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Prevailing Standards and Dimensions Governing Sanitary and Phyto-Sanitary Compliance in Indian Black Pepper Supply Chain

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Abstract

Sanitary and phyto-sanitary (SPS) compliance in agricultural trade has received considerable attention from policy makers, agribusiness firms, exporters and researchers for its perceived ability to contribute towards production and development of safe and quality agri-products for domestic and international markets. This paper has examined the prevailing standard practices and major dimensions governing SPS compliance along the black pepper supply chain in India. It has been found that knowledge generation and dissemination of food safety aspects are essential to upgrade domestic food safety standards as to comply with the international standards. The important dimensions include application of Good Agricultural Practices, Good Manufacturing Practices, Good Handling Practices and Hygienic Practices besides physical and financial infrastructures along the supply chain. An important policy implication of this study is that the efforts and investments should be targeted towards promotion of important dimensions governing SPS compliance along the supply chain.

Key words: Standards, dimensions, black pepper, sanitary and phyto-sanitary

JEL Classifications: D18, F15, F19, H41, I18, K33, L84, Q18

Introduction

The increasing integration of global agri-food markets has created opportunities for expansion of food trade. However, these have been accompanied by stringent food safety measures, especially in the developed countries (OECD, 2000). This has posed new challenges before the developing countries in harmonizing their food regulations and standards with the emerging global trends so as to sustain their share of global trade in food commodities and cash crops. To reduce risk intrinsic in the global trade, several technical requirements need to be fulfilled by the producers, processors and exporters (Kumar, 2009). The sanitary and phyto-sanitary (SPS) requirements of importing countries (as per their Acts) are increasingly being applied to the production and trade of agricultural products. There is an ample opportunity for developed countries to tweak the standards stronger than necessary to achieve the optimal levels of social protection and to twist the related testing and certification procedures to make their imports more competitive. Developing countries should view SPS not as a trade barrier but as an opportunity to upgrade quality standards and market sophistication (Jongwanich, 2009).

India's Foreign Trade Policy (2009-14) aims to achieve an annual export growth of 15 percent with an

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annual export target of US$ 200 billion by March 2011 and 25 per cent in the next three years. In order to achieve this, the Government of India has been providing a policy environment through a mix of measures including fiscal incentives, institutional changes, procedure rationalization, and enhanced market access across the world and diversification of export markets. India is a major exporter of black pepper. The Spices Board of the Ministry of Commerce, Government of India, has shown keen interest in improving participation of farmers and exporters in the growing export markets for black pepper by enhancing their capacity in compliance with food safety and quality requirements of the importing countries. The Spices Board has taken several initiatives to realign and reconfigure the production (good agricultural practices), processing (good manufacturing practices), and handling practices of black pepper as to maintain its competitive edge in the global market.

Kerala is the major black pepper growing state in India. Most operations like sieving, washing and sun drying were being done manually. However after a series of rejection of export consignments in the late-1980s, several agribusiness companies invested in mechanical cleaning, washing, drying, and packing equipment. Subsequent regulatory concerns about microbiological contamination of black pepper in the United States served as a catalyst for investment in sterilization facilities. Since many agribusiness firms have started complying with Hazard Analysis and Critical Control Point, International Standard Organization (HACCP, ISO 9000) and other certified food safety or quality assurance standards. Thus, a number of forces, directly and indirectly, affect the compliance of SPS measures in black pepper. In this backdrop, this paper has examined India's existing safety standards in relation to international standards, and has discerned and quantified the major dimensions governing SPS compliance at various levels of the black pepper supply chain.

Data and Methodology

The time series data (1986-2010) on area, production, productivity and export of black pepper were collected from publications of Spices Board and FAO Trade Year Book. The extent of instability in black pepper production and export was estimated using Cuddy della valle Index (Elsholz and Harsche, 2008). It was performed over the coefficient of variation to compute instability in the area, production, yield as well as export of black pepper. The instability measured in relative terms by this Index corrects the overestimation of the level of instability in time series data characterized by the long- term trends. The Cuddy della valle Index (I) is:

$$I = CV^* (1 - \text{Adj } R^2)^{0.5}$$

where,

CV = Coefficient of variation = (Standard deviation/Mean) *100, and

Adj R^2 = Adjusted coefficient of multiple determination.

Black pepper trade activities are concentrated in and around Kochi city. Hence, a survey of stakeholders (producers, traders and exporters) was conducted in Cochin to elicit information related to the SPS practices being followed by them. Various food safety measures adopted by different black pepper importing countries were collected from the websites of some of the countries like Japan, USA, EU and Malaysia for the year 2010.

Information on various issues governing SPS standards in black pepper was collected from a random sample of 120 farmers, 60 processors and 60 exporters. Factor analysis technique was done to discern and quantify the dimensions governing SPS compliance. It provides a means of identifying and measuring the relationships or basic patterns in dataset (Nagabhushanam and Hiremath, 1990). It was done with the Principal Component Axis Method of factoring (Hotelling, 1933). The Principal Component model is expressed as per Equation (1):

$$Z_j = a_{ji} + a_{j2} F_2 + a_{j3} F_3 + \ldots\ldots\ldots\ldots\ldots + a_{jq} F_q \quad \ldots(1)$$

where,

Z_j = Magnitude of the indicator j ; i.e. j^{th} principal component or factor in the model,

a_{jq} = The factor loading of the q^{th} indicator in the j^{th} principal component or factor,

F_q = The amount of association in magnitude of indicators, the uncorrelated trait measured by factor q which is possessed by the indicator j,

j = Factor loading with reference to indicators (1, 2, 3, …, q),

q = A set of indicators in the model (1, 2, 3, ..., q), and

a_{jq} F_q = Factor coefficient or loading of indicator j on factor q.

Since the unrotated factors are rarely interpretable and may not give meaningful pattern of variables, a new set of variables was generated by rotations. The Varimax Rotation method (Kaiser, 1958) was used which maximizes the variance of factors in the matrix and contains several high or low loadings. Only those factor loadings were considered which had more than or equal to 3-times the standard error. The inferences were drawn on the basis of factor loadings (< 0.50) in the final loading matrix by using the following standard error formula (Equation 2) of factor loading (Harman,1967).

$$\sigma_a = ½ [(3/ r – 2 – 5r + 4r^2) / N]^{0.5} \quad \ldots(2)$$

where,

σ_a = Standard error of factor loadings,

r = Average value in correlation matrix or factor loadings, and

N = Number of observations.

Results and Discussion

Black pepper is a premium commodity and is high in demand in the overseas markets. The spice export period was divided into pre-WTO regime (1986-1995) and post-WTO regime (1996-2010) because the spice export from the country received a major boost in recent years. The values of instability index in area, production, yield and export of black pepper during pre-WTO and post-WTO periods are presented in Table 1. The index values showed a rise in instability in area, production and yield in the post-WTO period. The instability index for export of black pepper in terms of quantity as well as value also increased. This could be due to fluctuations in international prices of black pepper. These findings indicate that black pepper market has become riskier in the post-WTO period due to fast changes in the global pepper business.

Prevailing Mechanisms of Maintaining and Setting of Quality Safety Standards of Black Pepper

(1) The Codex Alimentarius Commission (CAC) constituted partly by Food and Agriculture Organization (FAO) and World Health Organization (WHO) adopted the Code of Hygienic Practice for Spices and Dried Aromatic Plants in 1995, which is mainly applicable to spices and dried aromatic plants. It covers minimum requirements of hygiene for harvesting, post-harvest technology (curing, bleaching, drying, cleaning, grading, packing, transportation and storage including microbial and insect disinfestations), processing establishments, processing technology (grinding, blending, freezing and freeze drying, etc), and packaging and storage of processed products. It also takes into account personal hygiene required at the time of processing the product.

(2) In India, Agmark standards for spices are set as per the Spices Grading and Marking Rules, 2005 (Ministry of Agriculture, 2005). As per these rules, clear instructions regarding the method of packing to be adopted, quality and characteristics of spices (whole and powder) are explained explicitly. Under the 'In Process Quality Control (IPQC)'

Table 1. Instability Index of area, production, yield and export of black pepper in India

Particulars	Pre-WTO(1986-1995)		Post-WTO (1996-2010)		Overall Period (1986-2010	
	CV (%)	CDI (%)	CV (%)	CDI (%)	CV (%)	CDI (%)
Area	14.628	3.84	11.278	10.50	17.44	10.024
Production	18.990	11.15	19.031	18.941	23.46	19.816
Yield	9.6776	9.442	12.95	11.223	11.71	11.6818
Export (in quantity)	34.4759	32.81	38.890	35.273	35.89	35.56
Export (in value)	35.966	34.003	58.206	46.62	58.64	58.26

Source: FAOSTAT (1986-2010)

scheme, only the units having all the prescribed facilities as per rules to produce safe product shall be approved for the processing and packing of black pepper for export under their own supervision and control.

(3) In USA, USFDA (United States Food and Drug Administration) fixes the standards for black pepper to be sold in USA in consultation with the ASTA (American Spice Trading Association). Indian export consignments to the US are inspected based on the standards and requirements of USFDA.

(4) For Europe, the European Spice Association (ESA) fixes the standards for black pepper import and also imposes rules regarding the procedure to be adopted for sample test. ESA also specifies methods to be adopted by the black pepper exporting countries to test the physical parameters (e.g., for testing moisture content in the product, test to be conducted is ISO 939; similarly, to check the volatile oil content, ISO 6571 is to be adopted). In EU, irradiation is banned, unless agreed mutually by the buyer and the seller.

(5) International Pepper Community (IPC) is an intergovernmental organization of pepper producing countries established in 1972 under the auspices of UNESCAP (United Nations Economic and Social Commission for Asia and Pacific). The IPC includes Brazil, India, Indonesia, Malaysia, Sri Lanka and Vietnam as full members and Papua New Guinea as an associated member. They have also developed certain quality standards for black pepper in 2001.

Consumer pressure, protection of brand image, stricter food regulations in the EU during 1990s have forced many countries in EU to raise their food safety standards (Kumar and Kumar, 2003). Super markets in the developed countries have responded to the changing regulatory and demand conditions by seeking to meet consumer demands for all the products (Dolan and Humphrey, 2002). A comparison of quality standards on various parameters adopted by various countries is presented through Tables 2 to 4.

The Agmark standards regarding organic extraneous matter are 250 per cent stricter than the ESA (European Spice Association) standards. For inorganic extraneous matter, the Indian (Agmark)

Table 2. A comparison of physical quality standards adopted by various countries and institutions for black pepper: 2010

Particulars	Agmark (India)	ASTA	ESA	Japan	Malaysia	IPC
1. Organic extraneous matter (% m/m) max	0.8		2			
2. Inorganic extraneous matter (% m/m) max	0.2	1	2		1	1
3. Light berries (% m/m) max	5				2	2
4. Pinhead and broken berries max	4					
5. Bulk density (g/L) min	490					550
6. Moisture % (max)	11	12	12	11	10	12
7. Total ash (% m/m) max	6		7			
8. Non volatile ether extract % (min)	6					
9. Volatile oil % (mL/100 gram)	2.5		2			
10. Piperine content (% m/m) min	4					
11. Whole insects dead (by count)		2			≤2 in sample	
12. Excreta mammalian (mg/lb)		1			0	
13. Other excreta (mg/lb)		5		0		
14. Mold (by weight)		6			1	
15. Insects defiled /infested % by weight max		5		0	1	
16. Acid insoluble ash (% w/w) max			1.5			

Sources: Various government websites, Spices Board.
Note: % m/m = per cent mass / mass, % w/w = per cent weight /weight, mg/lb = milligram per pound, g/L = gram per litre

standards are stricter compared to those of US, Malaysia and IPC by 500 per cent and ESA by 1000 per cent. In respect of moisture content, the Indian (Agmark) standards are 190 per cent higher than of US, EU and IPC. The Japanese and Indian standards are on the same level, whereas the Malaysian standards are stricter compared to Agmark (Indian) standards. The Indian (Agmark) standards are more relaxed in the case of light berries compared to the Malaysian and IPC standards. A minimum bulk density of 490g/ L is required for marketing in India, whereas IPC requires a higher minimum requirement of 550 g/L. Compared to EU standards, the volatile oil content standards are relaxed in India. Some parameters like maximum amount of pinhead and other broken berries and several technical regulations like minimum piperine content are defined only in the Agmark (Indian) standards and are probably more relevant in the Indian context only.

Physical parameters are clearly specified in the ASTA standards as well as in the Malaysian and IPC standards. The presence of insects and excreta are not at all allowed in Malaysia, whereas it is allowed to a certain limit in the US. But, these physical parameters are not defined in the Agmark (Indian) standards which indicate that these parameters are not considered important in India, and this needs to be reviewed. The exporters have to devise their black pepper business strategies revolving around the physical parameters of quality standards within the jurisdictional limits of the specifying institutions/ the agency. This would ensure that the products exported were of required quality and would not face rejection at the receiving end. On few parameters, this comparison shows common standards and reveals their relative importance.

Another set of food safety measures includes standards on microbiological parameters which are collated in Table 3. None of these standards is defined in Agmark (India) standards except for aflatoxin which is more relaxed compared that of US (7-times) and EU (3-times). Other microbiological parameters like Salmonella, yeast, mold and *Escherichia coli* (*E. coli*) are not defined in the Agmark standards. The presence of Salmonella is not tolerated in any of these countries. Compared to the standards of other countries, ESA has clearly defined the microbiological parameters. The Agmark (India) standards on physical and microbiological parameters are on a higher side as compared to those of other countries. Undefined microbiological parameters in other countries in reference to Agmark standards create confusion for exporters.

Pesticide residue limits are important parameters of food safety standards. Farmers face difficulties in complying with the limits of pesticide residues. Pesticide restrictions and the allowable maximum residue limits (MRLs) vary across importing countries. A combination of MRL regulations and pesticide regulations impedes trade (Aloui *et al*., 2005). The pesticide residue tolerance limits allowed by different importing countries are presented in Table 4.

The Agmark (India) standards for pesticides are loose compared to EU standards (especially in Germany, Netherlands and Spain) but the US standards are more relaxed than the Agmark standards. For malathion, the Agmark standards are stringent (800%) but are loose for other pesticides. For synthetic pyrethroids like cypermethrin, the Agmark standards are 50 per cent relaxed compared to the EU standards.

Table 3. A comparison of microbiological parameters adopted by different countries for import of black pepper: 2010

Particulars	Agmark (India)	ASTA	ESA	Malaysia	IPC
1. Salmonella		Not allowed	Not allowed	Not allowed	Not allowed
2. Yeast and mold			10^6 No./g absent max	10^2 No. count/g max	
3. *Escherichia coli*			10^3 No./ g absent	10^1 No./g max	
4. Aflatoxin B1		2 ppb (max)	5 ppb		
5. Aflatoxin B1+B2+G1+G2	30 ppb (max)	4 ppb (max)	10 ppb (max)		

Sources : Various government websites, Spices Board
Note: ppb = parts per billion, 10^6 g = 10^6 numbers per gram

Table 4. Pesticide residue tolerance limits fixed by some black pepper importing countries and India

(MRL in milligram per kilogram)

Pesticide	Agmark (India)	US	Netherlands	UK	Germany	Spain
Acephate	0.2	4				0.1
Azinphos-methyl	0.5					
Chlorpyriphos	1	1	0.01	-	0.05	0.05
Cypermethrin	0.1				0.05	0.05
Diazinon	0.1		0.05	0.05	0.02	0.05
Dichlorvos	0.1	-	0.05	-	0.1	-
Dicofol	0.1	5	0.05	0.5	0.02	0.02
Dimethoate	0.5	2	0.01	0.05	0.5	0.05
Disulfoton	0.05				0.02	
Endosulfan	5	2	0.02	0.1	0.05	
Ethion	5	1	0.01	-	0.05	0.1
Fenitrothion	1		0.05	0.05	0.05	0.05
Malathion	1	8	0.05	8	0.05	

Sources: Various government websites, Spices Board

Regarding dicofol, an organochlorine compound, the US standards are relaxed compared to Indian standards, but EU standards are stricter for compounds like acephate and dimethoate. However, for organophosphate compounds like ethion, the US standards are stricter than Indian standards. This shows a wide difference in the relevance of various pesticide residues in different countries. These differences arise from the specific rules and procedures adopted by the nations for sampling and testing of imported food commodities.

SPS Codex brings nations together to evaluate agricultural and processing methods and bring out commonly accepted guidelines for the international food safety based on the best available science. The need is to generate knowledge by scientific research in food safety arena and policy alignment according to the changing global regulations. The various pieces of legislation functioning separately needs to be integrated for creating harmony in regulation of food safety issues into one with a view to simplifying and making them more user-friendly for both regulatory and industry at the international level. The Export Inspection Council (EIC) of India conducts strict inspection of black pepper exports. An EIC certification is a foolproof guarantee for the importing countries that the products meet the required standards of hygiene and food safety. By adopting the international quality standards, India is giving herself a chance to trade more freely with the important trading partners around the world and retaining its comparative advantage in new global regime by adjustments and restructuring the global supply chain to new business formats.

The trade in spices is driven by a multitude of factors, viz. changing consumer consumption pattern, improvements in production, transport and other supply chain technologies. Three important components of HACCP are: Good Agricultural Practices (GAP), Good Harvesting Practices (GHP) and Personal hygiene requirements. The GAPs are to be practised at the field level. So awareness regarding GAP practices is required at the farm level. The GMPs are to be practised by processors. Mitchell (2003) has advocated that a well functioning market provides incentives for firms to supply products that embody the characteristics of safety and quality that consumers demand because firms derive higher profits from doing so since their reputation is critical for repeat sales. Compliance with the safety standards is a must to maintain the market. The comparative ranking of the factors governing SPS compliance at farmers, middlemen and exporters levels in the black pepper supply chain is presented through Tables 5 to 7. The major factors influencing the SPS compliance at farm level include knowledge about GAP practices, financial support related to infrastructure, interpersonal skills and information flow and physical infrastructure.

The knowledge about GAP practices was most important in SPS compliance and explained around 49 per cent of total variance. Though farmers did not

have much idea about the consumer requirements and about the product quality in international markets, Spices Board with the cooperation of Kerala Agricultural University (KAU) and State Agricultural Departments was successful in disseminating the knowledge about GAPs at the farm level. A small share of about 1 per cent of earnings of the export value of the produce is credited to the Spices Board. The Spices Board provides intelligence system to the farmers and other intermediaries in the form of increased knowledge flow about GAP, prices and other non-price factors. The GAPs are reviewed after every 2-3 years by the importing countries based on the advancement of scientific knowledge and emergent health risk related issues. The corporate business organization hires consultants for updating the knowledge of consumers and Codex of international markets and other legal and technical provisions of GAP.

Infrastructure related to financial support to farmers explained 25 per cent of the total variance. The variables of this dimension include access to Kisan Credit Card, rate of interest, hassle-free lending and borrowing procedures, knowledge of quantity versus price, and apt price discovery mechanisms via commodity exchanges. The predominant role of Spices Board in regulating business in a healthy competitive mode lends support to this dimension. The interpersonal skill and the tacit information among the farmers to carry out pepper farming operations explained about 21 per cent of the total variance. The traditional knowledge about crop, agro-ecological environments and continuous flow of skill and information from informal as well as formal sources provide a strong base for this dimension. The adoption of traditional farming practices of pepper cultivation could be one of the reasons for the superior quality of Indian black pepper supplemented by the suitable agro-ecological environments in the spice belt of Kerala.

The physical infrastructure dimension trails in explaining SPS compliance at the farm level. The available physical infrastructure, viz. transportation, pucca road, cemented road linked to the market and satisfaction of the farmers from the returns of their produce in the market underlines its importance and adds a comparative advantage to pepper farming, especially in post-harvest operations.

Processors' Level

The agribusiness firms transform through processing, the raw material sourced from the farmers, into the desired form following the mandatory GMPs at the processing plant. The quantification of factors/ dimensions governing SPS compliance in black pepper at the processors' level, are presented in Table 6. The factors which influence the SPS compliance at the processor's level include: business strategy, skill and knowledge of processing, accommodation to safety standards, physical infrastructure and financial infrastructure.

The factor governing SPS compliance is highly relevant at the processing stage is the business strategy. It explained 35 per cent of the total variance. The variables like export demand for quality raw material (raw black pepper for further processing), consultation with other exporters and profit margin make business strategy significant. As we move away from production on the supply chain/ marketing channel, business approach becomes more prominent and will be reaching its crescendo near the point of ultimate consumption.

Skill and knowledge of processing methods is another factor which explained nearly 25 per cent of total variance. Adoption of technical knowledge from any formal agency, adoption of clean standards by the processor, awareness regarding the benefits of clean

Table 5. Factors governing SPS compliance at farmers' level: 2010

Dimension/Factor	Variance explained		Cumulative proportion of total variance (%)
	Value	Percentage	
1. GAP practices/ knowledge	34.89	49.12	49.12
2. Financial infrastructure	17.89	25.19	74.32
3. Information & Interpersonal skill	15.21	21.41	95.73
4. Physical infrastructure	3.02	4.25	100
Cumulative total	71.03		

Source: Field Survey (2010-11)

Table 6. Factors governing SPS compliance at processors' level: 2010

Dimension/Factor	Variance explained		Cumulative proportion of total variance (%)
	Value	Percentage	
1. Business strategy	9.474	35.03	35.03
2. Skill & knowledge of processing	6.608	24.4	59.43
3. Accommodation to safety standards	5.326	19.69	79.12
4. Physical infrastructure	4.2	15.53	94.65
5. Financial infrastructure	1.446	5.35	100
Cumulative total	27.042		

Source: Field Survey Data (2010)

processing, availability of grading facilities at the processing site are the variables involved in this dimension. Exporters require black pepper for further processing for export in accordance with GMPs and safety standards. Hence, exporters demand quality black pepper from their suppliers. Exporters have set their standards with respect to physical parameters like moisture content, and bulk density.

The ability of a processor to accommodate safety standards was the next most important factor explaining 20 per cent of the total variance. Personal involvement of the processor, source of black pepper (whether obtained from the local suppliers or commodity exchanges) and access to modified processing facilities give credence to this factor. Another factor which governs SPS compliance at the processing level is the physical infrastructure. It explained about 15 per cent of the total variance. Mode of transportation adopted, possession of own warehouses, number of people employed in processing, warehousing and other sample testing experiments are the variables that provide credibility to the factor. Financial infrastructure was not as important at this level. The availability of credit facility, rate of interest and procedure for processing loan were the variables which explained this dimension. This implies that processors are in a sound financial position compared to the farmers and have more of owned liquid capital. Also, the processors are intermediaries in the black pepper marketing channels and don't risk their capital compared to other stakeholders in the black pepper supply chain.

Exporters' Level

The sustainability of exporters' income depends on the acceptance or rejection of black pepper consignment by the importing countries. The base of acceptance or rejection is the legally vetted system of Codex compliance as per the Export Inspection Agency of the importing country. Hence, the exporter has to gear up all the operations for monitoring different stages, from farmers' level to the terminal markets of black pepper supply chain. The dimensions affecting the SPS compliance at the exporters' level are presented in Table 7.

Codex knowledge and its compliance was the most important factor governing SPS compliance at the exporters' level. It explained about 35 per cent of total variance. Knowledge about SPS and Codex standards, access to certification facility, possession of SPS compliance certificate /Spice House certificate, access to quality packing material, experience of rejection of consignments and reasons thereof, are the variables which explain this prominent factor. This factor gives consistency of assured supply and guarantee of compliance with the SPS standards at all levels of supply chain of black pepper. Non-compliance with the food safety standards will lead to rejection of products, thus damaging the reputation of the exporting firm and at the end, the exporting country.

Physical infrastructure is the next major factor influencing compliance standards at the exporter's level. Possession of own warehouse and transportation facilities, status of the processing plant utilization, access to grading and testing besides processing facilities are the variables of this important dimension. Availability of physical infrastructure is important for exporters. The presence of a plant with the required equipment and other paraphernalia is a *sine qua non* of a successful exporting firm to comply SPS issues to earn profit from the lucrative marketing.

Table 7. Factors governing SPS compliance at the exporters' level:2010

Dimension/Factor	Variance explained		Cumulative proportion of total variance (%)
	Value	Percentage	
1. SPS compliance & Codex knowledge	31.69	35.32	35.32
2. Physical infrastructure	21.29	23.72	59.03
3. Financial infrastructure	15.51	17.28	76.32
4. Assured quality	11.21	12.51	88.83
5. Interpersonal skill & knowledge	10.04	11.19	100
Cumulative total	89.74		100

Source: Field Survey Data (2010)

The financial infrastructure explained nearly 17 per cent of total variance. Availability of financial assistance, variability in the cost of compliance with the SPS standards over the years, frequency of black pepper procurement and mode of payment, potential nature of profitability of black pepper export, insurance cost, freight charges, and certificate clearances from designated agencies are the major variables which directly affect the financial infrastructure. Exporters invest huge amounts in agribusiness and take calculated risks. For them, each consignment of black pepper costs and reaps huge capital. They bear huge amount of risks and harvest big profits if succeed in complying with the SPS issues.

Assured quality explained nearly 12.5 per cent of the total variance. Duration of compliance with the standards, assured supply, direct linkage with the farmer, influence of grades like MG-1 (Malabar Grade -1) and TGEB-1 (Tellicherry Garbled Extra Bold-1) on the pricing of the product are the variables which give a strong foundation of this dimension. The raw material that the exporter procures from the processor should be of good quality. Each exporter has set up his own standards according to the designated markets which should be met by the supplier of raw material. This also is in effect a way for rating the credibility and consistency of a particular black pepper supplier.

Interpersonal skill and knowledge was the least important in the factor analysis. Requirement of agricultural background for survival as an exporter of black pepper, extent of connection in social capital building and agricultural literacy standards underline the importance of interpersonal skills and knowledge. Exporters should be good agri-business managers.

Awareness about good agricultural practices, good manufacturing practices and good hygienic practices needs to be generated amongst farmers at field level, manufacturers at processing operation and various middlemen at post-harvest operations. The farmers already have traditional knowledge about cultivation practices of black pepper in spice belt of the country and this knowledge needs to be amalgamated and appropriated with modern knowledge about food safety and quality codex. Farmers must be offered more financial support to comply with the standards. The availability of physical infrastructure adds a comparative advantage to the pepper farming, especially in post-harvest operations.

Conclusions and Policy Implications

The agreement on SPS measures under WTO serves as the main framework for the regulation of food safety issues. After WTO, black pepper from indigenous supply has become a relatively more risky enterprise from point of farmers and exporters. Inter-country, intercontinental and domestic standards of black pepper spice are in place due to organizations like CAC, ASTA, Agmark, ESA and IPC. Gaps and differences between parameters of domestic and international standards are observed due to specific rules, tolerance levels, scientific knowledge and procedures used by the inspection and other agencies for sampling and testing of imported products. Compliance with the varying SPS measures as fully legally vetted system of importing countries has brought challenges to Indian black pepper export. Scientific institutions need to generate knowledge in food safety arena and filling up gaps, deficiencies, etc in various food safety standards equivalent to

international standards according to the changing fast environment in the global scenario. Adoption and application of business aspects in black pepper production, processing, post-harvest practices and good hygiene practices at various stages in supply chain in the form of SPS compliance has become the mantra of survival of exporters in the international markets.

Since most of the importing countries have evolved SPS standards for having access to their markets, continuous efforts need to be made to harmonize the existing standards and form a uniform food safety standard by upgrading legislative, institutional and other elements of food safety system across India in line with the developments in both the international standards and requirements in major export markets. This would be possible if knowledge, financial support in the form of subsidy and latest lab equipment etc. needed for SPS compliance are available at management level. The knowledge about GAP, GMP, GHP and hygiene practices imparted to stakeholders of black pepper supply chain by public and private institutions at centre and state levels, has helped the spice industry to adjust to the new production regime according to the new food safety standards. Besides, physical and financial infrastructure influences SPS compliance standards at the exporter's level of black pepper supply chain. These efforts in harmonization in food safety standards will definitely encourage exports from developing countries by reducing transaction costs, asymmetry of information, etc. Effectiveness of the leaders of black pepper business is critical in the process of achieving the success of SPS compliance. Henceforth, the Indian exporters are usually placed at a disadvantageous position to make use of these novel procedures to meet the international standards because of their limited capacity to access and absorb the best practice, technology and information. The businessmen and policy makers need to invest in the major dimensions for strengthening the black pepper supply chain in the country.

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