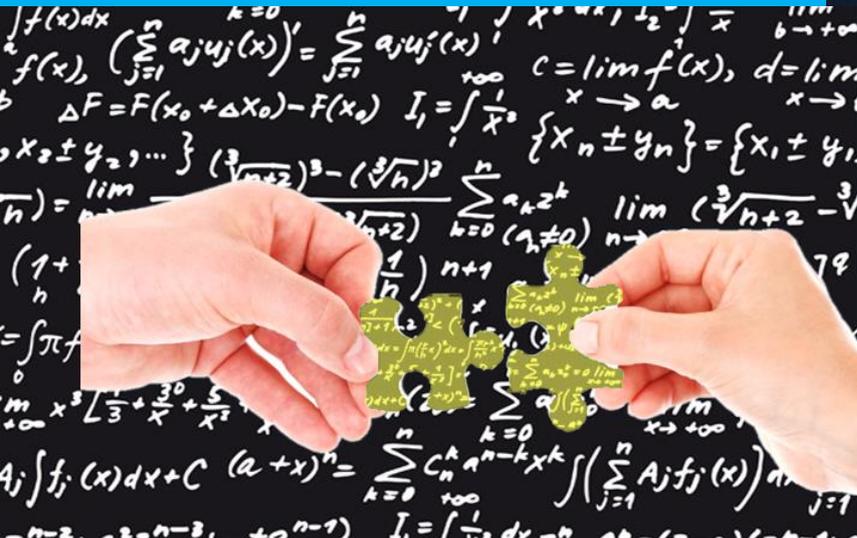




Demystifying Impact of Food Losses in International Trade of Food Products: Building Narrative for Developing Countries from Indian Perspective



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WORKING PAPER

Demystifying Impact of Food Losses in International Trade of Food Products: Building Narrative for Developing Countries from Indian Perspective

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Abstract

Food loss remains one of the central points of collective action around the world, as reflected in the 2030 Sustainable Development Agenda, but this issue is far more concerning for the developing countries. Several studies highlight the level and stages of food losses. However, there is limited work on understanding the food losses in the context of international trade. With ever-increasing volume of international trade of food products and understanding the levels and stages of food losses, this study aims to understand food losses in international trade from the context of developing countries. The study is based on a primary survey of three largest traded food products of India and examines the nature, causes, level and stages of food losses. It maps-out the entire journey of international movements of exported as well as imported food products, from the stage of packing to the stage of delivery at the last tradable point(s), excluding the final retail. The findings of the study are of immense relevance to developing countries in understanding the food losses and undertaking the policy, infrastructural and operational action(s) to reduce the food losses. Based on extensive consultation with traders, it was found that up to 19.5% of food is lost in India's international food supply chain, in particularly in the import-country (trade partner) food supply chain stage. The study suggests the generic as well as specific measures for exporting & importing firms, logistical agencies and institutions, and policy level regulatory actions for public agencies. These include capacity development on multiple levels, incorporation of good manufacturing practices, process improvements among agencies involved, as well as deeper understanding of the various factors leading to food losses in international trade.

Keywords: *Food loss; Food trade; Non-tariff measures; Non-tariff barriers; Sanitary and phytosanitary standards; Technical barriers; Regulatory procedures.*

JEL Codes: F1, F10, F13,

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List of abbreviations

ACE	Automated Clearance Environment
APHIS	Animal and Plant Health Inspection
APHIS	Animal and Plant Health Inspection Service
API	Application Programming Interface
AQSIQ	The Administration of Quality Supervision, Inspection, and Quarantine
CIQ	China Inspection and Quarantine
DAH	Department of Animal Health
DPD	Destination Port Delivery
DPE	Direct Port Export
FSC	Food Supply Chain
FSSAI	Food Safety and Standard Authority of India
IFSC	International Food Supply Chain
ISC	International Supply Chain
MOH	Ministry of Health
MRL	Maximum Residue Limit
NOC	Non-Objection Certificate
NTBs	Non-tariff Barriers
NTMs	Non-tariff Measures
PCIT	Certificate Issuance & Tracking
PPQ	Plant Protection Quarantine
SPS	Sanitary and Phytosanitary

TBT	Technical Barriers to Trade
TLFISC	Total Food Losses in the International Food Supply Chain
USDA	United States Department of Agriculture
WTO	World Trade Organization

1. Background

Food losses in the international supply chain (ISC) has emerged as an important area due to high socio-economic costs which poses significant challenges of food security, waste management and climate change. According to the Food and Agriculture Organization [FAO] (2015), around 800 million people do not have enough food to eat. The reduction in the food losses can contribute significantly to the reduction of world hunger as well as the improvement in food security (Neff et al., 2015; Kummu et al., 2016; Shafiee-Jood and Cai, 2016). It would also contribute to ensure food safety and nutrition (Affognon et al., 2015; Neff et al., 2015), especially in the developing countries where the highest number of people suffer from hunger and malnourishment (FAO, 2015). According to FAO (2018), around a third of all food spoils world-wide, quantitatively amounting to 1.3 billion tons annually, which is further likely to increase to more than two billion tons per year by 2030. The Food Loss Index of FAO provides food losses estimates at around 14 per cent from the level of post-harvest to the level of delivery at the last trading point(s) in ISC barring losses at retail stage. Food loss is not only an economic issue, as it also poses a moral and ethical issue(s) as almost 12 per cent of the world's population is suffering from hunger (Lohnes and Wilson, 2018). Globally, with the growing volumes and values of food products, there is an increasing share of food losses in the international supply chain; both in the developed and developing countries, with much higher magnitude in the developing countries. The key reasons for higher food losses in the developing countries are due to factors like inadequate trade logistics infrastructure, improper storage and food handling, unfavorable climatic conditions, lower frequency of international transport services, outdated storage facilities, absence of cold chain infrastructure, sub-standard packaging, lack of knowledge of markets, inefficient marketing institutions and marketing systems and food losses arising-out of rejections and refusals due to non-compliance of quality and sanitary-phytosanitary standards and non-adherence of mandated documentation including procedural compliance(s) (Chauhan et al; 2021).

2. Objectives of the Study

Building upon the existing work of research on food losses due to reasons such as agricultural production practices (Gustavsson et al. 2011), shelf-life (Porter et al., 2018), stakeholder's attitude (Beausang et al., 2017; Janousek et al., 2018; Peira et al., 2018), poor management of spoiled foods (Rijpkema et al., 2014; Zhu, 2017), food aesthetics (de Hooge et al., 2018; Devin and Richards, 2018), buyer-supplier agreements (Eriksson et al., 2017; Ghosh and Eriksson, 2019), supply-chain interruptions (Teller et al., 2018; Yang et al., 2017), improper or inadequate packaging (Goossens et al., 2019; Wohneret al., 2020) and stringent quality standards (Gillman et al., 2019; Hermsdorf et al., 2017; McKenzie et al., 2017), the objectives of the present study are:

- a. Mapping-out the food losses from the stage of export packaging to the point of delivery at last tradable point(s) for each identified product(s).

- b. Understanding the stages of food losses and estimating the quantum of food losses in definable logistics processes, i.e., Export Logistics, Inter-Country Logistics and Destination Country Logistics.
- c. Understanding the inherent reasons/ causes of food losses in scientific and practical terms, i.e., biological, climatic, physical and commercial & regulatory practices.
- d. Elucidating the institutional, operational and policy challenges and suggesting the way forward to overcome them.

3. Nature of Barriers in Food Trade

The formation of the World Trade Organization (WTO) in 1995 has led to substantial reduction in tariffs thus fostering the growth of global trade. With the reduction in import tariffs, non-tariff measures (NTMs) have arguably emerged as key obstacles to the growth and expansion of international trade. NTMs are policy measures other than tariffs that can potentially have an economic effect on international trade in goods (UNCTAD, 2010; Arita et al., 2017). The widespread use of NTMs has led to a less transparent and unpredictable trade policy environment and demands a deeper understanding of how NTMs affect trade (Fernandes et al., 2017).

NTMs are defined on the basis of their scope or design and are broadly categorized as technical measures and non-technical measures. Technical measures are related to Sanitary and Phyto-Sanitary Measures (SPS), Technical Barriers to Trade (TBT) and Pre-Shipment Inspections) while non-technical measures are considered hard measures and include price and quantity control measures, anti-dumping and safeguard measures, trade-related finance and investment measures (UNCTAD, 2013). Technical NTMs are sometimes portrayed as non-discriminatory regulations which, on the one hand, are aimed at protecting public health or the environment but simultaneously poses the costs of compliance of regulations (information, certification, administrative and procedural) thus impeding the growth of free trade (UNESCAP, 2019). However, some view NTMs as the neutral concept that constitutes a set of measures which may or may not have an impact on international trade. NTMs are sometimes incorrectly termed as non-tariff barriers (NTBs) as NTBs are subset of NTMs that have a 'protectionist or discriminatory intent and deter the free flow of international trade.

The volume of NTMs in agriculture and food trade has increased considerably during the past two decades (APTIR, 2019; Beckman and Arita, 2016). A significant volume of studies provide contrasting perspectives on the effects of NTMs on international trade in agricultural and food products. Most studies consider the 'standards as catalysts' while others favour the 'standards as barriers' explanation (Santeramo, 2019). There is a broad consensus that NTMs affect trade in agricultural and food trade through different channels which not only inflate trade costs but also result in food losses throughout the food value chain.

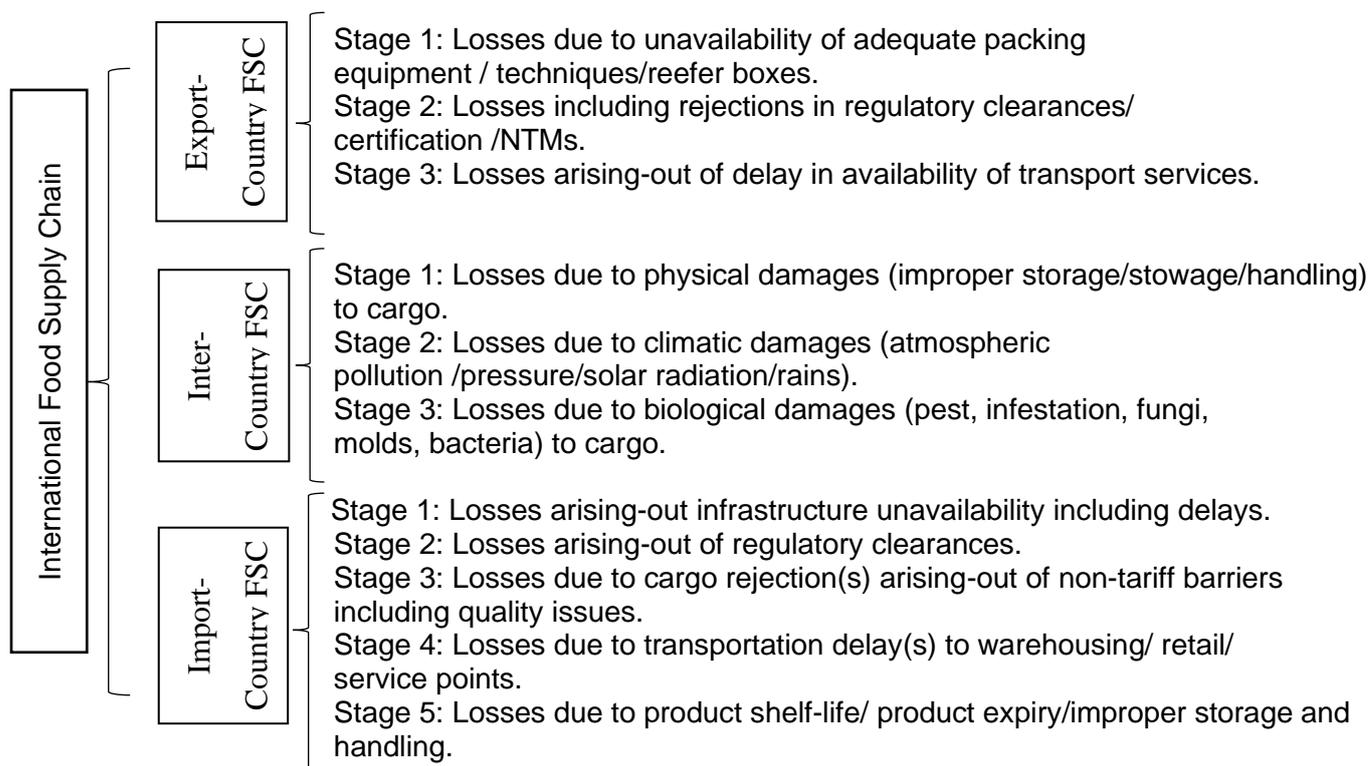
NTMs in food products can be broadly categorised into vertical and horizontal standards. Vertical standards are most demanding in international trade of food products given the multitude of sanitary, phyto-sanitary and environmental regulatory concerns embodied in their export and import. Horizontal standards are cross-cutting in nature and have similar effects across trade transactions. These are generally related to export-import procedures, documentary requirements, customs clearance, transport and logistics. Vertical and horizontal standards have profound implications to international trade in food products. They not only increase the cost and time of doing food trade but increase food losses due to delays at ports and border points. Understanding food losses in the international trade supply chain is a less explored domain and demands far more critical analysis.

4. Estimation of Food Loss: Selected Case Studies

There is limited research on mapping-out the food losses in the International Food Supply Chain (IFSC) of internationally traded goods. Accordingly, the stages of food losses³ in the entire value chain are mapped in consultation with exporters/importers of three identified product areas (Appendix-1). The stages of losses are Figure 1:

³ Appendices 1-Definitions of Stages of Food Losses in the International Supply Chain.

Figure 1: Stages of Food Losses in the International Supply Chains



Source: Author(s)

Further, Appendix 2 illustrates the model to statistically estimate the Total Food Losses in the international food supply chain (TFLISC) for the identified product(s). The questionnaire was shared with exporting and importing firms⁴ (List Attached) via an email in the month of July 2021, followed by interaction(s)/ interview with some of the leading experts of the respective product list⁵.

Table 1 summarizes the number of respondents contacted for the survey work. The number of firms vary across the product groups wherein respondents in marine sector are usually large export driven enterprises concentrated in one place, Cochin. For meat and fruits/dry fruits & nuts, the nature of firms is usually small and dispersed in northern India. Most of the firms in meat product groups are manufacturer exporters wherein for nuts & dry fruits/ fruits, these are trading firms involved in import and domestic trade business. The heterogeneity in the selection of firms across product groups is primarily due to their nature of business, size and scale, export commitment and knowledge and proportionate share in overall exports. In order to gather the data and study inputs, a semi-structured questionnaire was carried-out to understand the quantum of food losses and causes therein. This is further cross-validated with knowledge informant interviews

⁴ See Appendix 13 A, B, C, Page 35 to38

⁵ See Appendix 14, Page 38-39

(KIIIs) to develop a strong analytical perspective of food losses involved in logistics of identified goods.

Table 1: Product-Wise Details of Survey Respondents

	Marine products	Meat products	Fruits / Dry Fruits (Almonds and Nuts)
No of Contacted firms	15	170	340
Percentage of response	100	30	21
Actual Responses	15	51	71
Nature of Firms	Usually Export Driven Large Enterprises	Small Manufacturer Exporters	Small trading firms

Based on the above; the compiled results of the feedback (Table 2) of trade community on food losses at various stages of export and import are compiled as under:

Table 2: Estimation of Food Losses in India's International Food Supply Chain

		Percentage of FOB value of Exports		Percentage of CIF Value of Imports	
		Marine Products (HSN- 0306, 303)	Buffalo Meat (HSN- 0202)	Dry Fruits (Almonds & Nuts (HSN- 0802)	Apples (HSN 0808)
		Cochin, India to Shanghai, China	Meerut, India to Hanoi, Viet Nam	Los Angles, USA to Chennai India	Los Angles, USA to Chennai India
Export Country FSC	Stage 1.1: Losses due to unavailability of inadequate packing equipment/reefer boxes.	1.00%	1.50%	0.02%	1-2%
	Stage 1.2: Losses including rejections in regulatory clearances/certification(s)/NTMs.	2.00%	1.15%	0.06%	1-2.5%
	Stage 1.3: Losses arising of delay in availability of transport services.	0.10%	0.30%	0.09%	0.5-0.75%
	Sub Total (a)	3.10%	2.95%	0.17%	2.5%-5.25%
Inter-Country FSC	Stage 2.1: Losses due to physical damages (improper storage/stowage/handling) to cargo.	0.80%	1.00%	0.13%	1.5-2.5%
	Stage 2.2: Losses due to climatic damages (atmospheric pollution/pressure/solar radiation/rains).	0.15%	0.15%	0.27%	0.60-1.10%
	Stage 2.3: Losses due to biological damages (pest, infestation, fungi, molds, bacteria) to cargo.	3.03%	2.65%	4.04%	1.25-1.75%
	Sub Total (b)	3.98%	3.80%	4.44%	3.35-5.35%
Import-Country FSC	Stage 3.1: Losses arising out infrastructure unavailability including delays.	0.15%	0.20%	0.10%	1.0-1.3%
	Stage 3.2: Losses arising out of regulatory clearances.	0.30%	0.50%	0.03%	0.4-0.70%
	Stage 3.3: Losses due to cargo rejection(s) arising out of non-tariff barriers including quality issues.	2.75%	4.10%	3.61%	1.1-1.7%
	Stage 3.4: Losses due to transportation delay(s) to warehousing/ retail/ service points.	0.66%	0.10%	0.20%	0.9-1.35%
	Stage 3.5: Losses due to product shelf-life/ product expiry/improper storage and handling.	2.12%	1.23%	0.10%	2.2-3.85%
	Sub Total (c)	5.98%	6.13%	4.04%	5.60-8.90%
	Total Food Loss	13.06%	12.88%	8.65%	11.45-19.50%

Source: Author's Compilations based on Stakeholder's Survey

Based on above quantitative estimates (Table 2) from export and import firm(s) engaged in international trade, the specific causes of food losses in international trade logistics of identified products are listed down to understand the inherent reasons and plan policy and operational interventions to reduce/ minimize them. Table 3 shows that aggregate food losses in international trade supply chain. There is a reasonable ground to extrapolate these finding of respondents to calculate the absolute food losses in India's International Food Supply Chain due to reasons; first the selected food products, as the exportable and importable food products of India, constitute a major trade share with the trader partner selected. Secondly, the distance involved in the trade of similar goods is also higher in case of other trade partners of the selected products. Thirdly, the level of infrastructure available at destination is assumed to be similar as the level of economic development, logistics performance of other trade partners is also of the similar level.

Table 3: Estimated Food Losses in India's International Food Supply Chain

India's Marine Products Exports (\$ million, FOB Value)			
	2020	% of Food Losses	Estimated Absolute Food Losses
India's Exports to China	830.884	13.06	108.51
India's Exports to world	4526.39	13.06	591.15
India's Meat Products Exports (US\$ million, FOB Value)			
India's Exports to Viet Nam	444.5	12.88	57.25
India's Exports to world	2998	12.88	386.15
India's Fruits (Apples) Imports (US\$ million, CIF Value)			
India's Imports from USA	40.9	11.45	4.68
India's Imports from world	201	11.45	23.05
India's Fruits (Apples) Imports (US\$ million, CIF Value)			
India's Imports from USA	40.9	19.5	7.97
India's Imports from world	201	19.5	39.25
India's Dry Fruits (Almonds & Nuts) Imports (US\$ million, CIF Value)			
India's Imports from USA	805.234	8.65	69.65
India's Imports from world	927.373	8.65	80.22

Source: Authors' Calculation, based on the percentages in Table 2

5. Food Losses in Meat Export (Meerut, India to Hanoi, Viet Nam)

The primary source(s) of food loss at pre-packing stage occurring in export country food supply chain (FSC) is due to factors such as exhibition of traces of fresh blood in the frozen bovine meat which lead to 2nd order biotic activity in course of FSC, causing contamination, putridity, and decay in meat products. Sometimes, spots of mold, wherein fungus forms multicellular, thread-like structures in the meat leading to the spoilage of bovine meat. One needs to carefully vouch for such traces of mold at the pre-packing stage failing which food spoilage is bound to happen even when packed and refrigerated. Freezing constitute an integral and inseparable part of meat FSC, ideally freezing the exportable consignment at -63° C (eutectic point) as the exporting firms briefed that the rising temperature can lead to microorganism and enzymatic activity leading to rotting and putrefaction of meat, and consequential degeneration, decomposition and impairment in food quality as well as quantity. The exporting firms also listed unavailability of reefer boxes and refrigeration equipment along with high energy costs as one of the reasons contributing to food losses in frozen meat at pre-packing stage.

The specific reasons for food losses in Indian frozen bovine meat export are lack of awareness of proper packaging methods, techniques and skills as they treat the whole body part of a slaughtered animal as one unit of exportable product. The body part of slaughtered animal requires specific understanding of each part, for example the 'quarters' of frozen bovine meat should be packed in the clean and dry plastic or linen bag, also referred as "stockinet" while the boned portions should be wrapped in clean and dry film and then it can be put into cartons. Frozen meat requires precaution from moisture hence packaging must be resistant to humidity, which is occasionally caused by rain or snow, primarily rain in the case of movement of frozen bovine meat from Meerut, India to Hanoi, Viet Nam. Further, the frozen meat behaves like "stone" when frozen deep hence modules of apportioned meat (units) should conform to chosen pallet sizes, as odd dimensions lead to crumbling, withering and decadence, resulting in food losses.

The certification(s), regulatory food compliance constitutes an important part of export clearance(s) and an exporting firm has to comply with mandatory requirement of Common Name registration with Animal Quarantine Inspection Service along with optional compliance of breed, colour, sex, grade of the product, and scientific name (Appendix 3). Further, an export firm has to file for mandatory certification for Storage Condition and Foods & Supplement Proprietary Status with Food Safety Standards Authority of India which are also completed on a real-time basis except force-majeure cases (Appendix 3). Indian Customs needs 1-2 days of time to clear the Frozen Bovine Meat subject to documentary certification by AQIS & FSSAI (SWIFT PGA Filing) along with export-import policy compliance of note 3, 4, 6, 7, & 8 of Schedule 2 of India's ITC HS Code (Appendix 4). Exporting firms informed that much of the regulatory compliance/clearances/ certification system has been made in the online mode and food losses occur only in inadvertent circumstances, the probability of which is "less than 1 per cent" only,

as in the times of lock-down(s) imposed during COVID-19. The documentary flow of certifications, compliance and exportable frozen meat clearances with Indian Customs/ Partner Government Agencies is illustrated in Appendix 5.

In the inter-country FSC of frozen bovine meat, the sources of food losses are due to physical, climatic and biological damages. The frozen bovine meat is subject to food losses arising out of breakage and crumbling due to improper stowage and storage. The mechanical stresses are a common factor cited by the exporting firms that results in dilapidation in the shape of meat, leading to ruination and senescence of exportable product(s). Further, the improper cargo storage practices result in food losses, as the frozen meat must be kept in cool, dry and well-ventilated storage space. As exporting firms try to utilize the maximum stuffing space of a container, they unknowingly don't adhere to best practices in FSC. For instance, the best practices demand uses of crates and buckets to pack small pieces and use dunnage for large pieces to avoid physical losses, which many times are not used to utilize more shipping space. Further, frozen bovine meat is witness to biological and climatic changes as Indian exporting firm(s), at times fail to maintain the temperature at -18°C at the entire journey, primarily due to inter-modal nature of involved transport. For example, there are three mode of transportation involving minimum four inter-modal container transfer. First, from factory to Inland Container Depot (ICD) by truck, second by train from ICD to JNPT/Mundra port, third from JNPT/Mundra to Klang/Hanoi by ship. A truck starts its journey with a laden reefer container and completes the customs clearance and regulatory clearance formalities at Inland Container Depot, Dadri, (Uttar Pradesh). The frozen bovine reefer containers are ideally moved by Indian railway to either JNPT Mumbai or Mundra (Gujarat) wherein the entire journey of around 1450 Km and 1200 Km respectively and is ideally completed in 3-5 days (both road & rail run). The entire end-to-end journey (Meerut to Hanoi) may ideally take place over 16 to 20 days.⁶ The frozen meat transport must happen at -18°C and further relative humidity (95%), water content (50-75%) and maximum equilibrium moisture content (90%) must be maintained, failing which food losses are bound to happen. Exporting firms complain these things are beyond their control hence they cannot control these food losses even after properly intimating these instructions through Shipping Instructions.

Exporting firms also briefed about the food losses arising-out of non-adherence of certification/regulatory clearances at destination which are conducted in the legislative framework of Law on Food Safety, 2011, Guidance on the Management of Food Additives (MOH Circular 27/2012/TT-BYT), Law of Standards and Technical Regulations, Ministry of Health (MOH) and a guidance note issued by MOH on Maximum Residue Limit (MRL) as notified to WTO, time to time. Viet Nam requires exporters to be registered in the list of establishments eligible for export of foodstuffs of animal origin

⁶ Due to Covid-19 onslaught, container shortages, and reduced liner services, the current times taken is around 23-30 days.

(Frozen Bovine Meat) with the Department of Animal Health (DAH). Along with facility registration, there is a need for product registration. DAH is the only agency in charge of food safety inspections for imported food of animal origin. Viet Nam Food Safety Law mandates for sampling of each imported consignment for testing of microorganisms and physical and chemical indicators, and monitor for toxic residues (such as antibiotics, heavy metals, veterinary drugs, and pesticides) and permit imports with a Certificate of Quarantine and Food Safety Inspection by DAH. The rate of refusals/rejections/confiscation and destroying also lead to food losses (Table 2).

6. Food Losses in Marine Products Export (Cochin, India to Shanghai, China)

Marine exporters based at Cochin, India, exporting frozen marine products to Shanghai, China briefed about sources of food losses at pre-packing stage, starting from absence of required infrastructure for flash or rapid freezing process. Its absence slows the freezing process, resulting in formation of ice crystals, causing injuries and damage to cell walls (rupturing), which in due course leads to loss of cell fluids (thawing). One of the major food losses at this stage arises out of lack of reefer infrastructure equipment including unavailability of reefer boxes as marine products must be properly deep frozen at suitable temperature before being shipped, but essentially not to be exposed to excessive low temperature after freezing. This leads to depreciation, decay and degeneration in frozen marine products. The marine products, in such cases are subject to brown discoloration or freezer burn thus leading to food losses. The deep-freezing leads to the formation of frost thus leading to discoloration of marine products.

There are food losses at the stage of customs and regulatory clearances for exports. The most exported marine product (Frozen Shrimp-Other) falls under ITC HS Code 03061790 (Indian Nomenclature) and an exporting firm has to fulfil the mandatory and optional certifications/ compliance vis-a-vis Animal Quarantine Inspection Service and Foods Safety & Standards Authority. Further, as per S. No. 28 of Schedule 2 of ITC HS Export Policy of India; the export of marine species and products except those species (and their parts, products and derivatives) mentioned in the schedules of the Wild Life (Protection) Act, 1972 is permitted subject to Pre-shipment Quality Inspection Certificate issued by Export Inspection Council of India. Moreover, a Marine Products export firm have to comply with ISPM-15 standards, mandating for treatment of wooden material used in container/ pallets/ dunnage of by either Heat Treating or fumigation or coating of Methyl Bromide as mandated by CBIC vide its instructions F. No. 450/19/2005-Cus-IV dated 16.9.13 for compliance of phyto-sanitary compliance. The time taken including inadvertent delay leads to food losses (Table 2).

In the inter-country FSC, the food losses occur in marine products due to physical, climatic and biological reasons. The marine product when frozen becomes like a wooden stick, thus such frozen marine products require proper stowage to reduce physical

pressures and associated damages. Absence of ideal temperature, which should be -18°C to -28°C, also leads to biological disorders, decay and deterioration, of both quality and quantity of marine products. Exporting firms informed that they don't witness recognizable food losses even up to -10°C in shorter journeys but it occurs in certain shipments when such temperature cannot be maintained due to a variety of reasons in long international FSC operations. Climatic reasons contributing to food losses are non-adherence to require relative humidity which should be maintained at 90-95%, failing which food losses in the form of 'shrivelling' are bound to happen including reduction in the shelf-life of frozen marine products. In the shrivelling i.e. weight losses up to 1-2% occur due to loss of water content in long voyages of the inter-country FSC. The unavailability of equally sized pallets (bins), at times, leads to food losses as in absence of improper cargo securing, the frozen marine products wear, wither and wane-down with rubbing, abrading and grating. It has been reported by marine exporters that biological losses are also witnessed in 1-2% cases of the consignments when temperature goes down below -10°C with growth of intrinsic parasite worms.

The food losses arising out of certification/non-adherence to established standards in the destination country also constitute a sizable part of food losses. China's apex body for food import regulations is the General Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ) that is tasked with supervising the safety of manufactured, imported, and exported food. However, the operational clearances and import clearance permits are issued by China Inspection and Quarantine (CIQ), which works under the legislative mandate of AQSIQ (Appendix 6) and examine food at the point of entry. The Administration of Quality Supervision Inspection and Quarantine (AQSIQ) processes the following documents to China Customs for import clearance of cargo at destination:

- Seafood Test Report or certificate
- Certificate of Origin
- Application Form
- Export country official license

An Indian marine exporting firm must be registered in the database of AQSIQ. Indian marine exporting firms informed that they have witnessed very high levels of rejections, refusals, forfeiture and destruction of shipment(s), and blanket ban on exporting firms in the post COVID-19 period, most probably due to deterioration of Indo-China bilateral relations post-border skirmishes in June 2020. The issue was far deeper as it was not merely import consignment restriction(s) but is beyond as China blacklisted many of the marine products exporting firms from India. This was not the situation prior to COVID-19 pandemic. Indian Marine exporters are hostage to a bouquet of rejections, blanket bans, refusal(s) of import permit etc from July 2020 to date, resulting in food losses. CIQ has been citing reasons such as filth, decay, decomposition toxicity and presence of harmful substances (Appendix 7) in marine products as the reason(s) for rejections. Moreover, marine products are refused for import clearance citing presence of agricultural and veterinary drugs, and unsafe additives, food labelling issues, non-submission of documentary compliance and associated information etc. Further, CIQ destroys the

consignment if there is presence of bacteria beyond permissible thresholds, presence of antibiotic, and other harmful chemicals in the imported marine products from India. The exporting firms also divulged about food losses arising post customs and regulatory clearance(s) due to product shelf-life, improper storage at warehouses and at the final service points of delivery.

7. Food Losses in Import of Nuts (Dry Fruits) & Apples (Los Angeles, USA to Chennai, India)

7.1 Nut (Almonds & Pistachios)

Dry fruit and nuts importers in India are sourcing nuts (almonds & pistachios) from traders largely based at California to India. They listed the potential causes of losses in nuts & dry fruits FSC at the prepacking stage includes determining the year of harvest of nuts & dry fruits as age matters: older nuts have a natural tendency of food loss due to beetle infestation and rancidity, the latter being the prime factor responsible for food loss. Further, the nuts & dry fruits are prone to food losses due to exposure to dust, dirt, fats and oils. The improper packaging also results in food losses as nuts & dry fruits if not packed in cool, dry and ventilated place are prone to pest infestation such as beetles among others.

Importing firms do not witness major delay(s) in export customs clearance and other associated clearances from Partner Government Agencies as US Customs & Border Protection Department facilitate these clearances in an Automated Clearance Environment (ACE) under ACE Secure Data Portal. All regulatory clearances are done online which involves clearances from Plant Protection and Quarantine (PPQ), working under the aegis of Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA).

The inter-country FSC contributes to a sizable part of food losses in almonds and pistachios (Table 2). The food losses occur primarily due to non-adherence of required travel temperature (-3 °C to 0 °C), relative humidity (60-75%), water content (4% to 8%), required ventilation conditions including circulation of air in stuffed-in containers (minimum 10 air exchanges), and maximum equilibrium moisture content (65%). The non-compliance of these may lead to evolution of 2nd biotic order; caused by the emission of CO₂, heat and water vapour. Further, the loss of water content in absence of required temperature conditions contribute to shrinkage/shortage of nuts & dry fruits weight by as much as one per cent primarily due to moisture loss. Nuts & dry fruits are subject to food losses by spillage, and pilferage which is caused by use of traditional loading equipment (like hooks) as well as intended and planned theft by miscreants at destination port, or other nodes of FSC journey. The physical damage occurs to nuts & dry fruits with the non-use of ventilated containers which lead to loss of desired water content. Further, the

long course of international transportation, which ideally is 28-36 days⁷ in this case, exposed the nuts & dry fruits consignment(s) to solar radiation i.e., risk of self-heating leading to food loss.

Importing firms briefed that improper cargo handling practices, at times, contributes to food losses, for instance, if a shipment is exposed to extremely damp-weather (rain, snow) leading to higher moisture content; it can result in early infestation of beetle mold, leading to decay, spoilage, depreciation and putrescence. The importing firms intimated that enhanced respiratory activity (2nd order biotic activity) is the inherent reason for food losses in nuts & dry fruits. Nuts & dry fruits also have the risk of rancidity if consignment is exposed to any metals parts, wooden dunnage, mats and jute covering and other stowage material being used, as it is prone to contamination from external touch(es). Lastly, food losses occur as the nuts & dry fruits are prone to attacks from mites, cockroaches, saw-toothed grain beetles, flour beetles, meal moths, dried fruit moths and rats and mice in the absence of fumigation.

Furthermore, the food losses arise out of non-compliance of destination country food safety regulation, in this case, Food Safety and Standard Authority of India (FSSAI) may inspect, examine, test and exercise other preventive control measures before giving Non-Objection Certificate (NOC)/clearance for food items of plant or other origin as provided under relevant legal provision of Food Safety & Standards Act, 2006 of India (Appendix 8). The process of documentation and process flow of nuts & dry fruits import clearance is illustrated in the Appendix 9. Furthermore, the Directorate of Plant Protection, Quarantine and Storage may take necessary action for imported plant, plant part and various plant products and give NOC for release of consignment after following due process and procedure as mandated under the Destructive Insects and Pests Act 1914 as amended from time to time⁸ and Plant Quarantine Order 2003 (Appendix 9). Occasionally, there is delay in these clearances/ certifications/ approvals of NOC; thus, resulting in food losses, primarily through pilferage and theft. Phytosanitary Certification for nuts & dry fruits which is categorized as the plant material for consumption is done in 1-2 working days except those requiring fumigation and the same is issued after 3 working days.⁹ The documentary flows of clearances, time involved and potential reasons leading to food losses are illustrated in Appendix 10.

⁷ Due to COVID-19, container shortages and associated liner services disruptions, it is taking around 38-55 days for this journey.

⁸ The latest comprehensive amendment was in the Destructive Insects and Pests (Amendment and Validation) Act, 1992

⁹ Directorate of Plant Protection, Quarantine and Storage, Government of India (2022). Time line for Plant Quarantine activities for export of plants/plant materials. Available from <https://plantquarantineindia.nic.in/pqispub/pdf/files/file22015pqexpclear.pdf>

8. Food Losses in Import of Apples to India

Non-Objection Certificate (NOC)/Additionally; the apples export from the origin point requires certain certifications to be complied. Firstly, the Export Apple Act of the United States of America mandates inspection by the Federal or Federal-State Inspection Service. An exporter can avail online the “Export Form Certificate” certifying that “the consignment meets requirements of Export Apple Act.” It can be done on a real-time basis along with filing of documents to Customs Border & Protection agency of the United States. The food losses occurring at the stage are reported to be in the range of 1-3% depending on the ripening of apples, season, and external factors such as delay in cargo stuffing, clearances and documentary certifications. An exporter has to comply with quarantine norms of country of import i.e., India and it can be done away with Phyto-Sanitary Certificate issued by Plant Protection and Quarantine (PPQ) agency working under the aegis of Animal and Plant Health Inspection Service (APHIS). The same is done online on the same day for registered apple exporters via the Phytosanitary Certificate Issuance & Tracking (PCIT) system (Appendix 11). The importing firms informed that export clearances are done on real time basis, processed simultaneously with Customs Clearance and food losses at this stage occur primarily due to natural reasons as apple is a perishable product.

In the inter-country FSC, the combination of physical, climatic and biological damages occurs simultaneously thus necessitating far higher attention and care in transport and FSC of apples, for instance, the absence of controlled atmosphere requiring the maintenance of temperature in range of 1.1 °C to -4.4 °C, relative humidity of 85-90%, oxygen level of 2-3% and carbon dioxide level of 1-2%. Excessive exposure to CO₂ can lead to browning of the core of the apples (brown heart), thus leading to 100% loss of affected consignment. The sudden changes in temperature including ‘flash cooling’ can result in irregularly dispersed streaky brown marks thus leading to spoilage and rotting of apples. Similarly, improper ventilation and non-maintenance of cool and dry places in container boxes can lead to discolouration of outer skins, making apples unfit for sale, and resulting in food losses. Importing firms reported the major losses are occurring due to non-maintenance of controlled atmosphere in inter-country FSC, for instance, in the absence of required relative humidity and water content, apples are susceptible to major biological damages. Further, improper cargo stowage leads to impact and pressure-sensitivity, resulting in spoilage and decay of apples. For instance, the importing firm reported that jolting/vibration among packed boxes of apples can result in bruising thus spoiling and rotting the affected apples in a few days. Further it can lead to food losses of other packed apples thus contributing to major food losses at this stage of international FSC. Climatic conditions include the maintenance of required refrigeration temperature and storage in cool, dry and ventilated places. In absence of which the moisture arising-out of damp weather (rain & snow), can increase the risk of premature spoilage. Apples FSC necessitates the maintenance of controlled temperature of relative humidity of 85-90 percent, water content of 82-83 percent, and relative equilibrium moisture content of 85 percent. Apples consignments have high risks of mold development if the relative humidity remains > 90 percent. Apples can be stored for as long as 8-9 months subject

to mandated storage conditions failing which 2nd order biotic activity may decay the apple consignment with growth of mold, and other bacterial attacks.

The food losses at destination are relatively higher as country specific certification(s) clearances take time, coupled with poor storage condition(s) at destination ports in India. The destination clearances and logistics activities of Apples in India require a No-Objection Certificate (Appendix 12) from the Directorate of Plant Protection, Quarantine and Storage, which may take 3-4 days, resulting in food losses. An apple importer simultaneously has to process a No-Objection Certificate (Appendix 12) from the Food Safety Standard Authority of India (FSSAI) which can also take 2-3 days in normal course and 3-4 days in cases of mandated fumigation of imported consignment. In practice, this period is almost double, resulting in food losses, both by quality as well as in quantity. The food losses also happen in the process of distribution to the last point of tradable delivery which may involve 2-3 levels of channel, passing hand from the bulk merchant(s) to the wholesaler(s). The reported losses at this stage may vary, considering the turnover, seasons, level of heat, logistics assisting assets including cold-chain (LAACC) etc. and this stage is reported to have a maximum quantum of losses between 5.60-8.90% depending on involved factors.

9. Summary and recommendations

9.1 Findings

Based on the above, the following are seen as main reasons for food loss in the trade of these four products. Some of them are

- There is inadequacy of supporting infrastructure for both exportable and importable perishable cargo in India. For instance, the shortage of reefer containers, bins, tray, stowage support material etc. lead to food losses in case of marine as well as meat products. Further, high energy cost of electricity poses a challenge of flash cooling of reefer containers which also lead to physical damages to traded products. Similarly, in case of nuts & dry fruits and nuts imports, there is a shortage of warehouses which can handle such cargo which is sensitive to required relative humidity, water content, ventilation conditions, air exchanges, and maximum equilibrium moisture content.
- Regulatory Clearance(s) especially in cases where coordination between Central and State government departments is required, leads to enhanced time in export clearance thus resulting to food losses. Constitutionally, the matter related to animal husbandry are dealt by State level agencies, while that of foreign trade (bovine meat export) are dealt by Federal government wherein the coordination is needed in sourcing of cattle for phytosanitary and food clearances. Further, there exist silos of regulatory clearance(s) even

under the EDI system (each agency has its own system). For instance, it takes time to take clearances separately from animal quarantine, food safety, customs, plant quarantine and other associated commercial clearances from Goods and Service Tax Council and Directorate General of Foreign Trade.

- Inter-Country losses which occur physically, climatically, biologically are primarily due to inadequate logistics infrastructure, absence of timely logistic services and lack of awareness to follow the best practices of specific cargo handling by involved stakeholders in trade supply chain, for instance the improper use of bins, trays in case of marine products and improper stowage and storage of meat products leads to food losses. This occurs due to both lack of awareness of packing and stuffing staff and inadequacy of right bins, trays (marine), packing material, dunnage (meat) and use of hooks at time of loading (nuts & dry fruits) and absence of boxes (apples).
- Destination country losses occur primarily due to non-adherence to mandated sanitary and phytosanitary measures, absence of quality certification and supporting commercial & regulatory documentation(s) and absence of optimal trade infrastructure.

9.2 Suggestions for Minimizing and Reducing Food Losses

The study explains in detail the quantum of food losses and also elaborates comprehensively the reasons that lead to such food losses in the selected products. Based on above discussion, its policy solutions lie in

- 1) Capacity building and training of involved stakeholders in the Food Supply Chain as considerable quantum of food losses happens at prepacking, packing and stuffing stage which can effectively be addressed with implementing the targeted training program(s), best cargo handling practices manual(s) and hand-holding of managerial staff of involved trading firms, logistics and transportation companies on latest techniques, processes, practices and methods.
- 2) There is a need to incorporate the good manufacturing practices. The learnings of best practices can help understand the latest development in technology, packaging, storing and warehousing practices and minimize food losses in developing countries.
- 3) There is a need to augment the infrastructural capacities, capabilities, and competence in developing countries like India that can minimize a lot of food losses in the FSC.

- 4) The study highlights the nature of losses that occur due to non-compliance to certifications leading to rejections. Further, many times, a consignment is refused for final import clearance in absence of non-adherence of documentary compliance and associated certifications. This calls for a greater institutional level understanding, sensitivity and awareness of involved regulatory bodies to not only harmonize and standardize the regulatory procedures but to include the standard operating procedures in their business manual to give priority to clearance(s) related to perishable cargo (Box :1) For instance , there exists silos of EDI platforms for regulatory clearance by respective central and state agencies in India which can effectively be dealt with a “Cargo Community System” based on Application Programming Interface (API) as EDI establishes a connection between two EDI systems, wherein API is a web-based protocol that allows different systems to communicate simultaneously with each other thus bringing speed, timely clearance and transparent regulatory approval. (See Case in Appendix 15).

Box: 1

Step:1 Creating a common online portal with harmonize set of rules, procedures and forms between State and Centre for institutional and regulatory compliance from stage of sourcing of animals, suitability for meat, trimming, hygiene regulations, best packaging and labelling practices, issuance of health certificate and SPS certificate.

Step :2 Ensuring the standardise culling process and procedures for all abattoirs spread across the country.

Step: 3 Skilling manpower for Good Manufacturing and Good Hygiene Practices both at State and Centre level.

Step :4 Training and handholding of logistics and supply chain managers and other associated stakeholders in the international food supply chain (IFSC).

- 5) As the level of food losses are higher in case of imports, there is a need to work on the improving the processes, procedure and infrastructure for reducing the food losses in India. One way of dealing with is the fast-track the granting of Authorized Economic Operator Scheme to perishable goods importing firms in India which provides them an automated facility of clearing cargo at port itself under “Destination Port Delivery (DPD). Moreover, Indian Customs can sensitize its officers to grant priority to perishable cargo and clear it in a time-bound manner by coordinating it with other Partner Government Agencies.
- 6) Finally, there is a need to enhance the sensitivity of all logistics stakeholders of FSC to pay attention to causes of food losses, especially related to understanding the physical, biological and climatic factors leading to food losses in international FSC. The policy and operational solutions can help address these challenges and

help reduce the food losses in international FSC. The reduction in food losses arising-out of both regulatory and logistical hindrances can help feed millions of people and achieve the Sustainable Development Goals for a developing country like India.

The most impactful actions that can be taken to reduce the food losses are summarized as under:

- **Trade Actions (for Exporting & Importing Firms):**
 - Implementing Good Manufacturing Practices (GMPs) in meat cutting & processing
 - Implementing Good Packing Practices ensuring Biological Compliance
 - Ensuring proper Freezing & maintaining temperature in line with associated climatic parameters
 - Uninterrupted and regular supply of Reefer Boxes
 - Rapid Freezing of Containers
 - Bin/Carton Suitability to reduce physical damages
 - Ensuring Biological & Climatic compliance

- **Logistical & Transport Actions:**
 - Ensuring proper storage and stowage conditions and effective stuffing plan
 - Maintenance of temperature in the entire journey and transport nodes
 - Strengthening supporting infrastructure for Reefer cargo
 - Imparting latest logistics skills to the Staff of exporting and importing firms and third party logistic service providers.

- **Regulatory Action (for public agencies):**
 - Fast-tracking regulatory clearances for perishable goods (both exports and imports)
 - Smoothing-regulatory clearance under Direct Port Export (DPE) facility to perishable product exporters
 - Improving inter-agency coordination for export clearances
 - International best practices for Export Compliance (NTMs/ Codex Alimentarius/National Law)
 - Strengthening Testing & Inspection Facilities
 - Focus on harmonization of import clearance regime of destination country as per Destination Port Delivery (DPD) of Authorized Economic Operator Scheme and WTO-Trade Facilitation Agreement

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Annexures

Appendix 1: Definitions

1. *The stages of food losses in the ‘export-country logistics’ are from stage of export packing or stuffing of cargo in containers/reefer boxes to stage of regulatory clearances of cargo for onboard loading on the vessel.*
2. *The stages of food losses in the ‘international logistics’ are from stage of loading of cargo to stage of unloading at destination.*
3. *The stages of food losses in ‘import-country logistics’ are from unloading of cargo to stage of delivery at retail/ service points, excluding the final retail.*

Appendix 2: Statistical Equation for Calculating the Food Loss(es)

Total TFLISC = Sum of Food Losses at each stage of the international food supply chain

$$\text{Total TFLISC} = \sum S_i = \sum f(x_j) \dots\dots\dots (\text{Equation 1})$$

Where ‘Si’ stands for the losses in each critical stage of International FSC (Food Supply Chain); ‘Xj’ stands for the factors affecting losses at each step and ‘i’ represents critical stages from the stage of international FSC (prepacking stage to stage of delivery at retail/ service points).

$$S_i = \sum f(x_j) \dots\dots\dots (2)$$

The equation (2) represents the food losses at each stage of international FSC, i.e. export country FSC, inter-country FSC and destination country FSC. The measurable factors in this study are:

- a.** Food Losses in the Export Country Supply Chain (FLESC) = f (Losses due to unavailability of inadequate packing equipment/reefer boxes, Losses due to rejections in regulatory clearances/ certification(s)/NTBs, Losses arising of delay in availability of transport services),
- b.** Food Losses in the Inter-Country Supply Chain (FLISC) = f (Losses arising out infrastructure unavailability including delays/Losses arising out of regulatory clearances/Losses due to cargo rejection(s) arising out of non-tariff barriers including quality issues), and
- c.** Food Losses in the Destination Country Supply Chain (FLDSC) = f (Losses arising out infrastructure unavailability including delays/ Losses arising out of regulatory clearances/Losses due to cargo rejection(s) arising out of non-tariff barriers including quality issues/Losses due to transportation delay(s) to warehousing/ retail/ service points/ Losses due to product shelf-life/ product expiry/improper storage and handling)

**Appendix 3: SWIFT PGA Filing for Mandatory & Optional Export Clearances/
Certification(s) and Compliances of Frozen Bovine Meat and Marine Products**

PGA Code	PGA Name	INFO Code	INFO Desc	QFR Code	QFR Desc	REQ	Man Opt
AQCS	Animal Quarantine Inspn. Service	PNM	Product Name	COM	Common Name	Text	Mandatory
AQCS	Animal Quarantine Inspn. Service	CHR	Item Characteristics	BRD	Breed	Text	Optional
AQCS	Animal Quarantine Inspn. Service	CHR	Item Characteristics	CLR	Colour	Text	Optional
AQCS	Animal Quarantine Inspn. Service	CHR	Item Characteristics	SEX	Sex	Code	Optional
AQCS	Animal Quarantine Inspn. Service	CTG	Item Category	GRA	Grade of the Product	Code	Optional
AQCS	Animal Quarantine Inspn. Service	IDT	Item Identification	MIC	Microchips numbers inserted into animals for identification purposes	Text	Optional
AQCS	Animal Quarantine Inspn. Service	IDT	Item Identification	PAS	Animal Passport Number	Text	Optional
AQCS	Animal Quarantine Inspn. Service	PNM	Product Name	PET	Pet Name	Text	Optional
AQCS	Animal Quarantine	PNM	Product Name	SCI	Scientific Name	Text	Optional

	Inspn. Service						
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STC	Storage Condition	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	FSP	Foods & Supplement Proprietary Status	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STT	Storage Temperature	UQC	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	GRA	Grade of the Product	Code	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	IFC	Indian Food Code	Text	Optional
FSSAI	Foods Safety & Standards Authority	IDT	Item Identification	GTI	Global Trade Item Number	Text	Optional

Source: www.icegate.gov.in

Appendix 4: Foreign Trade Regime Compliance for Meat Export at the stage of Export Customs Clearance

Note No.	Provisions of Schedule 2, Export Policy of ITC HS Code for Frozen Bovine Meat Export (HSN-0202)
3	The export of chilled and frozen meat shall be allowed subject to the provision specified to the gazette notification on raw meat (chilled and frozen) under Export (Quality Control and Inspection) Act, 1963. Offals of buffalo too are subject to the same conditions of quality control and inspection. Laboratories duly recognized by APEDA, as well as in-house laboratories attached under the abattoirs cum meat processing plant registered with APEDA and Agency approved labs, may also be used to conduct the necessary tests for confirmation of quality under the supervision of the designated veterinary authority of the State. On the basis of these test and inspections carried out by Veterinarians, duly registered under the Indian Veterinary Council Act, 1984, employed by the exporting unit and supervised by the designated veterinary authority of the state, the veterinary Health Certificate may be issued by the designated authorities of the state.
4	Export of canned meat products shall be subject to pre shipment inspection either by the State Directorate of Animal Husbandry or Export Inspection Agency or Directorate of Marketing and Inspection Government of India or Municipal Corporation of Delhi (MCD) in accordance with either the standards prevalent in the exporting country or standards prescribed under the Meat Food Products Order, 1973 under Export (Quality Control and Inspection) Act, 1963 or orders made there under.
6	Export of meat and meat products will be allowed subject to the exporter furnishing a declaration, attached with copies of valid APEDA Plant Registration Certificate(s) to the customs at the time of export that the above items have been obtained / sourced from an APEDA registered integrated abattoir or from APEDA registered meat processing plant which sources raw materials exclusively from APEDA registered integrated abattoir/abattoir.
7	On the cartons for export of meat, the following details shall compulsorily be mentioned:- (i) Name of the Product. (ii) Country of Origin (iii) APEDA Plant Registration No. (iv) Name of the exporter.
8	The designated veterinary authority of the State where meat processing unit is located, may issue the certificate on the basis of the inspections carried out by Veterinarians duly registered under the Indian Veterinary Council Act 1984 employed by the exporting unit and supervised by the designated veterinary authority of the State. The Inspection Fee prescribed under the Export of Raw Meat (Chilled/Frozen) (Quality control and Inspection) Rules, 1992 shall continue to be paid by the exporting unit to the Agency as currently applicable

Source: Schedule 2 of ITC HS Code, Export Policy, Director General of Foreign Trade, India

Appendix 5: Documentary Flow of Customs Clearance, Certifications, Compliance of Frozen Bovine Meat Export from India

Step 1: File Shipping Bill to Indian Customs at www.icegate.gov.in

Step 2: Apply for NOC to FSSAI with documents:

- Country of Origin Certificate
- Importer Exporter Code (IEC) issued by the DGFT
- FSSAI Food Business License
- Bill of Entry
- The end-use declaration, a declaration that food is not GM food
- Besides this, depending on individual import items, other documents may be required.

Step 3: Labeling Requirements on Food Exports:

- Nutritional facts and information.
- The name of the brand, company, product, etc.
- The product description and the name of the ingredients used in the product.
- The volume of contents and net weight.
- The Labelling Language should be as per FSSAI (Packaging & Labelling) Regulations, 2011, and the product-specific labelling requirements.
- The “Best Before” date declaration.
- Net weight.
- Declaration of vegetarian and non-vegetarian by symbols.
- The name and address of exporter in India.
- Batch number, code number, lot number, and many more.

Step 4: Indian Customs may seek and check following other documents.

- IE Code License
- FSSAI License
- Product Approval Certificate
- Ministry of Agriculture Permit
- Ministry of Animal Husbandry permit
- Narcotics Certificate

Appendix 6: Law Regulating the Quarantine and Food Safety Standards in People’s Republic of China

1. Law of the People's Republic of China on the Entry and Exit Animal and Plant Quarantine (Revised in 2009);
2. Regulations for the Implementation of the Law of the People's Republic of China on the Entry and Exit Animal and Plant Quarantine;
3. Customs Law of the People's Republic of China (Revised in 2017);
4. Law of the People's Republic of China on Import and Export Commodity Inspection (Revised in 2018);
5. Implementing Regulations of the Law of the People's Republic of China on Import and Export Commodity Inspection (Revised in 2019);
6. Food Safety Law of the People's Republic of China (Revised in 2018);
7. Implementing Regulations of the Food Safety Law of the People's Republic of China (Revised in 2019)

Source:

Appendix 7: A Test List of Seafood Standards for Marine Products in People’s Republic of China

Test Methods	Test Project
Physical and Chemical Project	Lead
Physical and Chemical Project	Inorganic arsenic
Physical and Chemical Project	Methylmercury (when the total mercury levels do not exceed the limit value methylmercury, do not have the determination of methylmercury; otherwise, should be subject to determination of methylmercury)
Physical and Chemical Project	Cadmium
Physical and Chemical Project	Chromium
Shellfish toxins	Paralytic shellfish poisoning (shellfish Only)
Shellfish toxins	Diarrheal shellfish poisons (shellfish Only)
Physical and Chemical Project	Crystal violet, crystal violet invisible
Physical and Chemical Project	Malachite green, malachite green stealth

Radioactive detection	131 (Japan aquatic Only)
Radioactive detection	Cs-137 (Japan aquatic Only)
Microbial Project	Listeria monocytogenes
Microbial Project	Vibrio parahaemolyticus
Microbial Project	Vibrio cholerae
Microbial Project	Enterobacteriaceae
Microscopy	Parasites

Source: Administration of Quality Supervision Inspection and Quarantine (AQSIQ)

Appendix 8: Certification(s)/ Regulatory Compliance (SWIFT PGA Filing) for Dry Fruits Imports in India

PGA Code	PGA Name	INFO Code	INFO Desc	QFR Code	QFR Desc	REQ	Man Opt
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STC	Storage Condition	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	FSP	Foods & Supplement Propriety Status	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STT	Storage Temperature	UQC	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	GRA	Grade of the Product	Code	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	IFC	Indian Food Code	Text	Optional

FSSAI	Foods Safety & Standards Authority	IDT	Item Identification	GTI	Global Trade Item Number	Text	Optional
PQIS	Plant Protection and Quarantine	CHR	Item Characteristics	PLV	Plant Variety	Text	Mandatory
PQIS	Plant Protection and Quarantine	CTG	Item Category	PLC	plant Category	null	Mandatory
PQIS	Plant Protection and Quarantine	CTG	Item Category	PLP	Plant Parts	Code	Mandatory
PQIS	Plant Protection and Quarantine	PNM	Product Name	PCN	Plant Commodity Name	Code	Mandatory
PQIS	Plant Protection and Quarantine	PNM	Product Name	SCI	Scientific Name	Text	Mandatory

Source: Accessed from www.icegate.gov.in (E-Commerce Web portal of Indian Customs)

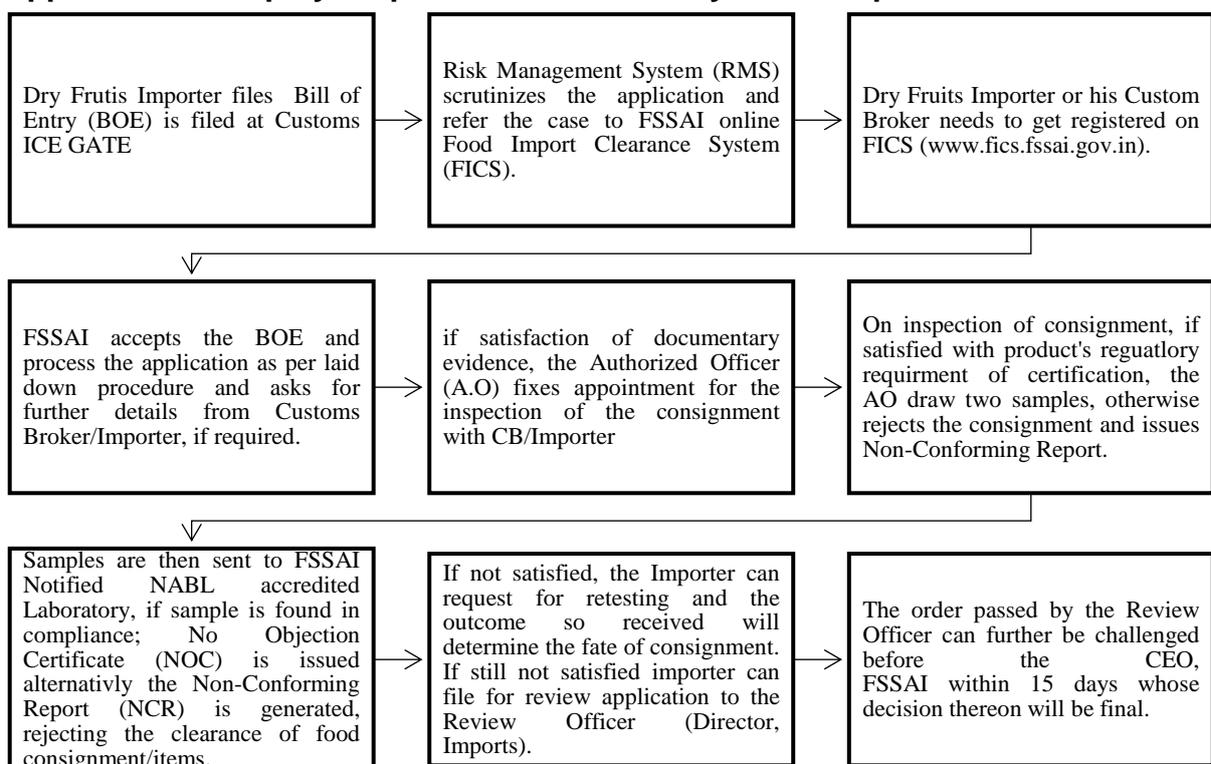
Appendix 9: The Regulatory Documentation Involved in Dry Fruits Import Clearance in India

S. No	Document Name	Regulatory Agency	Web Portal/ EDI Platform	Mandating Legislation/ Regulations/ Rules	Type
1	Bill of Entry	Indian Customs	www.icegate.gov.in	Section 46 of Indian Customs Act 1962	Mandatory
2	Commercial Invoice, Packing List, Bill of Lading/Airway Bill	Supplied by Exporter via Proper Banking Channels	https://www.icegate.gov.in/eSANCHIT.html (E-Sanchit Module)	Provisions of Chapter 2 of India's Foreign Trade Policy 2015-20 as extended till 2021	Mandatory
3	Common Name	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
4	Storage Condition	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
5	Foods & Supplement Propriety Status	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
6	Plant Variety	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
7	Plant Category	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
8	Plant Parts	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
9	Plant Commodity Name	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory

10	Scientific Name	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory
11	Importer's Declaration as mandated in Form 7 to Form 15 for end use	FSSAI	https://fics.fssai.gov.in/AOLogin.aspx	Food Safety & Standards Act 2006	Mandatory

Source: Author's Compilations based on Stakeholder's Consultations

Appendix 10: Step by Step Process Flow of Dry Fruits Import Clearance in India



Source: Accessed and Adapted from

https://www.fssai.gov.in/upload/uploadfiles/files/FAQs_Food_Import_15_01_2020.pdf

Appendix 11: Certification(s)/ Regulatory Compliance (SWIFT PGA Filing) for Apples Imports in India

PGA Code	PGA Name	INFO Code	INFO Desc	QFR Code	QFR Desc	REQ	Man Opt
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STC	Storage Condition	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	FSP	Foods & Supplement Propriety Status	Code	Mandatory
FSSAI	Foods Safety & Standards Authority	CHR	Item Characteristics	STT	Storage Temperature	UQC	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	GRA	Grade of the Product	Code	Optional
FSSAI	Foods Safety & Standards Authority	CTG	Item Category	IFC	Indian Food Code	Text	Optional
FSSAI	Foods Safety & Standards Authority	IDT	Item Identification	GTI	Global Trade Item Number	Text	Optional
PQIS	Plant Protection and Quarantine	CHR	Item Characteristics	PLV	Plant Variety	Text	Mandatory
PQIS	Plant Protection and Quarantine	CTG	Item Category	PLC	plant Category	null	Mandatory
PQIS	Plant Protection	CTG	Item Category	PLP	Plant Parts	Code	Mandatory

	and Quarantine						
PQIS	Plant Protection and Quarantine	PNM	Product Name	PCN	Plant Commodity Name	Code	Mandatory
PQIS	Plant Protection and Quarantine	PNM	Product Name	SCI	Scientific Name	Text	Mandatory

Appendix 12: Process of No-Objection Certificate of Clearance of Apples in India by Plant Protection & Quarantine Service Department

Import Procedure

Stage 1: Issue of Import Permit: An Importer intending to import agricultural commodities has to apply in advance for the issue of Import Permit in respect of the commodities listed in Schedule V and VI of PQ Order, 2003 in the prescribed form. The procedure to be followed has been shown in the flow chart at Annexure-II

Stage 2: Inspection of Cargo: Inspection of imported agricultural commodities on arrival at the port of entry for preventing the introduction of exotic pests and diseases inimical to Indian Fauna and Flora through implementation of DIP Act, 1914 and Plant Quarantine (Regulation of Import into India) Order, 2003 issued thereunder.

Stage 3: Cross Referencing of Test Report with Indian Customs: The import clearance involves various steps from receipt of reference from Customs until recommendation for its release or otherwise to the Customs including sampling, detail testing viz., bacteriological, mycological, entomological, nematological, etc., besides the post entry quarantine (PEQ) testing at the importers premises under the PEQ facility. The flow chart for import inspection and clearance is attached (Annexure-III). The post entry quarantine inspections which are required in case of cuttings, saplings and bud woods are carried out by the Designated Inspection Authorities constituting mainly the head of the Department of Entomology/Plant Pathology of the State Agricultural Universities/ICAR Institutions.

Stage 4: Undertaking Post Entry Quarantine Inspection in respect of identified planting materials: In line with the New Policy on Seed Development, 1988 and the provisions of PQ Order, 2003, the specified planting material for propagation (viz., cuttings, saplings, bud woods, etc.) require growing under Post Entry Quarantine for a specified period. The import permit for such planting material is granted based on a certificate from Designated Inspection Authorities of the concerned jurisdiction stating that the importer possesses the post entry quarantine facility for the imported planting

material. Such consignments are released with the intimation to the concerned Inspection Authorities for conducting further PEQ inspections and the final clearance is granted based on the PEQ Inspection Report.

Appendix 13(A): Demystifying Impact of Food Loss in International Trade of Food Products: Building Narrative for Developing Countries from Indian Perspective

(Please don't include Food Waste in definition of Food Losses)

	Level of Food Loss(es) in Exports from Kochi (India) to Shanghai (China)	% of Food Loss
Export Country Logistics	Losses due to unavailability of container boxes/ reefer devices	
	Losses due to Packaging Labelling, Unitization Devices and improper Handling	
	Losses arising out of delay in Food Certification and Clearances	
	Losses arising out of delay in Customs Clearance	
	Losses arising out of delay in other Procedural Delays	
	Losses arising out of delay in Transport related delays (factory/ICDs to gateway port)	
Inter-Country Logistics	Losses arising out of Physical damages (improper storage/stowage/handling) to cargo.	
	Losses arising out of Climatic damages (atmospheric pollution/pressure/solar radiation/rains).	
	Losses arising out of Biological damages (pest, infestation, fungi, moulds, bacteria) to cargo.	
Import Country Logistics	Losses arising out of delay associated with ship-berthing, port & terminal	
	Losses arising out of delay in customs clearances	
	Losses arising out delays in food clearances and certification	

	Losses due to hinterland transit/ warehousing /storage	
	Losses due to shelf life/ product expiry/ improper storage and handling	

Reasons for Food Loss:

1.
2.
3.
4.

Suggestions for Avoiding Food Loss:

1.
2.
3.
4.

Appendix 13 (B): Demystifying Impact of Food Loss in International Trade of Food Products: Building Narrative for Developing Countries from Indian Perspective

(Please don't include Food Waste in definition of Food Losses)

	Level of Food Loss(es) in Exports from Meerut (India) to Hanoi Viet Nam	% of Food Loss
Export Country Logistics	Losses due to unavailability of container boxes/ reefer devices	
	Losses due to Packaging Labelling, Unitization Devices and improper Handling	
	Losses arising out of delay in Food Certification and Clearances	
	Losses arising out of delay in Customs Clearance	
	Losses arising out of delay in other Procedural Delays	

	Losses arising out of delay in Transport related delays (factory/ICDs to gateway port)	
Inter-Country Logistics	Losses arising out of Physical damages (improper storage/stowage/handling) to cargo.	
	Losses arising out of Climatic damages (atmospheric pollution/pressure/solar radiation/rains).	
	Losses arising out of Biological damages (pest, infestation, fungi, moulds, bacteria) to cargo.	
Import Country Logistics	Losses arising out of delay associated with ship-berthing, port & terminal	
	Losses arising out of delay in customs clearances	
	Losses arising out delays in food clearances and certification	
	Losses due to hinterland transit/ warehousing /storage	
	Losses due to shelf life/ product expiry/ improper storage and handling	

Reasons for Food Loss:

1.
2.
3.
4.

Suggestions for Avoiding Food Loss:

1.
2.
3.
4.

Appendix 13 (C): Demystifying Impact of Food Loss in International Trade of Food Products: Building Narrative for Developing Countries from Indian Perspective

(Please don't include Food Waste in definition of Food Losses)

	Level of Food Loss(es) in Imports from California (USA) to Chennai or any other ports of India	% of Food Loss
Export Country Logistics	Losses due to unavailability of container boxes/ reefer devices	
	Losses due to Packaging Labelling, Unitization Devices and improper Handling	
	Losses arising out of delay in Food Certification and Clearances	
	Losses arising out of delay in Customs Clearance	
	Losses arising out of delay in other Procedural Delays	
	Losses arising out of delay in Transport related delays (factory/ICDs to gateway port)	
Inter-Country Logistics	Losses arising out of Physical damages (improper storage/stowage/handling) to cargo.	
	Losses arising out of Climatic damages (atmospheric pollution/pressure/solar radiation/rains).	
	Losses arising out of Biological damages (pest, infestation, fungi, moulds, bacteria) to cargo.	
Import Country Logistics	Losses arising out of delay associated with ship-berthing, port & terminal	
	Losses arising out of delay in customs clearances	
	Losses arising out delays in food clearances and certification	
	Losses due to hinterland transit/ warehousing /storage	
	Losses due to shelf life/ product expiry/ improper storage and handling	

Reasons for Food Loss:

1.
2.
3.
4.

Suggestions for Avoiding Food Loss:

1.
2.
3.
4.

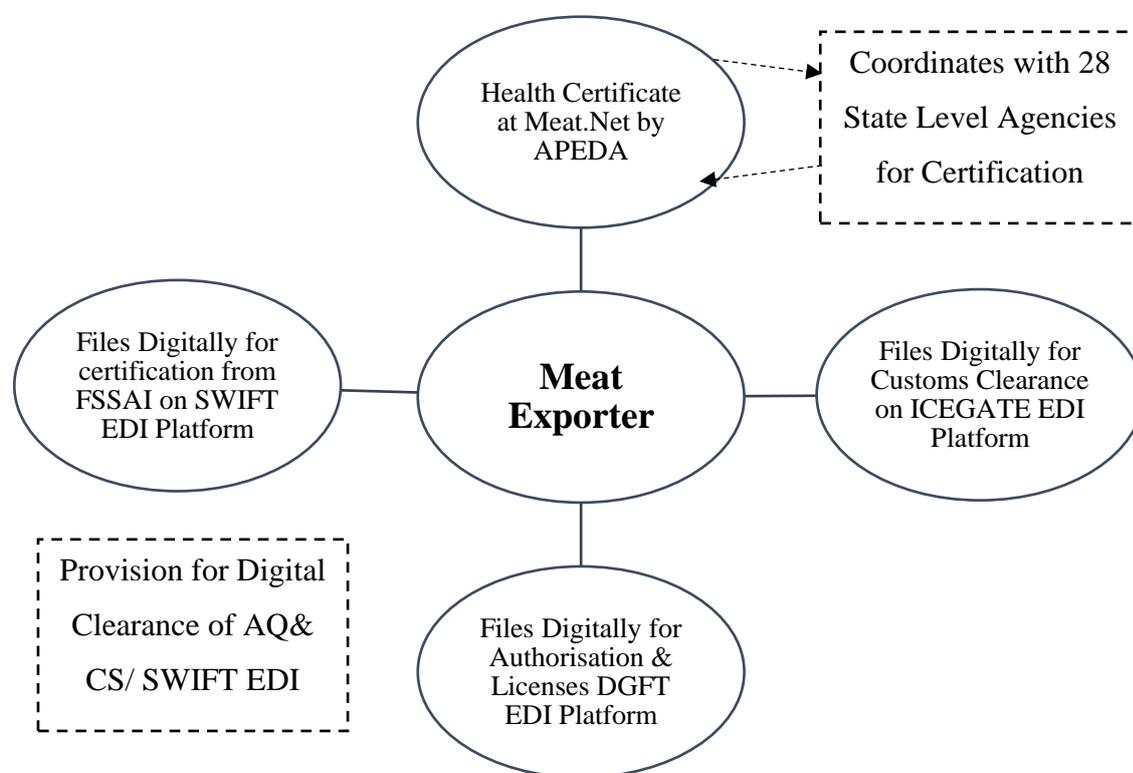
Appendix 14

Name of Lead Expert	Organization		Email Address
Mr. Rajneesh Sasidharan	Sea Food Exporters Association of India, Kochi, India	Marine Products	seaihq@gmail.com
Dr. Sudhanshu (Animal Products, Processed Food, Quality, Logistics)	Agricultural & Processed Food Development Authority	Meat Sector & Fresh Fruits (Apples)	sudhanshu@apeda.gov.in
Mr. Ali Liyaqat, Member, All India Meat & Livestock Exporters Association (AIMLEA)	AL-HIND EXPORTS, Meerut, India	Meat Sector	sales@alhindexports.com
Mr. Sunil Dutt	Federation of Indian Exporters Organization	Dry Fruits	sunildutt@fieo.org

Appendix 15 : The case of greater institutional understanding among Regulatory Agencies for India’s Meat Exports:

The involved clearance agencies in meat exports are first; the Agricultural & Processed Food Development Authority (APEDA) for ‘Health Certificate’ and ‘Traceability Certificate’ which in turn has to coordinate with respective state government agencies (28 States in India.) for certification, as animal husbandry is a ‘State Subject’ Vide Entry No. 15, List II, State List of Indian Constitution. Additionally, Food Safety certifications are also required from Food Safety & Standards Authority. Tax Clearances are required from GST Councils. Authorisation and Licenses are required from Director General of Foreign Trade and finally Indian Customs clear the cargo. The labyrinth of associated clearances are done in EDI enabled digital platform in the following fashion.

Figure1: Silos in India’s Meat Export Clearance System



These certifications and clearances are done on an EDI platform which provide ‘regulatory services’ not the ‘business solutions’ as required for time-critical perishable industry. The solution lies in creating a ‘Cargo Community Platform’ based on Application Programming Interface (API), similar to the kinds of used by Banking, Financial Services, & Insurance industry.

There exists similar kinds of problems in active and uninterrupted interface and clearance mechanism for other perishable industries, necessitating the greater institutional level understanding, sensitivity and awareness of involved regulatory bodies, as pointed by us.

In addition to above, there is need to harmonize and standardized the regulatory procedures for certifications from state agencies on a single harmonized form with approach called “one country- one system”. APEDA Meat.net facilitates it with harmonized procedure and standardized manual but with layered and heterogeneous level of responsibility with State Animal Husbandry Department, Authorized Processing Establishment(s), District Veterinary Officer, and designated Veterinary Officer(s). This brings redundancy in the effective and time-bound functioning of the system in absence of harmonized governance and functioning. Hence; a standard operating procedure is required involving harmonized regulatory procedure from both central and state agencies.

Further, the awareness for export of goods is increasing fast, yet there is need to sensitize the state level official(s) for clearance mechanism of perishable cargo. This requires training and handholding of involved regulatory agencies and it can be achieved by involving the stakeholders in the entire supply operations of the meat export business.



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