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Research paper

A Study on Business Implications Due to Automation in Indian Seafood Industry with Specific Reference to the Frozen Sector

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Abstract

The global demand for Indian seafood has been rising over the years. Marine product export figures have hit an all time high in terms of both, value and volume. The exports during the year amount up to 11,34,948 megaton values at INR 37870.90 crores, which is approximately USD 6 billion. There are more than 300 frozen seafood processing plants in the country. Some products exported are meant for the retail market and for direct consumer market, however, most of it is meant for reprocessing. This is because most of the technology and machinery used in Indian processing plants are traditional and some processing methods have become outdated. However, exporters are slowly moving towards newer technologies and processing styles in their factories. Value addition is being considered seriously by many seafood exporters. Value added products like IQF, breaded shrimps, marinated seafood, cooked products are now processed in some factories. Even packaging of Indian seafood has undergone many changes like vacuum packing, shrink packaging. Freezing is usually done by ammonia gas, this is now gradually being replaced by a less riskier neon gas in many processing plants. Advanced metal detection systems, highly sensitive water proof weighing scales and palletized automatic operated cold store are some other advancements seen in the recent years. Despite, efforts from various exporters, implementation of all these advancements can be done in large scale only with the help of the government, since such upgradation will incur a lot of investment. With support from various financial institutions, technical help from various government agencies and with the determined perseverance of the exporters, Indian seafood industry can enrich its processing technologies with the latest technology and advanced machinery making it reach great heights globally. This study presents the business implications of automation in the frozen food sector. It also presents the policy implications for implementing automation on a mass scale in the frozen seafood sector.

Keywords: *Automation, Seafood sector, Frozen foods, Business implications.*

1. Indian Frozen Seafood Industry – An Overview

The Indian fishery resources consist of coastline of 8118 kilometers, continental shelf of 5,30,000 sq. kms, Exclusive Economic Zone of 2.02 million Sq. Kms., and estimated 2.5 million hectares of brackish waters, lakes and other inland water bodies. Having such a vast resource, Indian seafood has got huge demand globally. Frozen Shrimp exports began in the mid 1960s. Only less than 1 % of the Indian seafood is domestically consumed, whereas the remaining 99% is meant for export all over the world. Indian seafood is mainly exported to the US, Europe, Middle East, China, South East Asian countries and Japan. The US market is the largest market for export, most of the products are meant for the retail market and direct consumer market. China and South East Asian countries are the net biggest buyers of Indian seafood. However, the seafood is mostly meant for reprocessing. The reprocessed material is then value added and e-exported to higher value market. Middle East buying is a mix of value added products and also material meant for reprocessing. Europe export involves huge risk, heavy documentation and detailed packaging. European buying is mostly meant for the consumer market and hence a lot of value addition is required for this market. Japan exports are mainly based on the brand image of the product. Shrimp was exported in block frozen form for reprocessing in the importing countries. More advanced frozen technologies like Individually Quick Freezing and Freeze Drying facilities came up from 1985 onwards. Frozen shrimps constitutes of 675 of total export, fish exports were only 13% of total exports, followed by Cephalopods of 11% and all other remaining varieties contributed 9% of the total exports. Consequently, Shrimp comprises the single largest and most important species in value terms of Indian seafood export.

2. Purpose of the Study

Given the export potential of Indian Sea food, it is imperative to understand and keep up the global standards to ensure that the products reach out across the globe. The frozen sea food export sector is dominated by MSMEs and technology upgradation is a strategic decision for them since it involves huge capital investments. But to meet the buyer expectations and fulfill the established norms by different importing countries, it is essential to understand the latest technological advancements. Apart from improving quality, technology deployment shall also bring down the costs to exporters over the long-term.

3. Objectives of Study

Based on the above purpose, the study has been pursued with the following objectives

- To analyze the current production, freezing and storing technologies, machine room and laboratory facilities utilized in the frozen seafood sector.
- To examine the latest and advanced processing technologies, methods and machineries, freezing and storing methods, machine room facilities, latest laboratory techniques and recent packaging trends in the frozen seafood sector.
- To identify the advantages and implications of using the latest technologies for the frozen seafood exporters in India.

4. Research Methodology

This is a descriptive study based on secondary data. The secondary sources used in this paper are articles, journals and reports.

5. Current Production Technologies

- Block Processing
- Individually Quick Freezing
- Blast Freezing

Block Processing

This method of processing is one of the oldest methods of freezing. The sea material is kept inside various pan trays, chill water is poured into the trays and then these pan trays are placed in several freezer plates. These plates are enclosed within a chamber and freezing gas is passed through various hoses into the freezer plates. Generally ammonia gas is used for freezing the product. The freezing time takes about 75 minutes to 90 minutes. After freezing the plates are lifted up and the pan trays are taken out of the freezer and the pan trays are passed through a de-panning machine which melts the ice and separates the product from the pan tray. The slabs are then packed into the master cartons. This type of processing is mainly meant for reprocessing in the buyer countries. The main market for block processed products is China, Japan and South East Asian countries.

Individual Quick Freezing

This type of freezing is of 2 stages, freezing and hardening. The raw material is placed on the freezer belt individually piece by piece. The frozen pieces are then passed through a water sprayer and then through a hardener. The water prayed on the material is hardened and the icing or glazing layer is formed on each of the pieces and then the products are finally packed in polybags. The glazing percentage may differ from 10 percent to 30 percent based on the buyer requirements. This kind of processing is mainly meant for the retail sales targeted at the final customer. Packaging must be generally attractive and detailed as it is being sold directly to the consumer. The freezing time is very short about 6 -10 minutes and the hardening time takes about another 7-8 minutes. So, the entire freezing takes about 15-20 minutes overall. Another difference from the block freezing is that the pieces are frozen individually and so it can be marketed directly to retailers. However, the production cost in the IQF line is more than that required for block processing of the raw material.

Blast Freezing

This freezing is mainly done for fish. There are sea material is kept on individual trays. These trays are then placed on trolleys. After setting the entire material onto the trolleys, they are pushed into the blast freezer room. Inside the room there are blower fans, these fans blow gushing air onto the product at a temperature less than -40 degree centigrade. About 3-5 metric tons of the raw material can be placed in the blast room. Freezing generally takes about 6-7 hours. After freezing the trolleys are moved out of the room and the tray is dipped in chilled ice water having a temperature of less than 4 degree centigrade and then again placed onto the trolleys and moved into the blast room for the hardening stage. The hardening ensures that a protective ice layer is formed around the frozen product which helps it to protect it from melting. After few hours of hardening, the trays are taken out of the room and the products are finally packed. This type of processing involves a lot of labour and a long freezing time. However the production cost is comparatively less than that of IQF.

6. Current Freezing and Storing Technologies

- Ammonia Freezing
- Ammonia cold store

Ammonia Freezing: This is the most common type of freezing followed by many processing plants. Ammonia gas is pumped by various compressors through various vessels and freezing lines into the freezer hose and plates. The temperature will be maintained around -40 degree centigrade and the freezing time is generally 90 minutes. However, ammonia gas is very risky as inhaling this gas can cause giddiness and nausea. So, the leakage of this gas much be controlled to a zero tolerance limit.

Ammonia cold store: Many cold stores are also operated by ammonia gas. Ammonia gas is pumped to many fan blowers and cold air will be generated by these fans into the cold store. The temperature will be manually maintained from -18 degree centigrade to -20 degree centigrade.

7. Current Machine Room Facilities

- *Slip ring compressors*: This type of compressor is used by most of the processing plants. It is handled manually by the machine operator. The machine moves stage by stage and slowly starts once it reaches the final stage. The power consumed by these compressors is very high. The service and maintenance is low and the spares are readily available in various places.
- *Open condensers*: All machines need to be cooled because of the heat generated by them. Cooling towers and condensers are generally used to cool the compressors and other machineries. The condensers are open type condensers with water flowing in and around various cooling pipes. These condensers generally require a lot of space; however the maintenance cost is very low.
- *Single Vessel System*: As stated earlier, ammonia gas is passed to various machines for the cooling purpose. The ammonia is passed through a single vessel system. This means that there is only one common path/line for ammonia transmission to the vessels and there is no designated individual line for every machine.
- *Block Ice facilities*: Preservation of the raw material is very important in seafood processing facilities as all these good are perishable. Ice must be properly put on the seafood to preserve the material. The more the ice, the better the freshness of the material. Block ice is generally used across various processing plants. Blocks of ice are produced using huge containers filled with water and a small percentage of salt. Block ice does not cover much of the surface area and requires more labour to break it.

8. Present Laboratory Facilities

Every processing unit needs to have atleast one in-house laboratory according to Export Inspection Council of India. The

lab mainly tests for antibiotics and various microbiological parameters. Presently, the media preparation is done manually and the testing time generally takes about more than 4 days.

9. Packaging Methods

Generally packing for block processed material is done by placing blocks in polybags and then placing into the master cartons. However, sometimes the polybags are placed inside inner branded duplex cartons and then put inside the master cartons. This is done if packing has to be done in any specific buyer brand. The master carton is then sealed using gum tape and placed inside the store. In case of IQF, the material is packed in plain or printed polybags and then placed into the master carton. The ploybags also have a space for header card which details the product specifications. The labels are pasted on the master carton which tells about the source, manufactured date, expiry date and other details.

10. Advanced Processing Technologies, Methods and Machineries

Indian processing style and techniques are generally considered to be old fashioned and obsolete when compared to other processing styles and machineries used in other countries like China, Vietnam, US, etc. If Indian exporters can match their style, then Indian seafood exports can reach great heights across the world.

Some of the advanced processing styles are:

- *Cooking /Blanching*: Cooked or blanched products use the similar line of technology used for raw IQF processing, but here the products are heated and then dipped in cold water. It is then dried and passed through a glazer. After glazing it is passed through the hardener and the final product is packed as cooked or blanched IQF products. If the temperature of the heater is maintained above at 78 degree centigrade, it is called cooking. If the temperature is maintained around 60-68 degree centigrade it is known as blanching. Cooked products have a very low level of bacteria content in them. This process is highly sensitive and the production area needs to be very hygienic. The quality of the food product is considered to be top class and is of high demand globally.
- *Marinating*: In this production line, the raw material is passed through a conveyor belt and the marinade is spread uniformly across the material. It is then passed through the freezer and into the IQF hardener and then finally packed. It is a ready to eat product aimed at the final customer and retailers.
- *Breaded Production*: In this type of production, the batter is poured on the material and bread crumbs are simultaneously put on the batter. The mixture is then fried for more than 10 min at a very high temperature of more than 170 degree centigrade. After frying, it is passed through the IQF freezer and then packed and stored. Glazing or hardening is not done in this process. This method is meant for supermarkets and retail markets.
- *Surimi & Nobashi Production*: Surimi is seafood paste which is done by grinding the seafood. It is then frozen and packed. Nobashi process is done by placing each peeled shrimp onto the nobashi tray and then placed into the IQF freezer and packed. These processes require highly skilled labour and are time consuming.

11. Latest Freezing and Storing Methods

Nowadays, Freon gas is used for cold store and freezing the products. Freon is harmless and an odourless gas and so the risk of any leakage can be eliminated. Freon operated cold stores are automatically run. The machines switch on when the temperature drops and cuts off when the temperature is too high. Since it is an automated system, there need not be any worries of operational negligence. Freon freezers and Freon cold stores are very expensive and the maintenance costs are considered to be very high. Another main disadvantage of this system is that if there is any leak, it very difficult to find out from where the leak is occurring, since the gas cannot be detected easily. Many cold stores have now become palletized and this makes storing very easy, but there is a lot of unused space inside the store when pallets are used. Earlier thermocol used to be the insulation for cold stores, but these have been replaced by insulated PVC puff panels. These panels give a good appearance and neat ambience inside the cold store.

12. Advanced Machine Room Facilities

- *Automated Drive compressors and screw compressors*

Automated drive compressors are used to run various compressors. The drive compressors automatically move each stage based on the power usage inside the plant. Hence, these are power efficient and help in saving a lot of electricity costs. Screw compressors are used for very fast processing and freezing. These compressors are very expensive and maintenance costs are also very high.

- *Closed condensers*

These condensers function as the same way as open condensers. However they are within an enclosure and occupy very less space. They are more efficient than open condensers; however they incur a lot of maintenance costs.

- *Multi vessel system*

Ammonia gas is passed through several channels in this method. So, if there is any maintenance in one particular line, that line alone can be shut down and the remaining line can function normally. The entire cooling system need not be dependent on one single of passage for cooling.

- *Flake ice/cube ice*

In this method, ice is produced as flakes or cubes. Flake ice ensures that there is more surface area contact on the product and hence the raw material well preserved than block ice. The freezing method is quite complex when compared to block ice, but the maintenance costs are quite nominal and the production time is a bit fast.

13. Latest Laboratory Techniques

ELISA test kit has replaced the previous Pre-harvest test report, which is required for checking the antibiotics level in the seafood. Various high-end instruments have come up recently which help in getting the microbiological results very fast. The ELISA test kit is made mandatory by the Export Inspection Council for every processing plant. Each and every raw material processed at the factory must be tested for antibiotics and must be submitted for obtaining the health certificate. Laminar flow chamber and nitrogen evaporator are used for preparing the media and for getting the most accurate results.

14. Recent Packaging Trends

Vacuum packaging is used for sucking the air out of the polybag and wraps around the seafood product. The final packing takes the shape of the product. This type of packing ensures prolonged shelf life of the product. Shrink packaging is a technology used for sucking out the water content in the seafood product and frozen. At the customer's end, when the consumer puts the product inside water, it sucks in the water

and bloats up into the original shape. These are some advanced type of packing which are used only in foreign countries.
There are other packing systems like automatic sealing machine which seals the polybags and also the master cartons thereby protecting itself from any physical damage. Automatic strapping machine is used strapping the master cartons making it very rigid and firm.

15. Conclusion

To stand apart from other seafood exporting countries, Indian seafood exporters must adopt to the latest processing styles, technologies and machineries. However, the exporters themselves cannot do it alone; they need to be supported by various government agencies like the Export Inspection Council, Marine Products Export Development Authority of India, EIC approved laboratories. Moreover, all these improvements incur a lot of investment and hence a lot of financial support must also be provided by the government to the exporters. Value addition always comes with extra labour and hence more manual power is to be included in every processing plant. Only with the help of government agencies, financial institutions and various other supporting organizations, the Indian seafood exporters can reach the best standards in this industry at the global level.

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