Benchmarking International Food Safety Performance in the Fresh Produce Sector

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BENCHMARKING INTERNATIONAL FOOD SAFETY PERFORMANCE IN THE FRESH PRODUCE SECTOR

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Abstract

The objective of this paper is to assess food systems performance in Mediterranean countries to deliver safe food (fresh produce), and to demonstrate the capacity to the satisfaction of private customers and public regulators. To that end, an international benchmarking exercise was developed to assess the quality performance gap in food standards across countries and food systems. The study was carried out in three Mediterranean countries: Spain, Morocco and Turkey and involved an audit of the citrus and tomatoes supply chains, and a comparison with existing 'best practice' in infrastructure and management practices at both firm and industry level. The aim was to identify the gaps between fresh produce exporters and a best practice company. To that end, the Spanish fresh produce supply chain was used as the benchmark since in many areas it is more advanced than elsewhere.

Keywords: benchmarking, performance, quality and safety, fresh produce, Mediterranean countries.

1. Introduction

Market performance has many dimensions, and in industry studies is usually understood, *inter alia*, to be profitability, equity, and efficiency. While these performance dimensions are not irrelevant here, the principal market performance characteristic within this paper is quality: 'products and services that satisfy customers' implicit and explicit needs'. Food safety is one aspect of quality. Research into food safety and traceability is motivated by concerns about the level of performance of the food system in delivering to consumers safe and healthy products which meet consumers' demands. This paper concerns assessing performance in the sense of the capacity of the food industry to deliver safe fresh fruits and vegetables (fresh produce) to consumers.

Firm and industry performance with respect to food safety and quality standards will be strongly influenced by the structural characteristics of food chains, the strategies of individual firms, and the level of coordination within the food system. Thus, the food chain does not just concern the supply of products but is a series of interconnected flows of goods, services, incentives and information between the different participants in the market chain (Poole *et al.*, 2002). Within this model it is the information feedback effects that tend to make the chain more responsive and efficient. As feedback between firms and individuals occurs, individual decisions to produce, sell, and buy become better coordinated. The focus of the methodology presented in this paper has much to do with information exchange throughout the supply chain concerning quality standards and compliance. In highly coordinated food markets, it is the creation of information and responsiveness to information that results in the food system delivering to consumers the products that satisfy their preferences.

The capacity of a food system to deliver safe food – and to demonstrate the capacity to the satisfaction of private customers and public regulators – will be strongly influenced by the

organisation of the supply chain: that is, the structure of the food chain and the strategies of individual firms. The number, size and functions of firms within the food chain, access to market and the competitiveness of the system are structural features. The way firms interrelate and their individual strategies make up the conduct of the system. Policy effects are food safety and traceability laws, national and international standards and regulation. Both the organisation of the market and the effectiveness of the policy or regulatory framework are influenced by the level of economic development, and levels of technology and management in the supply chain, the level of effective consumer demand for quality, safety, and traceability.

Improved market coordination is most likely to be one of the tools to improve market performance in respect of food safety and traceability. That is, the organisation and coordination of the system depends on the way individual firms relate, the extent to which they share information, the degree to which they attempt to coordinate supplies, and so on.

The increasing demands for food safety and quality in developed countries are resulting not only in stringent policies at national and supranational (EU) level. More significantly, they are eliciting a response at the private level with the development of an important number of third-party certified quality assurance schemes (Garcia Martinez *et al.*, 2002). Food chains must be transparent and 'traceable' as consumers expect to be able to trace each food item back to its earliest production stage. As a result, changes in market structure and firm strategy are occurring right down to the production level in order that supply chains deliver safe food. However, concerns have risen regarding its impact on developing countries, such as the ones covered by this paper, where supply chain processes and procedures cannot be upgraded very quickly. Hence, there is the danger that rising food safety standards will continue to be a major impediment to trade for developing countries in the foreseeable future (Garcia Martinez and Poole, 2003).

This paper presents a benchmarking methodology for assessing the quality performance gap in food standards across countries and food systems, and reports research undertaken to demonstrate the level of performance to the satisfaction of private customers and public regulators. The study was conducted in three Mediterranean countries: Spain, Morocco and Turkey. The research involved an audit of the citrus and tomatoes supply chains, and a comparison with existing 'best practice' in infrastructure and management practices at both firm and industry level. The aim was to identify the gaps between fresh produce exporters and a best practice company. The Spanish fresh produce supply chain was selected as the benchmark since in many areas it is more advanced than elsewhere. The results of the study enabled identification of areas for further improvement regarding management practices and control mechanisms for food safety and quality by learning from the best practices and processes by which they are achieved.

2. Methodological Framework

Benchmarking is the process by which companies look at 'best practice' in the industry and try to imitate such strategies and procedures. Benchmarking enables identification of the gap between current and optimal, or 'best practice' performance levels. The benchmarking process is, therefore, valuable to companies in opening up many different ideas about processes, approaches, and concerns (Allan, 1997).

Benchmarking has an internal dimension whereby an organisation critically examines itself in search of best practice, as well as an external dimension whereby the organisation analyses its industry and other domains in an attempt to identify external and competitive practices, which may be implemented in its operating environment (Yasin, 2002). Given its external focus, the methodology will help fresh produce exporters to identify gaps in performance regarding food safety and quality controls and production and handling systems, and to develop appropriate strategies for closing them.

2.1. Identification of Benchmark Measures

The study reported here focused on dimensions of performance, which aimed to represent a firm's capabilities to meet current demands for food safety and quality by international customers. These were developed in three ways. In the first place, *a priori* knowledge of the food systems suggested important dimensions. Secondly, researchers undertook a review of relevant literature and

electronic information such as EUREPGAP (EUREP, 2001) and Güngor and Güngor (2000). Thirdly, discussions were held with industry experts to identify the key dimensions for performance as viewed from within firms.

The critical dimensions were:

- **Dimension 1**: Supply chain management practices: degree of specialisation, degree of vertical integration and co-ordination, information sharing, quality orientation, supplier and customer base;
- **Dimension 2**: Operational infrastructure: processing and packing, storage and transport;
- **Dimension 3**: Safety and quality controls in the export process.

For dimensions 1 and 2, key performance measures (KPIs) were developed in terms of practices, which describe internal and external business behaviour, and which tend to lead to the creation of a performance gap. The areas of analysis and KPIs are shown in Table 1. Each KPI was explored using questions, which made up a questionnaire for use as a discussion guide during firm visits and interviews with fresh produce exporters.

Dimension 3 concerned the specific safety controls carried out by firms at each stage of the export process. To explore this, a scheme of control points was developed, based on a HACCP control system for the citrus and tomato supply chains. Each firm was asked to indicate in which areas of the supply chain they were responsible for safety and quality controls, and which controls they carried out.

2.2. Scoring System

The complexity of benchmarking performance dimensions tends to raise difficulties in assigning quantitative measures to the selected indicators. For Dimensions 1 and 2, a qualitative approach was used to compute each KPI and as in other studies (e.g. Food and Drink National Training Organisation, 2001) data were then recoded into three levels, as follows:

Level 1:	Firm shows little or no capacity in achieving ‘best practice’;
Level 2:	Firm shows some capacity in achieving ‘best practice’;
Level 3:	Firm shows ‘best practice’ in this area (e.g. consistent performance, clear and demonstrable systems in place, certification).

The different elements within the framework characterised each level, indicating the firm’s policies and practices in this aspect, rather than specifying certain criteria. This method has the advantage of permitting identification of areas in which firms have room for improvement (Gilmour, 1999). For Dimension 3, firms indicated in the questionnaire whether they carried out a particular control measure and if they carried out additional control measures at each stage.

2.3. Data Collection

Fresh produce (citrus and tomato) exporters were identified and contacted in Morocco, Turkey and Spain. Firms were approached on the basis of their supplying citrus or tomatoes to a range of customers. A total of four firms were visited in Morocco (four citrus exporters); seven firms in Turkey (five citrus exporters and two tomato exporters); and five firms in Spain (two citrus exporters and three tomato exporters) between February and May 2002. Interviews with exporting firms used a discussion guide in the form of a questionnaire, and discussions were recorded. The questionnaire ensured a systematic structure to the discussions and that target areas were covered to the same depth in each country and sector in a consistent way. Throughout these interviews, it was important to enable and facilitate discussion of the issues rather than merely finding numerical performance data.

Table 1. Key Performance Indicators

Areas of Analysis	KPIs for comparison in benchmarking framework
DIMENSION 1. Supply Chain Management Practices	
1.1. Coordination of the Supply Chain	1.1.1 Exporter-producer Information Sharing *(Directness of the relationship in communication of requirements, specifications and regulations)*
	1.1.2 Market orientation *(Varieties supplied and ability of exporter to predict customer requirements)*
	1.1.3. Production flexibility *(Abilities of the exporter to meet changing customer requirements)*
	1.1.4. Customer orientation (Vi*sits from customers to advise and check on safety and quality practices through the production and export system*)
	1.1.5.Vertical integration (*Involvement of exporter in upstream or downstream processes in the supply chain)*
	1.1.6. Vertical coordination *(Degree of co-ordination of between operations in the supply chain)*
	1.1.7. Traceability systems *(Existence of documented traceability systems)*
	1.1.8. Segregation *(Segregation of product from different suppliers within the packing house)*
	1.1.9. IT systems *(Investment in IT systems and their use throughout the system for accountability and product tracing)*
1.2. Safety and Quality Orientation of the supply chain	1.2.1 Quality certification *(Level of certification obtained by the firm, e.g. ISO, HACCP)*
	1.2.2 Quality control staff *(Number of staff, staff availability and training level)*
	1.2.3 Worker knowledge *(Producer and exporter worker knowledge of Quality Control)*
	1.2.4 Training *(Packhouse worker training level)*
	1.2.5 Social responsibility *(Exporter policies for worker health, safety and welfare)*
	1.2.6 Environmental management *(Exporter environmental management policies and practices)*
	1.4.7 Safety and quality requirements *(Safety and quality specifications as part of exporter-customer contracts/agreements)*

DIMENSION 2. Exporter Operational Infrastructure	
2.1.Processing and packaging (P&P)	2.1.1. P&P technology *(technology used in P&P operations)* 2.1.2 P&P quality *(Quality of P&P materials and operations. Flexibility to meet customer requirements)* 2.1.3 Labelling flexibility *(Flexibility in meeting customer labelling requirements)*
2.2 Storage and Transport	2.2.1 Storage capacity *(Firm's storage capacity)* 2.2.2 Storage quality *(Firm's storage quality and timing)* 2.2.3 Transport quality *(Availability of transport of required quality and encountering of problems en route to customer)*

3. Results of the Benchmarking Exercise

The results from the benchmarking exercise are presented below. As noted, the practices of the Spanish exporters were taken as 'current best practice' with which to compare the practices of Moroccan and Turkish fresh produce exporters. These are the practices which have often but not always been assigned to a 'level 3' in the benchmarking analysis. It must be acknowledged that there are areas in which further development and improvements are possible in Spanish 'current best practice', as viewed by customers and in the context of best practice in other industries, and that the comparisons made should be considered to be relative and not absolute.

Moreover, because the study involved only a small number of firms, the results and conclusions should not be extrapolated to the industry as a whole. Results must also be interpreted in the light of the current public regulatory system that exists in each country and the level of customer demand for safety and quality properties, which prevails in destination countries.

3.1. Dimension 1: Supply Chain Management Practices

Coordination of the Supply Chain

Exporter-producer information sharing: Exporters in Turkey (score 1.43) are less likely to have systems in place for providing producers with information (i.e., market intelligence, crop protection regulation, quality standards, etc.) that those in Morocco (score 2.75). Generally the Turkish firms have a much looser supplier-customer relationship due largely to high level of fragmentation of production in Turkey and also problems caused by growers being long distances away from packinghouses. In Morocco, some degree of vertical integration and contacts with Government agencies facilitate communication greatly. In Spain (score 3.0), the functioning of the extensive cooperative system of marketing depends on intense producer-exporter communication. Within such organisations are to be found technicians whose responsibility it is to communicate particular requirements and regulations according to specific systems.

Market orientation: Moroccan exporters (score 2.00) rely heavily on the EACCE (*Etablissment Autonome de Controle et de Coordination des Exportations)* for services of export inspection and control. EACCE also provide information from market research and advice on market trends, customer demands, and new opportunities. All the Moroccan firms supply a mix of old and new varieties. For the tomato exporter, seed companies play a role in choosing the varieties to be grown, and this can change every year depending on market requirements. Market orientation was not a priority for Turkish firms (score 2.14), and there was little incentive to investigate new varieties or seek alternatives. Turkish exporters considered that they were assured of a market for their produce, if not in the EU then in central and Eastern Europe, or ultimately in the domestic market. Knowledge of new varieties is communicated between growers generally by word of mouth. Some producers maintain old varieties, which are popular in the domestic market, and this can be a problem for exporters (i.e., Washington, an old variety is widely grown). In tomatoes, local intermediaries who supply credit to producers decide on seed varieties. The Spanish fresh produce export sector presents a high degree of market orientation by monitoring closely demand trends in the European market (score 2.80). Firms are generally very well organised in terms of market research and customer requirements, having their own marketing departments or accessing this information through marketing cooperatives. Exporters also have good horizontal relationships with other firms and organisations that enable them to work together. Clients also supply information about the domestic and export market requirements.

Production flexibility: There is limited flexibility, in terms of changing varieties supplied, in both Morocco (score 2.00) and Turkey (score 2.00). Spanish firms (score 2.60) tend to have more proactive involvement in changing production to meet customer requirements due to better communication infrastructure to monitor and forecast consumer trends. The importance of related and supporting industries, particularly research institutes, in production areas facilitates the development and introduction of new varieties in Spain.

Customer orientation: Visits to exporters by customers take place regularly every season, the regularity and frequency depending on the customer. Customers have less direct involvement in Turkey (score 2.33).

Vertical integration: In Spain (score 3.00), and to a lesser extent Morocco (2.00), there is a high degree of vertical integration in terms of production, processing and export. All firms are involved in these stages. No firms are involved directly in import or retail in destination countries. In Turkey (score 1.29), firms show less direct involvement in production.

Vertical co-ordination: The structure of Moroccan (score 2.43) exporting and the tight schedule fixed by EU for exportation require a high level of co-ordination. Harvesting, processing and export transit are among the operations that are well co-ordinated. In Turkey (score 2.25), generally there is some coordination of operations though not with a high level of control (i.e., no tracking of product through system using IT systems or operations are controlled by one person). Spanish (score 3.00) operations are generally highly co-ordinated in large and modern packhouses, with full knowledge of the timing involved, and time in storage and transport minimised (i.e., one large tomato exporter has a high level of coordination in the warehouse, with sale and dispatch on the same day).

Traceability systems: There is full traceability in Morocco (score 3.00) and Spain (score 3.00). Any box sold in the northern European market carries codes and references that allow tracing of the product to the farm of origin and identification of treatments used at the packhouse. In Turkey (score 1.57), most of the exporters have no traceability guarantees, and customers do not require traceability.

Segregation: The level of segregation is dependent on traceability (i.e., full traceability requires full segregation). For Turkish firms (score 1.43) there may be partial traceability but without segregation of produce at all stages of processing.

IT system: There is more limited investment in IT systems in Turkey (score 1.57) than the other countries. IT is an expanding area for Moroccan exporters (score 2.25). IT use by the Spanish exporters (score 2.67) is generally high; with at least production records being kept in database. Most firms computerised systems for product tracking, traceability, producer information, pricing and accountability.

Safety and Quality Orientation of the Supply Chain

Quality certification: Clearly varying levels of certification are seen in each country, with no certification in the Turkish firms (score 1.00), although it was mentioned as being a future plan. Some Spanish firms (score 2.20) have certification greater than ISO 9000.

QC staff: Specialist, well-trained quality control staff are the norm in Morocco (score 3.00) and Spain (score 3.00) and less likely in Turkey (score 1.50) where this duty often falls to a general manager. In Turkey, there were problems cited such as quality control staff "acting as they wish".

Worker knowledge: There are less formal systems in Turkey (score 2.17) and Morocco (2.25) than in Spain (score 3.00) to ensure that workers are informed about safety and quality requirements. Spanish producers and workers are regularly informed and the level of coordination of quality and safety control throughout the supply system is high.

Training: Training is more informal in Turkey (score 2.00) and in Morocco (score 2.25) and may rely more on demonstration and explanation (most of the workers are illiterate). Records of training may not be kept for each worker. Some firms stated that workers change from season to season and therefore training could be difficult and costly. A certain level of worker training is specified as part of the ISO 9002 certification, so that Spanish (score 3.00) workers undergo regular training and a manual of training is kept for each worker. Under Spanish AENOR regulations each worker must have a food manipulation license and is then trained specifically for their type of work (i.e., packing line selection, machinery operation).

Social responsibility: The level of social responsibility generally was said to be high, though in Turkey (score 2.14) may not be to internationally recognised standards (i.e., in some firms, workers can work very long hours without breaks at particular times of the season). In the Moroccan firms interviewed, all the non-seasonal workers are insured and regulations adhered to, with access to medical care and provision for the workers welfare (score 3.00). In Spain (score 3.00), again, as part of ISO requirements, worker health, safety and welfare levels are consistent with international

regulations (e.g. in one citrus exporting firm, workers handling chemicals receive health checks every four months).

Environmental management: Environmental standards were present only in those firms with customer demands in this area (i.e., as a result of audits or specific certification: EUREPGAP, AENOR). They were not a consideration for most firms in Turkey (score 1.14) or Morocco (score 1.50).

Safety and quality requirements: Turkish exporters (score 1.57) place more emphasis on personal contacts and good relationships with customers than on contracts with formal specifications, whereas written agreements are used by all Moroccan exporters (score 3.00). For Spanish exporters (score 2.40), there can be different buying arrangements (i.e., auctions which do not use buying contracts).

3.2. Dimension 2: Export Operational Infrastructure

Processing and Packing technology: All of the citrus exporters in Turkey (score 1.86) and Morocco (score 2.25) have automatic sorting and grading lines, varying in the age of equipment and levels of technology used. There is generally a high degree of manual input in the processing and packing line, with a high emphasis placed on worker skill and judgement. For the Turkish tomato exporters, grading and packing of the product is entirely manual. In Spain, there is a high level of technology and automation in all processing and packing operations. All exporters have stages in the selection process that are manual, the most reliable method of fruit selection especially in the later stages of the process. For citrus exporters, there is a high level of harvested produce (15-20%) that does not make the grade and is rejected through selection, grading and processing operations.

Processing and Packing quality Packing quality depends on the customer requirements and their satisfaction with the current standard provided. No firms had any problems in meeting their customer requirements (all countries scored 3.00).

Labelling flexibility: Labelling is carried out by hand in a few of the Turkish firms (score 2.33), so as long as the customers requirements can be met by this method there are no problems. There also may be requirements in traceability labelling which not all Turkish firms are able to meet. Spain and Morocco again had not problems meeting customer requirements in this respect (score 3.00).

Storage capacity: There is limited storage capacity owned by the Turkish firms (score 1.83) – they are more reliant on storage hired at the ports than in Spain (score 3.00) and Morocco (score 3.00). Where storage is used in Morocco and Spain (infrequently, due to the fast processing time) it is of high capacity.

Storage quality: For the Turkish firms (score 2.17) for which storage capacity is inadequate there can be problems in finding alternative storage with the required temperature or atmospheric controls. In Spain (score 3.00) and Morocco (score 3.00) this is not a problem.

Transport quality: Some problems are experienced in finding transport of the required quality in order to transport from Morocco (score 2.75) and Turkey (score 1.71) to the European market. There can be disruption of transport routes and delays, which affect the quality of the produce. Spanish transport facilities were optimum (score 3.00).

3.3. Dimension 3: Quality and Safety Controls carried out by exporters

Analysing Dimension 3 involved assessing the specific safety and controls carried out by firms at each stage of the export process. As indicated earlier, to measure dimension 3 a scheme of control of critical points was developed, based on a HACCP system for the citrus and tomato supply chains. Each firm was asked to indicate in which areas of the supply chain they were responsible for safety and quality controls, and which controls they carried out. This understanding of the use of controls in each firm allowed comparisons between firms.

Spain: There is generally full crop protection knowledge by the exporters. For instance, for one of the citrus exporters, every month the producers supply to exporters information about all the agrochemical treatments undertaken, which is then entered into a central database. For one of the tomato exporters, field technicians keep full records of each cropping unit, which are held on a

computer database. In the cooperative system, technical and regulatory advice is supplied by the cooperative. Full hygiene risk assessments are carried out and hygiene protocols established. Technicians advise on harvest techniques. Exporter packhouses use internal control systems to monitor the hygiene of products, based on HACCP.

Morocco: Most producers working for exportation are well advised technically and are fully aware of requirements. They are knowledgeable on production and pesticide treatment practices. The producers themselves are responsible for managing the harvest and there is little concern over practices during harvest. However, most workers are recruited on a seasonal basis and are not trained sufficiently in hygiene requirements. This concern can be significant for the groups who choose to become HACCP certified.

Turkey: The levels of quality and safety controls emplaced in Turkey were variable. In general, there is limited use of agrochemical treatments for crop protection: production systems are 'low input', due to cost constraints. Three exporters have some knowledge of producer practices, though do not maintain documented systems. Two exporters have no knowledge of producer practices ('*You cannot know what he has used or done'*). The largest citrus exporter is fully aware of producer practices and reviews take place. For two exporters, it is left up to the producer to carry out the harvest and there is no concern over particular practices during harvest. Other exporters demonstrated some awareness of harvest hygiene requirements and for the largest exporter a hygiene risk assessment has been carried out for harvest operations and a hygiene protocol established for harvest workers. One firm (firm 3) specifically mentioned that a further stage in the packhouse procedure is drenching of the inloaded fruit with disinfectant. They also said that the government determines the harvest time by the product type and they obey the calendar given to them in terms of harvesting. Calibration of thermometers is not carried out – they have three thermometers in the storage facilities, which must be in agreement.

4. Conclusions and Recommendations

Evaluation of the differences in practices among firms and between countries highlighted above may assist firms, particularly in Mediterranean countries, in adapting and responding to increasing quality and safety requirements by international customers in the valuable northern European market – and elsewhere. The situation of each firm within the country's physical and institutional infrastructure and the varying importance and reliance upon private and public controls are important considerations. Practices to manage safety and quality may not be as feasible in one country as in another as there could be large variations in resource availability and degree of modernisation and market-orientation of agri-food systems.

Findings from such benchmarking analyses should enable development of an industry Action Plan by identifying areas for improving safety and quality provision and suggesting the most effective strategies at firm level in each country. The stakeholders in improving food safety and quality assurance mechanisms are connected by, on the one hand, flows of goods and services, and on the other by incentives created by commercial imperatives and the institutional infrastructure of policies, law, regulation and information. Mapping the food chain stakeholders is an important exercise for improving industry-wide standards, even if the scope for individual firms actions' is restricted to the product supply chain.

The kind of actions necessary to improve industry performance can be tabulated and prioritised alongside the responsibilities of the different stakeholders in the fresh produce export supply chain: public sector (central or/and regional) and private sector (firm level and/or industry-wide). In conclusion, this final section presents a series of actionable strategies aimed to address some of the weaknesses identified for each dimension in this benchmarking exercise.

4.1. Dimension 1: Supply Chain Management Practices

Coordination of the Supply Chain

In the future, it is expected that vertical co-ordination of supply chain relationships will increase further, driven by demand for greater safety and quality assurance (Fearne and Hughes,

1999). Therefore, initiatives should be developed at firm level among competing exporters to increase the level of coordination among actors in the supply chain.

To increase the level of coordination in the fresh produce supply in Mediterranean countries there is a need to support and encourage horizontal cooperation among producers. Hence, initiatives at government level should be developed to encourage and support horizontal cooperation among fruit and vegetable producers. Initiatives on horizontal integration of small-scale producers into second-tier co-operative businesses may require third party support in terms of provision of concessional finance and management skills. The likely welfare impacts of supply chain rationalisation also suggest that the public sector needs to be involved so that social objectives such as employment and income levels are taken into account.

Key to demonstrable safety in the fresh produce supply chain is traceability. The fragmentation of supply chains indicated above makes it very difficult for Mediterranean fresh produce exporters to establish traceability systems or achieve partial segregation. Nevertheless, increasing demands by international customers for 'farm to table' process controls to manage both quality and safety require Mediterranean fresh produce exporters to adopt these management practices and to coordinate safety and quality more closely with importers.

Safety and Quality Orientation of the Supply Chain

The implementation of effective and demonstrable quality control systems (i.e., HACCP-based or alternative food safety risk management systems) is recommended as the most-effective means of reducing food safety hazards.

Product quality control systems and product traceability both require investment in human capital. Subsequently, investment is required in physical capital including QC infrastructure and business information/ICT systems, both within the individual firm and with other firms in the supply chain or network. Thereby, initiatives should be developed at government level aimed to support firm-level investments, which are prerequisites to implement effective and demonstrable quality control systems. Preferential financing arrangements or tax-credits for IT- and QC-related investment in physical infrastructure could be one such mechanism. In a wider context, the possibility of developing food safety and quality networks, local benchmarking activities, vocational training and trade fairs involving SMEs would be an important mechanism for building human capital within the industry and for achieving greater social (or small enterprise) inclusion in Mediterranean countries.

4.2. Dimension 2: Export Operational Infrastructure

Fresh produce undergoes many changes post-harvest, which lead to senescence and deterioration. The quality of fresh produce is determined by pre-harvest factors (i.e., variety, maturity stage and cultural practices) and post-harvest care during harvesting, handling, packing, transport, storage and distribution. Each step must be controlled and verified in order to meet quality standards. However, the technical and financial constraints in Mediterranean countries very often make the required investments in export and marketing infrastructure impossible. Firms must make private investments to stay in the market. Second, another feasible approach is to develop joint public/private initiatives to improve export infrastructure. Once again, preferential financing arrangements or tax-credits for firm-level infrastructure-related investment would be one such mechanism.

4.3. Dimension 3: Quality and Safety Controls

The number of HACCP-type controls carried out by exporters in each country reflects, to a large extent, some of the same deficiencies highlighted above. The lack of vertical coordination in Morocco and Turkey, particularly at producer-exporter level, results in looser controls of production and pesticide treatment practices compared to the Spanish model.

Based on the evidence from this study, the long-term strategies for Mediterranean countries to sustain and further develop an international demand for their products lies in building up the trust and confidence between exporting firms and importers/retailers in the quality and safety of their produce. Small-scale suppliers in these countries could enjoy a comparative advantage by supplying new and innovative products.

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