CONCLUSION
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The present study was focused on the Analysis and Integration of supply chain elements which are practiced in Food Corporation of India for ensuring the efficacious supplies of food grains to the Targetted Public Distribution System (TPDS). Non Probability Judgemental Sampling technique was used to obtain the responses from the 61 respondents. Respondents were selected from the different levels of management i.e. Operative management (32), Middle management (19) and Top management (16) in such a manner that they represent the different geographical locations of godown / storage points and offices of the Food Corporation of India involving various components of SCM (supply chain management).

Similarly 80 outlets (40 rural and 40 urban) of Targetted Public Distribution System(TPDS) i.e. Fair Price Shop (FPS) were selected representing the different geographical locations of i.e. Haryana, Punjab, Delhi & Bihar to have representative sample.

Here the respondents were asked to indicate a degree of agreement and disagreement with each of a series of statement on the lines of Likert scale. The scale items had either 3 or 5 response categories ranging from

1. Not at all good to Very good.
2. Not at all satisfied to Very satisfied.
3. Not successful at all to Very successful.
4. Not at all effective to Very effective.
5. No problem at all to significant problem.

Each statement was assigned a numerical score ranging from 1 to 5 or 1 to 3. Each degree of agreement was given a numerical score and the respondent’s total score was computed by summing these scores. This total score of respondent revealed the particular opinion of a person/ respondent.

To study of responses from the managers/ officials of FCI and TPDS outlets which were spread over Punjab, Haryana, Delhi & Bihar a structured questionnaire used for the present study consisted to set of questions. First demographic profile of respondents; Second, to measure the response from the managers/ officials of FCI and
TPDS outlets. Various standard criteria suggested by Edward & Kilpatric (1948), Anastasi (1961) and Gupta (1999) have been used in the selection and edition of the statements.

The first objective was to understand the mechanism of supply chain management as practiced by Food Corporation of India. In the present study while understanding the mechanism of various elements of supply chain and other related factors in Food Corporation of India, it has been observed that in order to ensure efficacious supplies of food grains to the Targetted Public Distribution System (TPDS), the following elements have to work in tandem as each one of them is of paramount importance in the entire system because of their inter dependency on each other and FCI would require to arrange capacities, technologies, human resources and market intervention (international as well) in order to become more meaningful in the present context and scenario.

- Procurement
- Storage / Warehousing
- Movement / Transportation
- Distribution
- Quality Control Measures
- Effective Financing
- Synergy among the above elements and network of FCI and various functionaries of Targetted Public Distribution System such as intermediary storage system and network of Fair Price Shops etc (FPS).
- Effective usage of Information and Communication Technology to integrate the above aspects and elements.

The second objective was to critically analyse and evaluate the relevant components of supply chain management where in it was observed and felt that each component can play a crucial role and the following has emerged on various components.
Procurement

Farm to Mandi

The farmers harvested wheat traditionally during April-June for the Rab Crop and similarly paddy is harvested during the kharif crop. Earlier the scarcity of agricultural labour during the harvesting season had meant that the harvesting activities were spread out over a longer time horizon. The advent of the mechanized harvesters decreased reliance on agricultural labour and large fields could be harvested within a shorter time span. In situations where the market prices were higher than MSP, the farmer had some incentive to spread out harvesting so that he could take best advantage of a fluctuating market price. In the situation where most procurement was on MSP, the farmer was most interested in offloading the entire produce in the Mandi and getting paid for the crop. Thus the time period of wheat procurement had decreased substantially and the entire bumper crops are expected to come to the mandis within a short time window of about twenty days.

The reduction in harvesting period put considerable strain on the Mandi operations. The rate of arrival far outstripped the rate of off-take from the Mandi. The farmer brings wheat and paddy to the mandi in tractors in bulk form and made several trips to the mandi for transporting the harvested amount. The wheat or paddy unloaded at the area designated for the specific Aarhtiya with whom the farmer was connected. The crop is spread out for drying and then bagged, stitched and weighed by the labour appointed by the Aarhtiya. The drying process could take two days and at peak arrival there is little space available for spreading out the grains. Every available space in the cemented courtyard of the mandi would be filled with spread out grains or stacked bags. Once the mandi yard is full, bags were stacked in any available place including on the adjacent roads and even in nearby schools and public places.

Mandi to Godown

FCI appointed one transporter for each mandi who is responsible for transporting the grains from mandi to FCI godown. During peak times, the total number of trucks for this transportation outstripped the total number of trucks available for hire in the entire state. This mammoth logistical exercise is frequently
disrupted by road blockages by farmers who wants FCI to accept their crops irrespective of the moisture content and other quality related parameters. Shortages of gunny bags also led to delay in evacuation from mandis.

Once a truck is loaded, the truck moves to the nearby FCI godown where a large queue formed for trucks waiting to enter the godown. Unloading operations at the FCI godown were dependent on the availability of contract labour. FCI is one of several state level procurement agencies.

**Farmer related issues**

- Crop rotation for future is helpful.
- Role of government financing institutions is important as the impact of same is for the staggered procurement and storage at “On form Silo’s” and “On mandi” storage system and storage at village / community level can feed local level PDS. This will motivate farmers to deliver in bulk to silo’s facilities available to the farmers.
- Technical knowhow to the farmers is important.
- The time period in which crop is sold/ purchased is crucial for farmer & Government both.
- Dependence of farmers & to some extent of Govt as well on Aarthia systems/ mandi system is crucial and it can be upgraded.
- Purchases can be made directly from the farmers in an staggered manner.
- Cleaning / offering of crop can be arranged by Mandi Board.
- Implementation of MSP and creation of mandi system in other states such as Bihar/ M.P/ West Bengal and other potential state would minimize / cut down the movement / transportation cost to consuming state.
- However crop rotation to cash crops such as Dalhan, Tilhanetc would reduce pressure for procurement of wheat / paddy / rice etc
- To have temporary storage system at mandi level with all measures for safety of stocks.
Storage / Warehousing

The grain is stored in 50 kg bags in either covered godown or in Cover and Plinth (CAP) storage. Due to the non-availability of covered scientific godowns/warehouses grains (wheat & paddy) are stored in the CAP also. CAP storage consists of a raised plinth over which the bags are stacked and covered by a plastic sheet. The grains need to be fumigated and treated at specific intervals to control infestation. The bags were periodically restacked so that the bags at the bottom of the stack would not burst due to the weight on them. This exercise adds to the expenditure towards storage / warehousing.

With godowns spread all over India, effective monitoring of the quantity and quality of the food stocks is a challenge. What worsens is the situation that a large portion of the stocks are stored in CAP storage, with only plastic sheets as cover. Temporary warehouses may not be effective in keeping rodents out. Bags kept at the bottom of the stack could burst due to weight of bags on top. Plastic sheets could develop holes and expose the grains to the weather. Fires could start during the hot and dry summer while heavy downpours could inundate entire stacks during monsoon. FCI had internal standards for fumigation and periodic movement of the bags in a stack. However, consecutive bumper crops and record storage amounts put pressure on manpower engaged in monitoring of food stocks and allied activities.

Movement / transportation

The lack of adequate storage capacity at the procuring states meant that the food grains had to be evacuated and stored in receiving states in advance of requirements. FCI has a monopoly in interstate movement of food grains. The movement is through Indian Railway (IR). While FCI gives its requirements for the rakes as per the origin-destination pairs, the actual placing of rakes was completely at the discretion of IR. A long period of unavailability of rakes could be followed by IR placing five rakes, all at the same time. The bunching up of rakes resulted in difficulties for FCI as the capacity of five rakes could be more than the capacity of the godowns near the railheads. Simultaneous loading of rakes also impacts the labour requirements. IR charges demurrage for any delay in loading / unloading after the stipulated norms. IR could also dynamically change the destination of the rake
depending on its own rake demand supply position at different locations. This situation affects the planning of FCI which escalates the cost of transportation and other related expenses.

Some of the important points effecting the movement / transportation are:

- Storage capacity
- Allocation of TPDS
- Turnovers / frequency and pattern of lifting (depends upon availability of funds with state TPDS) this factor would in fact make the supply efficacious to TPDS.
- Availability pattern of rail wagons/ trucks etc. This is very crucial.
- End to end costing is a crucial factor in planning of movement by railways.
- Matching of working hours with FCI of railway is important.
- Honouring of FCI movement plan by Railways is crucial for efficiency and cost cutting.

**Distribution / Targetted Public Distribution System (TPDS)**

Once the stock reached the destination railhead, the bags were unloaded and stored in the FCI godown at the railhead. The state level agency involved in the TPDS then lifted the stocks from the FCI Godown and transported the stocks to its own godowns for onward distribution to different districts of the state. The stocks are finally distributed to the consumers through the Fair Price Shops (FPS) as per the different targetted schemes like Above Poverty Line (APL), Below Poverty Line (BPL) and Antyodaya (AAL) scheme and other welfare schemes through their nominees.

**Quality Control Measures**

The shelf life of stored grains is a contentious issue with many questions whether grains could be stored for more than three years even with the best of fumigation and preservation techniques. The policy of first dispatching from CAP storage and then from the covered godowns meant that grains were dispatched using Last in First Out (LIFO) and not First in First Out (FIFO) rule. The result is that a
higher proportion of the old stock would have quality related issues and hence would not pass the strict quality parameters for export.

**Effective Financing**

Under this element however FCI has been trying to cut down and control the subsidy elements on food by various measures but the decision making about various policy matters rests with the Ministry concerned and Govt of India option of raising the funds from the open market has to be explored and improvised effectively so that burden of subsidy can be minimized and controlled. Trading / Commercial activity is an area which needs to be explored.

The third objective was to determine and cogitate the synergy and integration in supply chain elements for successful relationship between FCI and Public Distribution System (PDS) outlets. It has been seen here that diversion of food grains from the leaky public distribution system back into the FCI procurement process is an serious issue. The absence of traceability of stocks meant that FCI had no way to distinguish if the grains being brought in the mandis were coming from fresh produce or from previous stocks. While it is apparent that FCI has to procure whether this is due to bumper harvest or bumper diversion.

Stoppage of diversions in TPDS would also bring down the procurement level thereby cutting down the procurement & other related expenses. Simultaneously it would also ensure availability of food grains to TPDS.

In the availability of food grains following is important.

- Time
- Place
- Quantity
- Quality
- Affordability
- Lifting pattern by FPS/wholesalers in some states such as Bihar is crucial as wheat and rice is lifted from FCI godown to distribute both commodities together to consumer.
- Ease of availability (as & when)
- Availability of funds with FPS/ wholesaler
Knowledge of all the above to the beneficiaries of TPDS is crucial for the efficacy of system.

- Railway, FCI and state agencies / bodies can together have to ensure the above objectives to make the other supply chain elements effective & meaningful.

Availability of Wheat, Rice in godowns / BINS at Taluka / Panchayat / Village level for 3 months is important as cushioning effect to ensure regular supplies and to cut the cost on part of FCI and Govt will have to check out the availability of funds for such as credit limit etc.

The fourth objective of this study was to evaluate the role of information exchange system for an affective supply chain management of foodgrains.

After analyzing this aspect, it may be seen that usage of modern information exchange system is crucial and imperative for effective supply chain.

The effective use of Information and Communication Technology (ICT) can make the flow of information smooth about various aspects of supply chain such as

- Availability of food grains.
- Time of availability
- Place of availability
- Rates / Prices of the commodities.
- Information on Public Portal for transparency.
- Results of the study show that it works as a bridge between FCI, state agencies, FPS network and consumers for the purpose of all information about foodgrains.
- An essential support mechanism for decision making by higher levels of management in FCI and state government as well for making the supplies effective.
- Connectivity and availability of information among public can minimize the incidence of leakages and diversions in TPDS and in turn this can ensure effective supplies of food grains to TPDS.
- Usage of ICT has enhanced the efficiency in all spheres and operations in FCI.

Some of the other conclusions which can be drawn from this study are as follows
• Damages to the stocks are due to unscientific storage system such as open storage (CAP).

• Preservation of stock for longer period in view of excessive stock holding and this also escalates the inventory carrying cost.

• Disposal of old stocks is an important issue.

• Upgradation of quality control equipments and laboratories can enhance the quality of food grains.

• Co-ordination with railway for effective implementation of movement plan

• Inadequacy of staff in certain crucial areas such as procurement and preservation to be addressed effectively.

• Inadequacy of internal checks and balances such as internal audit and physical verification of stocks

• Image of FCI (public perception)

• Aggressive policy for export/import will help in ensuring international participation/ interventions.

**An SWOT Analysis about various aspects of FCI (Supply Chain Elements)**

**Strength**

• Experienced cadre based manpower such as Technical, General (Admin), Finance, Legal, Movement, Depot etc.

• Technical knowhow of work methods

• Written set of rules to guide the staff

• Nationwide net working/ network of offices

**Weakness**

• Not much innovation on procedures, file work and decision making

• Continuous fear of vigilance cases
• Lack of transparency in certain areas.
• Technology is not in complete use on real time basis while handling of stocks in godowns and railhead etc.
• At present limited storage capacities on overall basis (National) and at some states smaller godowns then needed.
• Lack of Autonomy in Decision making and commercial activities which is one of the cause of increased subsidy etc.
• Dependency on Railways for transportation.
• Lack of effective coordination with state machinery for distribution.