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A Study on Performance of Regulated Markets in Tamil Nadu

S. Surender^{1*}, P. Balaji¹ and K. R. Ashok²

¹Department of ARM, Tamilnadu Agricultural University, Coimbatore, India.
²Department of CARDS, Tamilnadu Agricultural University, Coimbatore, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i930650

Editor(s):

(1) Dr. Roxana Plesa, University of Petrosani, Romania.

Reviewers:

(1) Shanta Rajapaksha Yapa, Cardiff Metropolitan University, Sri Lanka.

(2) Jean Adanguidi, University of Abomey-Calavi, Benin.

(3) Pardeep Kumar, University of Delhi, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/72695>

Original Research Article

Received 15 June 2021

Accepted 20 August 2021

Published 26 August 2021

ABSTRACT

The aim of the paper is to study the performance of regulated markets in TamilNadu. Regulated markets are essential for regulating and monitoring the financial and economic system thereby reducing market charges and providing facilities to producers and sellers in the market. At present in Tamil Nadu 284 regulated markets are functioning under 23 market committees to ensure fair prices to farmers produce. The primary data were collected by structured questionnaire to study the constraints faced by the farmers in regulated market and also the brain storming session were conducted between market committee, farmers, traders, FPO's(Farmer Producer Organisation), etc.. to improve the efficiency of regulated market. The secondary data were collected from District market committees. The tools used in this study are Percentage analysis and Garrett ranking method. The results shows that nearly 80 to 90 percent of Market fee collected outside, for the sale and purchase of notified agricultural produce would be affected due to the farm bill 2020 and this problems can be fairly rectified by some alternative measures or models in which market shops construction, Primary processing centres, etc.. will improve the performance of the regulated market. The major constraints faced by the farmers was high transportation cost.

*Corresponding author: E-mail: surendersubramanian1997@gmail.com;

Keywords: Performance; trends in arrivals; market fee collection; revenue models; garett ranking.

1. INTRODUCTION

A regulated market is one that is established by law for a single commodity or a group of commodities. State governments set up these markets under the APMC (Agricultural Produce Market Committee) Acts. This market is run by a market committee made up of representatives from the State Government, legal entities (such as the District Board), dealers, and farmers themselves. The government appoints the committee to oversee the market for a set length of time. The committee establishes market costs such as commissions and ensures that neither the buyer nor the vendor is represented by a 'dalal.' This eliminates unlawful deductions from the farmer's price and guarantees that the proper weights and measures are utilised. The committee is responsible for the licensing of brokers and weighmen and is empowered to punish anyone found guilty of dishonest and fraudulent practices. It hears all the complaints and in case of disputes, it arranges for arbitration. The chairman and Vice-Chairman of the Committee are from the farming community. The regulated market system has proved a good source of generating income for the marketing boards and this income is used for creating rural infrastructure. Regulated markets predominate in areas where commercial or non traditional crops are grown. Cooperative marketing and distribution and banking are also linked with the regulated markets [1-6].

The majority of India's marketable excess agricultural produce is sold outside the controlled market yard spaces, according to NSSO(National Sample Survey Organisation) data. Only roughly 40% or less goes to mandis in India, which has less than 6700 regulated marketplaces for its 14 crore agricultural households — 2284 APMCs (Agricultural Produce Market Committee) that operate 2339 primary markets and 4276 sub-market yards. There are 23000 rural haats, which operates as weekly markets on specific days. Small and marginal farmers have a limited marketable surplus to begin with, and due to a lack of institutional credit, they must sell to local traders who also act as seed and agrochemical dealers. In India, by March 2019, the e-NAM (electronic- National Agriculture Market) platform had registered 1.55 crore farmers/sellers, 68000+ commission agents, and 1.22 lakh traders/buyers, including 650+ FPCs/FPOs (Farmer Producer Company/ Farmer Producer

Organisation). However, inter-state trading through this portal has been dismally low, and farmers are not always able to secure MSPs (Minimum Support Price) through this channel.

In Tamil Nadu 284 Regulated Markets are functioning under 23 market committees to ensure fair prices to farmers thereby reducing the market charges and protecting the farmers from the influence of traders by creating basic infrastructure and marketing facilities. Every market committee has its own notified area and notified crop for the purchase and sale of that notified agricultural produce. Since regulated markets have established adequate infrastructure facilities, functioning of regulated markets and utilization of existing facilities to its fullest capacity is either low or negligible in certain regulated markets throw many challenges for effective use of available infrastructural facilities and successful functioning of the regulated markets in Tamil Nadu.

The concerns that are raised in states will lose revenue since market fee cannot be collected for the produce if traded outside the notified area for the notified crops [3-8]. Similarly, if the entire farm trade moves out of the regulated market due to this provision in the farm law, the concern is that, this will eventually end up the Minimum Support Price (MSP) based procurement system despite the fact that the government assured continuance of MSP based procurement system. Further, the facilities created under electronic-National Agriculture Market (e-NAM) may be underutilized /unutilized, if entire farm trade goes out of mandis. Also, the use of existing electronic facilities and their operations can also be affected as other than an individual can establish, manage and operate electronic trade and transaction platforms. Further, due to various provisions that lead to revenue loss to the APMCs(Agricultural Produce Market Committee) apart from creating competitive edge with private traders. These provisions, thus throw many challenges for the APMCs(Agricultural Produce Market Committee) and far reaching consequences on functioning and revenue generations of the regulated markets in Tamil Nadu. Under this context, no doubt, the present status of APMC(Agricultural Produce Market Committee) requires higher efficiency through creation of infrastructure facilities and manpower. So, the present study was carried out with the following objectives to address the challenges

faced by the APMC(Agricultural Produce Market Committee) in Tamil Nadu.

The specific objectives of the study are

- (i) To study the performance of Regulated Markets;
- (ii) To suggest suitable alternative revenue models for sustainability of Regulated Markets.

2. METHODOLOGY

2.1 Study Area

The study covered two APMCs (Agricultural Produce Market Committee) in state for assessing the functionality and financial implications of the regulated markets in Dharmapuri and Krishnagiri district by using the data collected from the records maintained by the district market committees and surveys.

2.2 Data

The study is based on primary and secondary data collected from the study area. The primary data were collected by structured questionnaire to study the constraints faced by the farmers in regulated market and also the brain storming session were conducted between market committee, farmers, traders, FPO's, etc.. to improve the efficiency of regulated market. The secondary data were collected from District market committees for the three year period ending 2020. (i.e., from 2017- 2020). Opinion surveys were also conducted in select market committees through brain storming sessions. Infrastructure requirement for establishing the PPC(Primary processing centres) with capacity based on the arrivals, investment requirement for creating PPC (Primary processing centres) with various capacity, working conditions of the facility, potential lessee, functioning of e – NAM (electronic- National Agriculture Market) were also gathered from each market committee secretaries and various stakeholders like farmers, traders, FPO's (Farmer Producer Organisation) during the focus group discussion.

2.3 Simple Percentage Analysis

Percentage is denoted by the sign percent, which simply means "per hundred." One percent (or 1%) is one hundredth of a total or whole number, and is computed by multiplying the total or whole

number by 100. The formula used to calculate percentage is: (value/total value) \times 100%.

2.4 Garret Ranking

This tool is used to identify the most significant factor which influences the respondent. In this method the farmers are asked to rank all the factors based on constraints which influences them the most. It is calculated by using the formula

$$\text{Percent position} = 100(\text{R}_{ij} - 0.5)/N_j$$

where, R_{ij} = rank given for i th variable by j th respondent

N_j = number of factors ranked by j th individual

Garret table is used to convert the percent position into scores. The score assigned by each individual for each factor is summed and total value and scores of mean value are calculated. The most significant factor will have the highest mean value.

3. RESULTS AND DISCUSSION

The results are purely based on the data provided by the District market committee of Dharmapuri and Krishnagiri District and the brainstorming sessions between the farmers, traders, market committees, FPOs, (Farmer Producer Organisation) etc.. and the sample farmers constraints during the selling of their produce in regulated market.

3.1 Performance Analysis of Regulated Market

The performance analysis of regulated market comprises of trends in arrivals, total market arrivals, notified crops, performance factors, market concentration, market density of each regulated market arrivals in Dharmapuri and Krishnagiri districts of Tamilnadu.

3.1.1 Trends in arrivals- district-wise and

Commodity arrivals is one of most important criteria for assessing the performance of the regulated markets and this measure is useful to understand the adverse effect of central new farm laws on revenue collection as no market fee can be collected for the produce that are marketed outside the market yard. Of the two districts selected regulated markets of Dharmapuri district handled, on an average,

more than 3,469 tonnes of agricultural commodities, while in Krishnagiri district regulated markets witnessed low market arrivals compared to Dharmapuri districts with an annual market arrival of 1805 tonnes. The annual pattern of arrivals showed that there were both high and low arrivals over triennium period in all the Market Committees.

However, there was not much increase in arrivals in the regulated market in these districts as evident from the share of arrivals in the marketable surplus of major notified commodities (Table 1). Further, we could not find any correlation between the arrivals and number of notified crops (Fig. 1). Though there are 16 regulated markets presently functioning under the selected market committees, the private traders' intervention in the transactions of commercial crops are dominant as evident from the production and quantity of market arrivals. Similarly, many studies proved the fact that one of the major constraints faced by farmers was high transportation cost to bring their produce to market when the production is low.

The notified crops in Dharmapuri and Krishnagiri district are Paddy, Cotton, Groundnut, Redgram, Coconuts, Horsegram, Tapioca, Potato, Castor, Varagu, Tamarind, Gingelly, Jaggery, Mochai, Samai as of 2019- 2020 data provided by both district market committee (Fig. 1). The trends in arrivals of notified commodities

had a negative change due to the transportation problems and Covid Crisis. The maximum amount of Tamarind crops are arriving in both the regulated markets.

3.1.2 Assessing the performance factors

There are a total of 16 regulated markets functional in these two selected districts. Maximum number of 874 villages are served by regulated markets in Krishnagiri district and around 499 villages are served by regulated markets in Dharmapuri district. Geographical area served by Dharmapuri and Krishnagiri regulated markets are 642.54 sq.km and 571.44 sq.km respectively. On average each regulated market in the country serves an area of 459 sq.km, the situation varies from state to state in terms of area covered per regulated market. National commission on agriculture had recommended that regulated market should be available within 5km radius. Accordingly the country needs 41838 markets but 27738 markets spread all over the country (21221 are primary and 6261 are terminal and wholesale markets). The average number of villages served by regulated market in Dharmapuri and Krishnagiri District are 71 and 87 villages which is very lower than all India average of 258 villages per regulated market. Hence this data reflects that there are more enough regulated markets available in the selected study area.

Table 1. Total market arrivals (in tonnes)

Market Committee/ Districts	2017-18	% Change	2018-19	% Change	2019-20	% Change
Dharmapuri	3781.39	36.33%	4064.24	39.04%	2563.79	24.63%
Krishnagiri	1134.25	20.94%	2342.05	43.23%	1941.31	35.83%

(Source: Dharmapuri and Krishnagiri District Market committee)

Dharmapuri and Krishnagiri District

■ Food crops ■ Pulses ■ Oilseeds ■ Fibre crops
■ Plantations ■ Tuber crops ■ Tree crops ■ Sugar crops

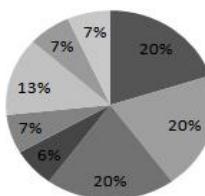


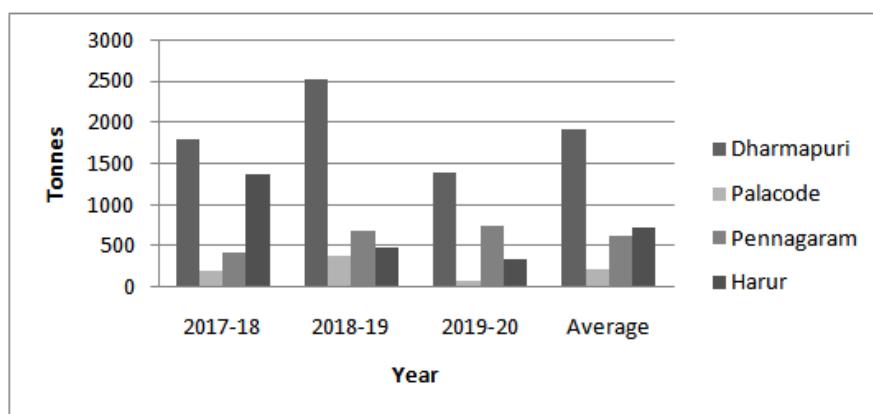
Fig. 1. Notified crops – district market committee wise

(Source: Dharmapuri and Krishnagiri District Market committee Annual administration Report 2017-2020)

3.1.3 Trends in arrivals and market density – district regulated market-wise

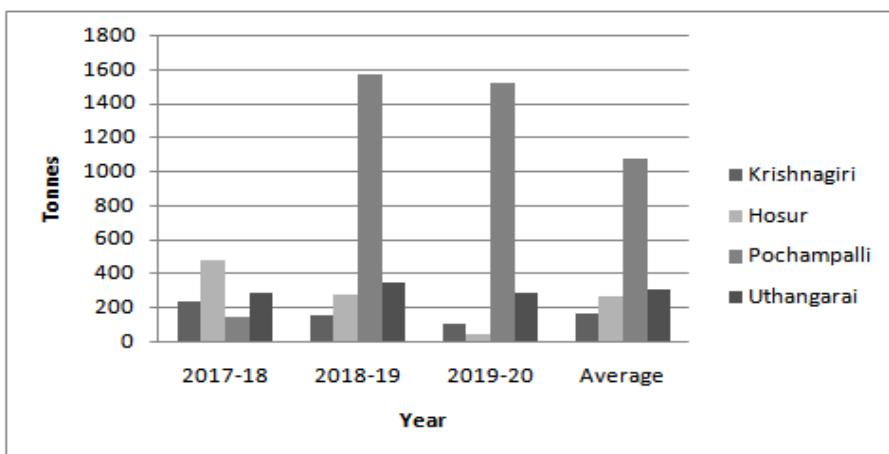
Market arrivals of notified and unnotified agricultural produce at regulated markets depends on the facilities available, location and transport-connectivity of the market. Therefore, improved market infrastructure helps in monitoring and controlling marketing losses. The fact was proven by many earlier studies. There were low market arrivals in four regulated markets in northern Karnataka due to improper

weighing of products and inadequate grading facilities [9]. In Tamil Nadu sales at the market increased significantly with an improvement in market facilities and with decrease in travel time from the village to the market [10]. Our estimates reveal that improvement in market facilities and increase in market density are facts remain for upward trends in commodity arrivals of notified crops in the market yards only in these two districts that led us to analyze market-wise trend in arrivals in each district in the following Fig. 2 and Fig. 3.



(Source: *Dharmapuri District Market committee*)

Fig. 2. Market arrivals in Dharmapuri district – regulated market wise (in tonnes) for the year 2017-2020



(Source: *Krishnagiri District Market committee*)

Fig. 3. Market arrivals in Krishnagiri district - regulated market wise (in tonnes) for the year 2017-2020

3.1.4 Trends in market fee collection for arrival inside the market yards

The market fee collected inside the market fluctuates over the triennium period ending 2020 with an average of 9.71 lakhs in Dharmapuri district. While Krishnagiri district collected an average of 3.39 lakhs with a slight increase and decrease over the triennium period ending 2020 (Table 2). These fluctuations were due to the production and productivity pattern of the farmers over the period of 3 years.

Likewise, the market fee collected inside the market yard in both Dharmapuri and Krishnagiri district for the triennium period of 2017-2020 were plotted in the graph that is represented in Fig. 4 and Fig. 5 respectively.

Dharmapuri RM of Dharmapuri district and Uthangarai RM of Krishnagiri district collects the maximum amount of fee inside the market yard when compared to all other regulated markets over the three year period.

Similarly Pappireddypatti, Kambainallur and Papparapatti in Dharmapuri district and

Kelamangalam, Kaveripattinam, Bargur, Denkanikkottai and Royakottai in Krishnagiri district have no market arrivals because they were functioning under rental premises and also they don't have any infrastructure facilities.

3.1.5 Trends in market fee collection for arrival outside the market yards for the year 2017-2020

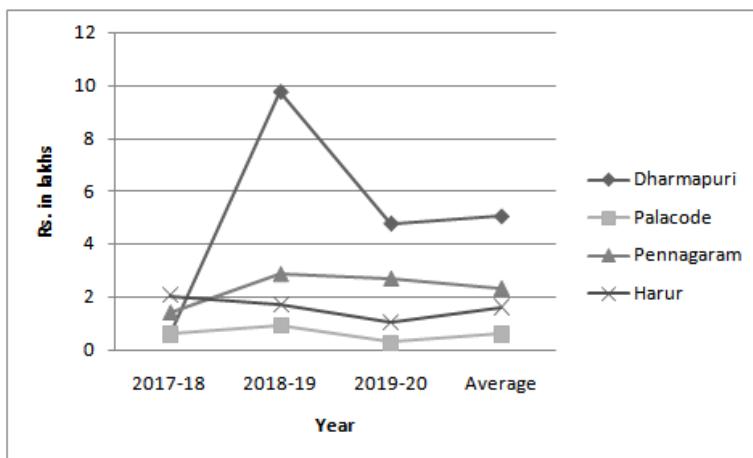
The market fee collected outside the market for trading notified agricultural produce were generated a revenue on an triennium average of 69.48 and 164.08 lakhs in Dharmapuri and Krishnagiri district respectively (Table 3). It contributes 80 to 90 percent revenue of the net present value to the regulated market of Dharmapuri and Krishnagiri district and shows an upward trend over the years.

The maximum amount of market fee collected outside the market yard in Harur RM and Krishnagiri RM of Dharmapuri and Krishnagiri district respectively shown in Fig. 6 and Fig. 7. Similarly the regulated market functioning under rental premises also generates revenue to the both the district.

Table 2. Market fee collected (Rs. in Lakh) inside the market yard for the year 2017-2020

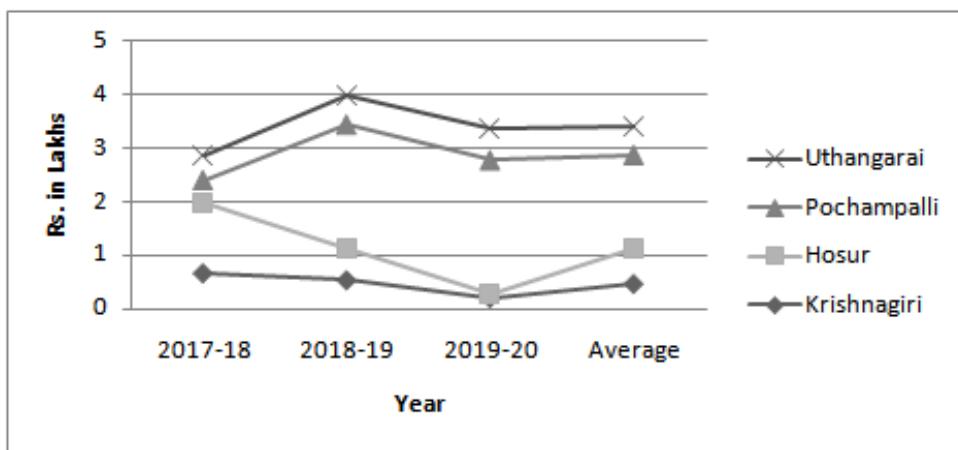
Market Committee/Districts	2017-18	% Change	2018-19	% Change	2019-20	% Change
Dharmapuri	4.81	16.5%	15.41	52.87%	8.93	30.64%
Krishnagiri	2.87	28.22%	3.96	38.94%	3.34	32.84%

(Source: Dharmapuri and Krishnagiri District Market committee)



(Source: Dharmapuri District Market committee)

Fig. 4. Market fee collected inside the market yard in Dharmapuri District market committee - regulated market wise (Rs. in Lakh) for the year 2017-2020



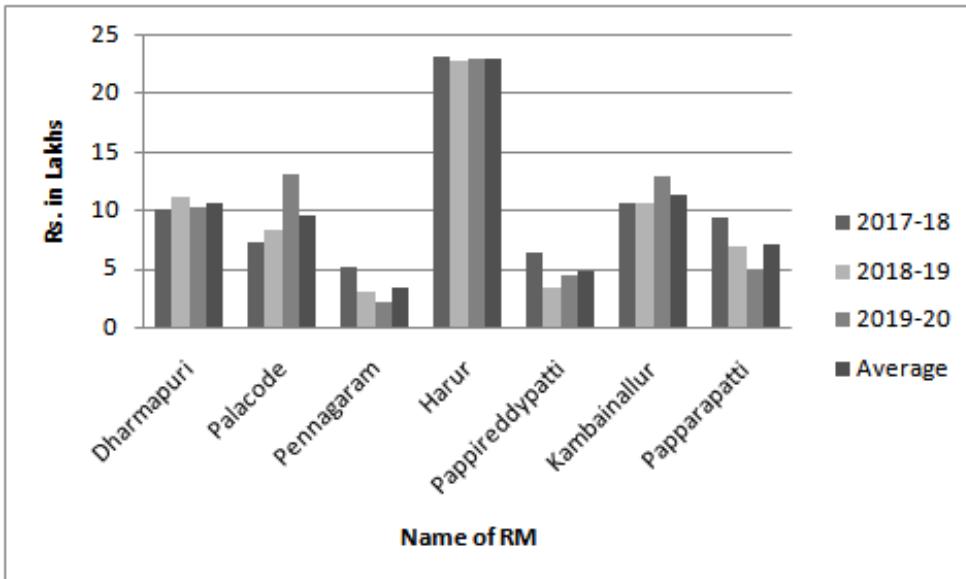
(Source: Krishnagiri District Market committee)

Fig. 5. Market fee collected inside the market yard in Krishnagiri District market committee - regulated market wise (Rs. in Lakh) for the year 2017-2020

Table 3. Market fee collected (Rs. in Lakh) outside the market yard for the year 2017-2020

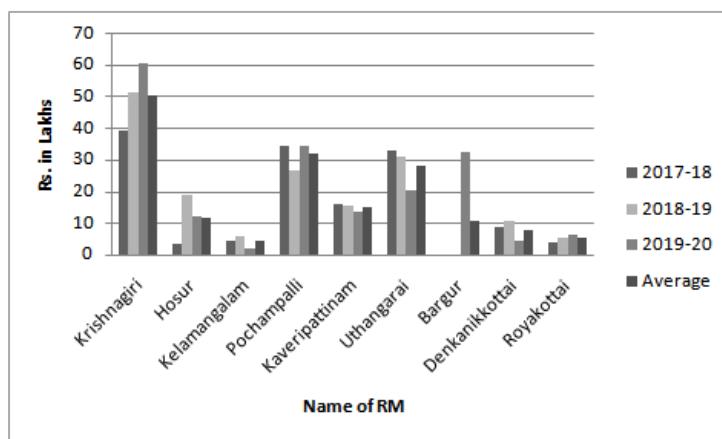
Market Committee/Districts	2017-18	% Change	2018-19	% Change	2019-20	% Change
Dharmapuri	71.79	34.44%	66.12	31.72%	70.53	33.84%
Krishnagiri	142.36	28.92%	164.48	33.41%	185.41	37.67%

(Source: Dharmapuri and Krishnagiri District Market committee)



(Source: Dharmapuri District Market committee)

Fig. 6. Market fee collected outside the market yard in Dharmapuri district - regulated market wise (Rs in Lakh) for the year 2017-2020



(Source: Krishnagiri District Market committee)

Fig. 7. Market fee collected outside the market yard in Krishnagiri district market committee - regulated market wise (Rs in Lakh) for the year 2017-2020

3.1.6 Percentage of regulated markets functioning in rental premises

There are totally 16 regulated markets in Dharmapuri and Krishnagiri district. Out of these 3 regulated markets namely Pappireddypatti, Papparapatti and Kambainallur are functioning under rental premises in Dharmapuri district and 5 regulated markets namely Keelamangalam, Kaveripattinam, Bargur, Rayakkottai and Denkanikkottai are functioning under rental premises in Krishnagiri district. Totally 50% of regulated markets are functioning under rental premises and 50% of regulated markets functioning in own buildings in Dharmapuri and Krishnagiri district.

3.1.7e – trading and infrastructure facilities in Dharmapuri and Krishnagiri district

e- trading facility provides an opportunity to farmers and traders for the sale of their notified agricultural produce through regulated markets but such facilities are available only in few regulated markets. Out of 16 selected regulated markets the facility is available only in Harur regulated market (2017- Present) of Dharmapuri district and there is no such e – trading facilities in all other regulated markets of Krishnagiri and Dharmapuri districts.

Also the infrastructure facilities that are presently available in regulated markets of Dharmapuri and Krishnagiri are listed in the Table 4. It comprises of total number of drying yards, godowns, cold

storage units and its capacity, and transaction sheds.

3.2 Financial Implications Due to Restriction of Market Area

The central farm laws namely (i) Farmer's Produce, Trade and Commerce (Promotion and Facilitation) Act, 2020; (ii) Farmers' (Empowerment and Protection) Agreement on Price Assurance and Farm Services, 2020; and (iii) Essentials Commodities Amendment Act, 2020 implemented recently also have some consequences on functioning of regulated markets in Tamil Nadu. These laws states that opening up of agricultural marketing outside the market mandis will create alternate marketing channels thereby reducing marketing/transportation cost and help the farmers in getting better prices. Further, the provisions under these laws provide the facilitative frame work for electronic trading and promote barrier free inter-state, intra-state trade of farmers produces. The farmers can enter into contract with agri-business firms, processors, wholesalers, exporters or large retailers for the sale produce at pre agreed price in order to transfer the risk of unpredictability from farmers to sponsors. Farmers can engage in direct marketing and that there is a third-party quality certification for monitoring and certifying the quality, grade and standards of farm produce and notification of registration authorities by the state government to provide electronic registration of the pre agreed contracts. Under the latest amendment of the Tamil Nadu Government, the

whole state of Tamil Nadu excluding the market area under the control of APMCs is classified as a unified market area as a result any person is allowed to establish private market yards and sub-yard anywhere in the unified market area by obtaining the license from the Department of Agricultural Marketing and Agri business which is valid for the period of three years. The Ordinance, 2020 amended in the act allows direct marketing by obtaining the license which was valid for three years.

Due to this ordinance, Market fee cannot be collected outside the market for the produce traded under notified area for notified crops. Nearly 80 to 90 percent of revenue generated through market fee collected outside the market will be affected. Krishnagiri district is likely to generate a revenue on an triennium average of 164.08 lakhs. Likewise Dharmapuri district is likely to generate a revenue on an triennium average of 69.48 lakhs. Hence all this revenue generation will be minimized or affected due to the central farm law 2020. Similarly we have to revamp these markets either to close or improving the infrastructure , likely loss could be magnified.

3.3 Suggest Suitable Alternative Revenue Models for Sustainability of Regulated Markets

The brain storming session were conducted in both districts regulated markets to find the proposal for compensating the financial implications and to improve the performance of regulated markets. From this session we can find the different revenue generation models that can generate revenue to the regulated market. In both the districts cold storage unit were required

for storing tamarind and banana for further processing and increasing the shelf life of the produce. Leasing out of storage facilities during offseason attracts traders or any agricultural processing organization to store their products for a period of time and regulated market can earn a revenue of 30000 rupees/year without any investment. Comparing all these models market shop construction ranks maximum in generating revenue to the both regulated market by means of minimum investment. Cold storage upgradation cum extension using solar panel also generate maximum revenue than market shop construction but it requires a huge investment of 6 Crore rupees. Additionally the PPC for paddy and pulses, solar dryer and village level hub creation generates minimum revenue than other models but it attracts more and more farmers, traders, FPO's, etc.. to enter into the regulated market.

Model: 1 Cold storage up gradation cum extension using solar power (600 metric tonne solar panel)

The Quantity required for both Dharmapuri and Krishnagiri district is one structure with a capacity of 600 metric tonnes for each regulated market. The approximate expenses is around 600 lakh rupees per 600 metric tonnes of cold storage. The approximate revenue generation is around 15 – 20 lakh rupees per year. The cold storage structures are required for storing tamarind and banana for further value addition process and increase the shelf life to the produce. Already the regulated markets are generating a gross income of 15 lakhs per year but it meet out a profit of only 2 lakhs per year and the balance amounts were fully paid as electricity expenses to the electricity board.

Table 4. Infrastructure facilities available

Name of RM	% of storage godown	% of Cold storage unit	% of Cold storage capacity	% of drying yards	% of transaction shed
Dharmapuri	25%	25%	90.90%	20%	25%
Harur	37.5%	25%	2.27%	20%	50%
Pennagaram	25%	25%	2.27%	20%	25%
Palacode	12.5%	25%	4.55%	40%	0%
Total	100%	100%	100%	100%	100%
Krishnagiri	12.5%	33.33%	37.5%	60%	100%
Pochampalli	37.5%	16.67%	12.5%	10%	0%
Uthangarai	25%	16.67%	12.5%	20%	0%
Hosur	25%	33.33%	37.5%	10%	0%
Total	100%	100%	100%	100%	100%

(Source: Dharmapuri and Krishnagiri District Market committee Annual Administration Report)

Model: 2 Market Shops construction

The market shops should be constructed in people's noticeable areas so that we can attract more customers to the shop. The initial construction cost is around 1.7 lakhs per shop and we can generate a revenue of approximately 24,000/ shop/ year by operating the shops on rental basis. This rent collection may vary among different regions based on the market value of the land. This model was proposed by both Dharmapuri and Krishnagiri district. The shop should be in convenient size of 10X17 sq.ft /Shop and the number of shops should be constructed may be decided as per the regulated market land holdings and there was a huge demand for it in both districts.

Model: 3 Solar dryer installation

The solar dryer of standard size of 3.75m*18m should be constructed in both the districts for drying copra and vegetables like tomato to improve the value addition concept among the farmers and traders by leasing the structure to them and by that the regulated market can generate a revenue of approximately 60,000 rupees per year with an initial investment of about 1.2 lakh rupees.

Model: 4 Leasing out of storage structure during offseason

The storage godowns can be leased to the traders or farmers or any organization during the offseason for agriculture based produce and regulated markets can generate an revenue of approximately 30,000 rupees per year. It doesn't need any requirement of expenses and it is financially feasible to all the regulated markets.

Model: 5 PPC for paddy and pulses

Installation of primary processing centres will require an investment of 30000 rupees/ machine

as of TNAU introduced Seed Cleaner-cum-Grader will clean and grade all type of seeds with overall dimensions of 1,800 mm x 1,200 mm x 1,800 mm with an efficiency of 95% cleaning and it is suitable for Paddy, Jowar, Bajra, Maize, Pulses with a running efficiency of 8 hours a day and regulated market can charge an amount of 300 rupees per day. This idea was suggested by farmers of Dharmapuri district.

Model: 6 Village level hub creation

Village level hub creation for mobilizing the agriculture produce at farm level will attract farmers and traders to store their produce safely and make efficient use of it. The mobilization capacity should be of 600 metric tonnes with an investment of approximately 40 lakhs and in return it generate an amount of approximately 50,000 rupees as rental premium. It also paves the way to collective farming and formation of farmers producer organization at a better rate. This model was suggested in the brain storming session by farmers of Krishnagiri district.

3.4 Constraints Faced by the Farmers in Selected Regulated Markets

The sample size of 60 respondents were selected and surveyed in Dharmapuri and Krishnagiri district to reveal the constraints faced by the farmers in the regulated market. The ranking of these eight factors were represented along with garret score in the following table 7. The first and foremost factor which has the most significant value of high transportation cost with an average score of 73.75, because many farmers are facing problems during transportation of produce from their farm land to the market. The second most significant factor is delayed payment because the farmers were getting the payments in installments after selling

Table 5. Constraints faced by the farmers

FACTORS	AVG. SCORE	RANK
High transportation cost	73.75	I
Delayed payment	70.48	II
Lack of grading facility	66.90	III
Exploitation by middlemen	54.52	IV
Lack of storage facility	51.22	V
Lack of market information	50.68	VI
Lack of Access to market credit	44.70	VII
Lack of basic amenities such as drinking water, farmer shed.	39.10	VIII

(Source: Focus group discussion conducted on Regulated markets)

their produce. The third most important factor is lack of grading facility because of it the farmers were unable to separate good and bad seeds, due to this problems they were getting low price for their produce. Followed by these factors exploitation by middlemen during the procurement, lack of storage facility, lack of market information, lack of access to market credit and lack of basic amenities has significant average score values of 54.52, 51.22, 50.68, 44.70 and 39.10 respectively.

4. CONCLUSION

This study concludes that 80 to 90 percent of loss in revenue is likely to occur due to the implications of the recent farm laws 2020 and to overcome such circumstances they suggested some alternative revenue generating models in the brain storming session. If these models are established, it will result in compensating the revenue losses, since these models have great potential and efficiency. Comparing with all these models leasing out of storage structure during offseason has higher potential of generating 30,000 rupees/year without any investment. Construction of market shops at people's noticeable areas in the regulated market will generate a revenue of 24,000 rupees/year/shop. Installation of Primary processing centres and dryer is beneficial to the regulated market for attracting farmers, traders or any organization but it should be region specific and crop specific and the technology should be innovative and efficient. Therefore these models are financially feasible and ultimately result in improving performance and increase revenue of the regulated market. Followed by this cold storage structure upgradation cum extension using solar panel will generate a revenue of 15 to 20 lakhs per year. But this model requires a huge investment of 6 crore rupees and it also requires 2-3 acres of land for installing solar panel for 600 metric tones, therefore this particular model is practically impossible and not financially feasible. The major constraints faced by the farmers is high transportation cost, delayed payment and lack of grading facility. These factors should be minimized by creating a good ambient infrastructure and better environment in the regulated market will always maintain a good relationship with farmers and the government.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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