly with businesses. At one end, helps farmers get better prices and deal with consistent demand and on another end, it helps retailers/customers to source fresh vegetables at competitive prices directly from farmers. Agr-itech startup does this effectively at lower cost, better speed and large scale using integrated supply chain powered by technology, data science, infrastructure, logistics and cold storage facilities. Agri-tech startup's supply chain operation involves the following major stages: Forecasting, Pricing, Farmer Harvesting, Collection Centers, Fulfillment centers, Delivery to Retailer/Customers/Processing unit.

Agri-tech startup's supply chain process starts with weekly forecasting; where the sales team publishes the customers growth plans for the week. Analytics combine growth plan with historic demand data and market conditions to prepare the weekly sales and procurement forecast at SKU (Stock-keeping Unit) level. The forecasting is crucial stage for them as it helps them in purchase planning to reduce wastage and it also helps in planning the supply chain in much more efficient way. Once the forecast is done, the next step involves the procurement team which goes on to give weekly indent to the farmers based on the existing farmer harvest calendar. Two days before the actual delivery date based on the existing market condition such as availability and price fluctuations, the procurement forecast gets revised once again. After it's revised, the procurement team again goes on to re-issue indent to the farmers to re-confirm it once again. The next step involves setting prices where product prices are collected from various markets, a

day before the delivery date. This price information is then used to set the purchase and selling price simultaneously to avoid price risks. Based on the indent, the farmer harvests the produce, grades as per startups quality standards and brings it to the nearby collection center. Once the product arrives at collection centers, the items are checked for quality, then weighed and transferred to crates in front of the farmer to ensure transparency. The farmer gets a receipt immediately and the money is transferred to his bank account in 24 hours. The items are then batched and loaded into truck enabled with real time tracking. Items from multiple collection centers arrive at fulfillment centers and are moved into inventory. Items are batched according to distribution center wise and as per the customer demand using queuing technology and this ensures huge volumes are processed without any error. Items are picked and packed as per customer orders. Mini trucks arrive at distribution centers early morning and items are loaded route wise into the vehicle. Mobile phones are issued to drivers/ gig workers/delivery boy to manage the deliveries. On the way back, the driver collects empty crates and cash from the customers and deposit the same to the distribution centers and thus completing the supply chain. If procurements exceed the demands, then that excess procurement sent to the 5K (Storage capacity) mega cold storages.

Hence, keeping these facts in view, an attempt has been made to access the *Role of Agri-tech (E- Commerce based) Startups in enhancing the Farmers Income in Karnataka. The broad* objectives are hereunder-

1. To find out the role of start-ups in uplifting the farmer's income in terms of producer's share in consumer's rupee of the major horticultural crops.
2. To spot out the impediments faced by farmers in using e-commerce in agriculture.

Methodology

Bengaluru district of Karnataka was purposively selected as a study area considering that the concentration of agri-tech startups were highest in this state especially in the metropolitan city of Bengaluru of about 27 percent. Many agri-tech startups have its headquarters at Bengaluru though it operates all over country, hence it is called the hub of agri-tech startups and IT sector. For the purpose of study 60 farmers were selected from those who are using agri-tech startups to sell their produce. Primary data was collected personally by interviewing each respondent through pre-tested schedules. The schedule was prepared according to the needs of the study and pretesting of the same was done before interviewing. Secondary data were also collected from Ministry of Agriculture and farmers welfare, NASSCOM, Department of Commerce and Industries, Government of Karnataka regarding agri-tech startups. For analysis of collected data following tools were applied for worked out the role of startups in uplifting the farmers income in terms of producer's share in consumer's rupee of the major horticultural crops. To estimate the producer's share in consumer's rupee from agri-tech startups through identify the marketing channels involved, various marketing costs, marketing margins involved from producers to consumers for that. Marketing costs were worked out by using the formula.

$$C=C_f+C_{m1}+C_{m2}+\ldots\ldots+C_{mn}$$

Where,
C = Total marketing cost of the commodity
C_f = Cost paid by the producer from the time the producer leaves the farm till he/she sells it.
C_{mn} = Cost incurred by middlemen in the process of buying and selling the commodity. Marketing Margins Marketing margins represents the difference between total payments (costs+ purchase price) and receipts (sale price) of the middlemen (nth agency). The marketing margins of the nth middlemen will be worked out by using below mentioned formula.

$$MT=\sum_{i=1}^{n}(Si-Pi)/Qi$$

Where,
MT = Total marketing margin
S_i= Sale value of a product paid by i^{th} firm
P_i= Purchase value of the product paid by i^{th} firm
Q_i= Quantity of the product handled by i^{th} firm
Price Spread is the difference between price paid by the consumer and the price received by the farmer for an equivalent quantity of farm produce. The formula

$$P_s=C_f-P_f$$

Where,
P_s = price spread
C_f = price paid by consumer
P_f = price received by the farmer

Similarly, the producer's share in consumer rupee worked out by using

$$Ps=\frac{\text{net price received by the tribal farmer}}{\text{price paid by the consumer}}X100$$

The impediments faced by farmers in using e-commerce in agriculture was worked out by using Friedman test was to spot the impediments faced farmers to adopted agri-tech startups to market their produce and also to spot the impediments faced the agri-tech farmers to use APMC to market their produce for comparison. For the purpose 60 additional APMC farmers were also interviewed. The Friedmen test was applied for the purpose, in this test a two-way ANOVA by ranks test was applied to identify the most severe constraints faced by the farmers with the following formula,

$$\chi^2_{r1}=\frac{12}{Nn(n+1)}\Sigma R_1^2-3N(n+1) \text{ at df} = n-1$$

Where,
N= Number of Respondents,
n= Number of broad constraints,
ΣR_1^2= Row ranks summed up in each column, squared and then add

Results and Discussion

The role of startups in uplifting the farmers income in terms of producer's share in consumer's rupee of the major

horticultural crops. Many farmers in India face challenges in reaching the right markets and obtaining fair prices for their produce. Agri-tech startups have built platforms that connect farmers directly with buyers and to the business, that cuts out the middlemen and ensuring a more equitable distribution of profits. They achieve this through mobile and web-based applications. This not only boosts farmer's income but also promotes transparency in the agricultural supply chain unlike in APMC markets. This was calculating by analyzing the marketing channels at both agri-tech and APMC with its marketing costs, marketing margins, and producer's share in consumer's rupee and even price spread involved while marketing of major horticultural crops found in the study area are ridge gourd, beans, brinjal, beetroot. The main marketing channels involved in agri-tech and APMC are:

Agritech

Producer → Agritech startup → Consumer

APMC

Channel I- Producer → Consumer

Channel II- Producer →Retailer → Consumer

Table 1: Marketing costs, Marketing margins and Producer's share in Consumer's rupee involved in the agri-tech channel of marketing.

SL. No.	Market functionaries	Ridge gourd Rs./Q	Beans Rs./Q	Brinjal Rs./Q	Beetroot Rs./Q
Producer					
1.	Net price received by producer	2430	3630	3430	2730
2	Marketing costs incurred by producer	70	70	70	70
2.1	Loading and unloading charges	10	10	10	10
2.2	Bag/ crate cost	-	-	-	-
2.3	Transportation cost	50	50	50	50
2.4	Grading at farmer level cost	10	10	10	10
2.5	Storage charges	-	-	-	-
2.6	Miscellaneous costs	-	-	-	-
3.	Sale price of producer/ agri-tech's purchase price	2500	3700	3500	2800
4.	Post-harvest losses (%)	8	6	5	5
Agritech Startup					
5.	Marketing costs incurred by agri-tech start-up	266	266	266	266
5.1	Loading and unloading charges	10	10	10	10
5.2	Grading charges	10	10	10	10
5.3	Transportation cost	50	50	50	50
5.4	Packaging cost	50	50	50	50
5.5	Logistics and cold storage cost	100	100	100	100
5.6	Advertisement cost	10	10	10	10
5.7	Delivery charges	30	30	30	30
5.8	Handling charges	6	6	6	6
5.9	Charity (as optional)	5	5	5	5
6.	Agri-tech's margin	3034	4034	2734	2934
	Subtotal (5+6)	3300	4300	3000	3200
7.	Sale price of agri-tech/ consumer price (3+Subtotal)	5800	8000	6500	6000
8.	Post-harvest losses (%)	5	5	5	5
9.	Total marketing costs	336	336	336	336
10.	Total marketing margins	3034	4034	2734	2934
11.	Total post-harvest losses (%)	13	11	10	10
12.	Marketing efficiency	0.72	0.83	1.11	0.83
13.	Producer's share in consumer rupee (%)	41	45	52	45
14.	Price spread	3370	4370	3070	3270

The table 1 clearly indicates that the Marketing channels of startups in the study area reveals the producer's share in consumer's rupee was 41% for ridge gourd which means every rupee spent by the consumer out which 41% share goes the producer and rest to the intermediary i.e., agri-tech here takes as its margin and in similar lines 45%, 52%, 45% for beans, brinjal, beetroot respectively.

APMC's channel I involve only two stakeholders i.e., producer and consumer are one of the shortest marketing channel in the marketing with no intermediaries involved of direct marketing with their marketing costs and margins involved in the process of marketing the produce from farmers to the end customer. In channel II one intermediaries retailer involved.

Table 2: Marketing costs, Marketing margins and Producer's share in Consumer's rupee involved in the APMC's channel I.

SL. No.	Market functionaries	Ridge gourd Rs./Q	Beans Rs./Q	Brinjal Rs./Q	Beetroot Rs./Q
Producer					
1.	Net price received by producer	1320	2400	2220	1740
2.	Marketing costs incurred by producer	180	300	280	260
2.1	Market fee/commission	150	270	250	230
2.2	Transportation costs	20	20	20	20
2.3	Storage charges	-	-	-	-
2.4	Miscellaneous costs	10	10	10	10
3.	Sale price of producer/consumer price	1500	2700	2500	2000
4.	Post-harvest losses (%)	8	6	5	5
5.	Producer's share in consumer's rupee (%)	88	88	88	87
6.	Price spread	180	300	280	260
7.	Market efficiency	7.33	8.00	7.92	6.69

The table-2 reveals that the producer's share in consumer's rupee was 88% for ridge gourd, beans, brinjal and 87% for beet root which means every rupee spent by consumer out of that 88% share goes to producer and rest was consumed as marketing costs involved by the farmer.

Table 3: Marketing costs, Marketing margins and Producer's share in Consumer's rupee involved in the APMC's channel II.

SL. No.	Market functionaries	Ridge gourd Rs./Q	Beans Rs./Q	Brinjal Rs./Q	Beetroot Rs./Q
Producer					
1.	Net price received by producer	1320	2400	2220	1740
2.	Marketing costs incurred by producer	180	300	280	260
2.1	Market fee/commission	150	270	250	230
2.2	Transportation cost	20	20	20	20
2.3	Storage charges	-	-	-	-
2.4	Miscellaneous cost	10	10	10	10
3.	Sale price of producer/ retail purchase price	1500	2700	2500	2000
4.	Post-harvest losses (%)	8	6	5	5
Retailer					
5.	Marketing costs incurred by retailer	135	135	135	135
5.1	Market fee	100	100	100	100
5.2	Transportation cost	20	20	20	20
5.3	Packaging cost	10	10	10	10
5.4	Storage cost	-	-	-	-
5.5	Miscellaneous cost	5	5	5	5
6.	Retailer margin	865	1165	865	865
	Subtotal (5+6)	1000	1300	1000	1000
7.	Sale price of retailer/consumer price (3+subtotal)	2500	4000	3500	3000
8.	Post-harvest losses (%)	10	10	10	10
9.	Total marketing costs	315	435	415	395
10.	Total marketing margin	865	1165	865	865
11.	Total post-harvest losses (%)	18	16	15	15
12.	Marketing efficiency	1.11	1.50	1.73	1.38
13.	Producer's share in consumer's rupee (%)	52	60	60	58
14.	Price spread	1180	1600	1280	1260

The above table reveals that the producer's share in consumer's rupee was 60% for beans and brinjal, whereas 52% and 58% for ridge gourd and beetroot respectively. In other channels the producer's share in the consumer's rupee were 26%, 30%, 29%, 29% for ridge gourd, beans, brinjal, beetroot per quintal respectively which is less compared other APMC marketing channel due to many middlemen involvement in other channels identified.

It was observed that the losses at agri-tech level due to transportation, handling, storage etc., are 5% for all the crops. And the total post-harvest losses accounts for 13%, 11%, 10%, 10% for ridge gourd, beans, brinjal, beetroot respectively. In APMC total post-harvest losses were worked out 28%, 26%, 25%, 25% for ridge gourd, beans, brinjal, beetroot respectively.

The details of marketing activities or functions involved in reducing the post -harvest losses in an agri-tech e-commerce startup. At producer level grading or sorting are done at the farm level based on the requirements of the startup. Transportation of produce from farm to startups by using trucks, tempos. For packaging newspapers, gunny bags crates and green leaves are used as coverage. There is no storage at producer level because the quantity is fixed before a day of procurement. At agri-tech startup the produce collected from the farmers are transported to distribution center from the farmer collection center after grading again as per the quality specifications in front of farmer. The distribution centers transport the produce according to the orders of the customers via online with its logistics facilitated trucks, through the gig workers called delivery

boy/girl after packing the item according to the order using cardboards, biodegradable seal tape, bubble wrapper etc., with proper labeling. These facilities ensure the quality and efficiency in handling and reducing the post-harvest losses. The losses are significant in APMC with compared to agri-tech.

Constraints

Though agri-tech startups have all innovative solutions yet farmers many face impediments to adopt such technologies. Hence, this study reveals the problems faced by the farmers in adoption of agri-tech startup and its need because of existing problems in the AMPC markets faced by farmers by comparing both the models of marketing. The findings are presented in table No. 4, table No. 5, and table No.6. Nothing will change if don't address the problems of farmers. The farmers refused to adopted agri-tech startups due the challenges that exists with agri-tech start -up identified as start-ups follows high standard grading such maintenance of high standard is difficult to the farmers there is no case of accepting the low quality produce at less price, the quantity which is fixed by the agri-tech before the day of procurement that's a agri-tech choice not the farmers, illiteracy of the farmers about electronic devices to utilize the agri-tech's startups services, and few farmers are not even aware of agri-tech startups, fear of exploitation by private company because it is priority of profit oriented mindset than the welfare of farmers, can change rules and regulations as per its convenience, price fluctuation as the markets demand and competition, limited number of farmer collection centers, farmers mindset to adopt new technology due to lack awareness, high transportation costs are main challenges identified in adopting agri-tech startups in the study areas.

Table 4: Constraints faced by APMC farmers in adoption of e-commerce agri-tech model of marketing.

Constraints	Mean Score
High standard grading	9.46
Specified quantity	8.48
Illiteracy about devices	3.76
Lack of awareness about agri-tech start-up	2.22
Fear of exploitation by Pvt.. company	7.61
Price fluctuation	6.93
Few farmers collection centres	4.84
Slightly higher price than market price	4.83
Refuse to technology adoption	4.67
High transportation cost	2.22

Table 5: Constraints faced by agri-tech farmers in using traditional APMC marketing model.

Constraints	Mean Rank
Entry and exit barriers	8.51
Huge APMC commission and taxes	14.73
(Lacks remunerative prices in the market)Less market price	13.95
Time consuming auctions	8.61
Delayed payments	10.18
Undue deductions in weighing	10.65
Frequent/rapid price fluctuations	12.48
Many middlemen involved	12.72
Lack of market information system	6.08
Monopolistic and cartelization of traders	5.82
Poor transportation and storage facilities	6.25
Non uniformity of APMC (varies from state to state)	1.82
Low adoption of contract farming	3.35
Substantial post-harvest losses	3.23
Political influences	1.62

Table 6: Test statistics of Friedman test

Test Statistics			APMC farmers	Agri-tech farmers
N			60	60
Chi-Square			374.26	811.12
Degree of freedom			9	14
Asymp. Sig.			.000	.000
Monte Carlo Sig.	Sig.		.000	.000
	99% Confidence Interval	Lower Bound	.000	.000
		Upper Bound	.000	.000

The above tables no 3, 4 and 5 shows that both farmer groups were found faced different constraints in which more constraints were faced by Agri- tech farmers in using APMC market. Chi- Square indicates the significant difference between the constraints, more the value indicates the more significance. Between APMC and Agri- tech, the more significance was seen with agri-tech farmers that is 811.12 and APMC farmers with.26. Asymptotic

significance indicates both the groups are statistically significant ($p< 0.05$).

Conclusion and Suggestions

The above discussions indicate that in APMC channel-1 and channel-II was beneficial for the producers share in consumer's rupee but these channels are rarely found in the APMC markets in the sampled areas. The study further reveals that agri-tech channels having producer's share in consumer rupee was high and it varied between 41 per cent ridge gourd to 52 per cent brinjal mainly due to less involvement of middlemen. Thus, the drawback of APMC in the studied area may be tackle with the innovations of e-commerce, agri-tech startup in this present twenty first century era i.e. digital era. It was expected that agri-tech's model will be win-win situation for the farmers and consumer's in the future. On the basis of various constraints involved in agri-tech model it is suggested that government should provide support for this type of startup. At present agri-tech statups give emphasis on the procurement of vegetables in study area but there is need to focus on other crops also for the betterment of farmers socio economic conditions.

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