Food safety governance in Saudi Arabia : Challenges in control of imported food

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Abstract: The operating environment for food safety interventions in nations such as Saudi Arabia, with limited local agricultural productivity, high reliance on foreign food imports and observance of Islamic laws, is remarkably challenging for the national control and regulatory institutions, since compliance to the mandatory food safety regulations and the local religious Halal standards must be ensured. This review offers a comprehensive analysis of the recently restructured food safety governance in Saudi Arabia from the perspective of its food imports control. Specifically, the nature of the food imports, the organization of the food safety governance and the current control practices of imported food, in consideration of food safety and Halal requirements, are analyzed through a triangulation of data and information from secondary sources (academic literature review and gray literature search) and primary sources (direct consultation of field experts). Statistical trade data on imported food were also performed. Results revealed that the process of centralizing all the control and regulatory activities under a single agency, which the government started to strengthen the national food safety governance, has not been completed yet. The resulting overlap of legislative and monitoring tasks by multiple entities augments the challenge of ensuring the safety, quality, and authenticity of imported food and their compliance to Halal standards. The vulnerabilities and challenges still to be addressed by the local food industry and the public sector are discussed, with implications for national and international field practitioners and policymakers of countries facing similar challenges.

Keywords: food control system, food safety governance, food safety management system, Halal food import, Saudi Arabia

1.   INTRODUCTION

Consumers, industries, and governments worldwide are increasingly expressing their concerns about the ability of national food safety governance and food control systems to guarantee the safety, quality, and authenticity of domestic and traded foods (Al Kandari & Jukes, 2012; WHO, 2007). Accordingly, many countries have implemented reforms on their food safety governance to ensure more effective ways to protect consumers (Jia & Jukes, 2013; Kirezieva et al., 2015; Unnevehr, 2015). A country's food safety governance is composed of national regulatory control norms and societal efforts to improve food safety, which shape food producers' motivations and actions (Kang, 2019).

As part of a national food safety governance, an effective food control system is not only necessary to guarantee food safety to protect domestic consumers, but also to ensure the safety, quality, and authenticity of exported and imported food (FAO/WHO, 2006). The FAO/WHO guidelines of 2003 discuss the importance of strengthening the organizational structures for national food control systems, and offer examples of three possible approaches, enabling authorities to choose the most suitable option for their country: (1) multiple agency system, based on various agencies responsible for food control; (2) single agency system, based on a unique and unified agency for food control; and (3) integrated system, based on a national integrated approach.

The single agency system and the integrated system are more likely to avoid problems of conflicts, miscommunication, and duplication of activities among the responsible agencies. A centralized and self-contained control structure, such as the single agency approach or the integrated approach, may achieve food safety more effectively while avoiding inconsistencies and gaps (FAO/WHO, 2003).

Countries and confederations, such as the European Union (Caduff & Bernauer, 2006; Iurato, 2017), the United States (Jia & Jukes, 2013), China (Guo, Bai, & Gong, 2019; Kang, 2019), and most of the Arab Gulf Cooperation Council (GCC) countries (Al Busaidi & Jukes, 2009, 2015; Alomirah et al., 2010; Randeree, 2019; Todd, 2017), including Saudi Arabia (Al Kandari & Jukes, 2012; Al Mutairi, Connerton, & Dingwall, 2015), have moved to adopt a centralized food control system based on the single agency approach or the integrated approach. Although the United States (where the food sector is primarily regulated by FDA and USDA) as well as the European Union (where EFSA, the European Commission and the national food safety agencies are involved in the food safety governance) follow an integrated system, most GCC countries, such as Kuwait, Oman, UAE, and Saudi Arabia, are passing from a multiple agency approach to a single agency system. This process of restructuring the national food safety governance has led such countries to upgrade also their food legislation and adhere to international food safety and quality standards (Jia & Jukes, 2013).

However, the operating environment for food safety interventions in nations such as the GCC countries and specifically Saudi Arabia is remarkably challenging, due to the limited local agricultural productivity, high reliance on foreign food imports, and observance of Islamic laws also in the matter of food (Al Kandari & Jukes, 2009; Al Mutairi et al., 2015). Ensuring the safety of large amounts of imported food and their compliance

with the mandatory local and international regulations as well as the religious Halal standards poses a great challenge for the regulatory authorities and control bodies (El Sheikha, 2015).

So far, several researchers have examined the national food control systems of the GCC countries (Al Kandari & Jukes, 2009; Kamleh, Jurdi, & Annous, 2012; Todd, 2017), including Saudi Arabia (Al Kandari & Jukes, 2012; Al Mutairi et al., 2015; El Sheikha, 2015). However, no studies yet evaluated the current food safety governance of Saudi Arabia and the recently updated control system of its imported food, which represents an estimated 80% of the overall food commodities available for consumption (World Bank, 2019).

This paper aims to fill this important socio-economic gap by conducting a comprehensive review of the recently restructured Saudi food safety governance examined in the perspective of its food imports control to identify the specific challenges. Through a triangulation of secondary sources (second-hand information), such as academic literature review (scientific journals' papers) and grey literature search (industry and government reports), and of primary sources (first-hand or raw information), such as direct consultation of field experts and statistical trade data, three main research questions are analyzed and discussed. The first research question is about the nature, quantities, and categories of food products and raw materials imported in Saudi Arabia, which were analyzed to get an insight on the situation regarding imported food. The second research question is about the recently renewed food safety governance of the Saudi food supply chain, which was investigated based on how the national food control system is organized among its designated institutions. To this purpose, the main actors of the food supply chain were analyzed in consideration of their constitution, roles, responsibilities, and their interactions regarding their legislative and control practices. The third research question is about the country's current control practices about imported food, which were examined based on how the border controls are managed in terms of food safety, quality, and Halal standards assurance, considering the national, regional, and international laws and regulations as well as the required industry standards. Finally, the challenges and issues identified were discussed from the perspective of both the Saudi food industry and the relevant governmental bodies, and implications for local and international field practitioners and policymakers of countries facing similar challenges were suggested.

2. METHODS

2.1 Analysis and trade data of imported food

In order to answer the first research question on the nature of Saudi Arabia's imported food, information was retrieved through the systematic analysis of online industry reports and market researches published by authoritative relevant sources, such as FAO, WHO, WTO, CIA, USDA, and World Bank, as well as by accredited private market research agencies. Industry and market reports were searched online using the following keywords: Saudi Arabia, country profile, food sector, food market, food imports. The reports' titles and texts were scanned and selected based on their language (English or Arabic), publishing body (Saudi Arabian or international), year of publication (from 2000 onwards) and information contained, focusing on the following topics: Saudi Arabia's population, geography, agriculture, trade patterns, and importing countries of raw materials and food commodities. When useful content was found, the available cross-references were analyzed to obtain further related information. Relevant qualita-

tive data were systematically extracted from the reports, analyzed through content analysis, and translated to English when necessary.

Concurrently, statistical trade data analysis was performed on the levels of food categories imported in Saudi Arabia and the major partner-countries of import/export. The data were extracted from the international trade database and market analysis tool Trade Map of the International Trade Centre (ITC, 2018). The search on Trade Map was performed by selecting as inclusion criteria all the available food and beverage products by the first two digits of their respective Harmonized System (HS) code imported in Saudi Arabia from the world for the yearly time series 2017. The resulting quantitative data that were considered for each product selected are: the total imported monetary value (in Euro), the imported monetary value per country relative to the top five exporting countries, and the relative share in value (in percentage) per country. An overview of the top food categories imported in Saudi Arabia for the latest available year (2017) was also elaborated by calculating the share in the total imported value for each product category.

2.2 Analysis of food safety governance

The second research question was addressed by conducting an academic literature review on Saudi Arabia's food safety governance, compared with the latest information retrieved from grey literature on its current situation to understand the evolution of the country's food law and food control system. The search was carried out systematically through Web of Science and ScienceDirect databases using the following keywords: Saudi Arabia, food safety governance, food control system, food law, food supply chain. The inclusion criteria for selecting the articles were their language (English), publishing body (Saudi Arabian or international), and year of publication (from 2000 onwards). Titles and abstracts of the selected articles were first scanned and texts were further analyzed if the following topics were covered: Saudi Arabia's centralization of the food control system, food safety governance organization among appointed institutions, food supply chain actors, tasks and interaction, food regulations, legal framework, and trade agreements. When useful content was found, the available cross-references were accessed and examined to obtain further related information. Relevant qualitative data contained in the articles were systematically collected and analyzed through content analysis.

None of the articles found was recent enough to provide the updated information about the current and on-going situation of the Saudi food safety governance, food control system, and food law. Therefore, the literature review was enriched with the data retrieved from the official websites, legislative texts, and internal reports of the country's public institutions involved in the national food safety governance with regulatory and control tasks. This search in the grey literature was conducted using the same approach adopted for the academic literature review. However, only the latest updated reports and information were considered. Relevant data retrieved were translated to English since most of the materials were available only in Arabic language.

To structure the analysis of the country's organization of its food safety governance among its designated institutions, the Saudi food supply chain actors have been identified and classified according to the holistic framework conceptualized by Springer-Heinze (2007) and implemented by Nanyunja (2015). This framework reveals the interactions among three fundamental levels in a country's food system: (1) micro level: chain operators performing

the basic activities of generating and adding value to a product, including farmers, manufacturers, traders, distributors, wholesalers, and retailers that together form the food industry sector; (2) meso level: chain supporters providing support services of various type in the interest of the chain operators, such as research centers, financial or investment institutes, industry associations, foundations, trade promotion agencies, media, and advocacy agencies; and (3) macro level: chain enablers controlling the functioning of the supply chain through the development and implementation of legislations, such as ministries, regulatory bodies, and food safety authorities that represent the public sector and enforce the law on the private sector (Nanyunja, 2015; Springer-Heinze, 2007).

2.3 Analysis of control practices of imported food

The national food control system regarding imported food was investigated by examining the in-the-field practices of the appointed institutions as the third research question. A triangulation of secondary sources (academic and grey literature search) as well as primary sources (direct consultation of field experts) was conducted. Method triangulation was performed to ensure the consistency and reliability of the findings by using different primary or secondary and qualitative or quantitative data collection methods. Concerning the academic literature study, data were obtained by accessing Web of Science and ScienceDirect databases, whereas the grey literature search was conducted to gather the most recently updated information, by consulting online the official websites and the internal reports of the national institutions responsible for the control of the country's food supply chain, specifically of its imported food. Both the gray literature search and the academic literature review were conducted using the same research criteria described as follows. The keywords applied were: Saudi Arabia, border control, food control practices, food imports requirements. The articles and reports' titles and texts were scanned and selected based on their language (English or Arabic), publishing body (Saudi Arabian or international), year of publication (from 2000 onwards), and information contained, focusing on the following topics: food safety, quality and Halal requirements, food industry standards, food inspections, share of responsibilities among border control's institutions. Relevant qualitative data retrieved were systematically collected, analyzed through content analysis, and translated to English when necessary.

This search was enriched by consulting directly the experts and employees operative within the examined public organizations and the private food sector, to enhance the reliability of the information previously collected and investigate whether the laws and regulations reflect the real in-the-field practices. A representative of the Saudi Food and Drug Authority (SFDA) executive management for food imports control, an employee of SFDA at border controls and a Saudi food trader importing a variety of food products from different European countries were consulted via e-mail and telephone through semistructured interviews with open-ended questions covering the following topics: typologies of laboratory tests and documentary checks on imported food, collaboration among control authorities and public institutions, process required to import food. The insights obtained from the interviews were analyzed through content analysis, translated to English, compared and integrated into the secondary data previously retrieved, by adding new information and substituting outdated data with the updated.

3. RESULTS

3.1 Dependence on food imports

3.1.1 Background of the Saudi Arabian agro-food chain.
Saudi Arabia's economy is among the 20th strongest economies in the world, ranking overall as the major 20th importer and 19th exporter at the global level (CIA, World Factbook, 2019). Its economy is productive and well-integrated into the regional and the global supply chain, with linkages through the GCC area and trade agreements with international markets.

Saudi Arabia's ethnically diverse and rapidly growing population of 33 million people is expected to increase with the recently planned opening of national borders to leisure tourists for the first time (Saudi Vision 2030, 2019). Most of the country is characterized by low-density inhabited desert, with an arid climate and high temperatures during most of the year. With only 1.5% of arable lands, the country is unable to produce domestically enough output of agro-food to satisfy the large local demand and the request for product diversity (World Bank, 2019).

3.1.2 Trade analysis of imported food.
Despite the efforts that have been made by the government to increase food production and bring a decline in food imports, Saudi Arabia continues to import most of its food and raw materials (Oxford Business Group, 2015). An estimated 80% of the overall food products available for consumption is imported from a total of 157 world countries (SFDA, 2019; World Bank, 2019). Large quantities of food ingredients must be imported, transported, and distributed over vast distances along the country (Al Kandari & Jukes, 2012).

As represented in Figure 1, among the over three quarters of domestically consumed agro-food and beverages that Saudi Arabia derives from foreign suppliers, the majorly imported food categories are cereals (21%) mainly from India, meat (16%) mostly from Brazil, and dairy products (15%) primarily from New Zealand (percentage data from 2017). The table in Appendix 1 details the imported values and shares in value of the most imported food categories and their respective world exporting countries (ITC, 2018).

3.2 Organization of national food safety governance

3.2.1 Towards the centralization of the food control system.
SFDA is the governmental body that has been created in 2003 to take control of all food safety regulations and monitoring activities along the supply chain to pass to a centralized food control system based on a single agency approach. It was established to avoid the overlap of roles and the discrepancy in implementing regulations on food safety and public health, previously occurring when a combination of ministries and agencies were sharing safety control duties along the food supply chain (Al Kandari & Jukes, 2012). The establishment of SFDA has given a major opportunity to achieve a truly effective food control system in which food safety has the highest priority (Al Kandari & Jukes, 2009). However, it still collaborates with the responsible ministries for several control duties and regulatory tasks. The transition from multiple to single agency approach is still on-going within the Saudi food control system, but short-term strategic plans are in motion to see it completed by 2020 (SFDA, 2018).

3.2.2 National food law.
Saudi Arabia is an Islamic state in which the Shariah Law serves both as a constitution and legal framework. The government approves national legislations and applies GCC regional and international regulations that do not contradict the provisions of the Sharia Law. Most food safety legislation falls into this category, where standards are generally based
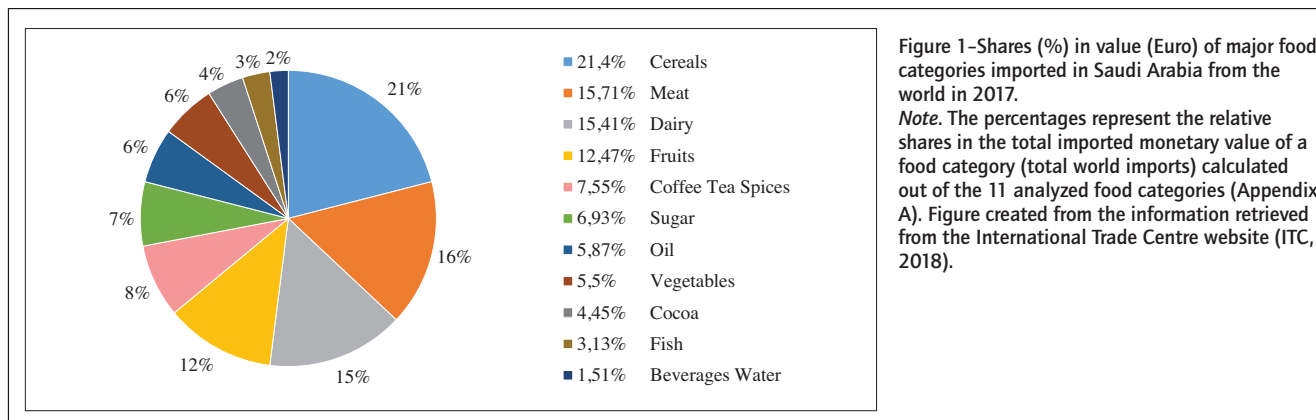
Figure 1–Shares (%) in value (Euro) of major food categories imported in Saudi Arabia from the world in 2017.
Note. The percentages represent the relative shares in the total imported monetary value of a food category (total world imports) calculated out of the 11 analyzed food categories (Appendix A). Figure created from the information retrieved from the International Trade Centre website (ITC, 2018).

Pie chart legend:
- 21,4% Cereals
- 15,71% Meat
- 15,41% Dairy
- 12,47% Fruits
- 7,55% Coffee Tea Spices
- 6,93% Sugar
- 5,87% Oil
- 5,5% Vegetables
- 4,45% Cocoa
- 3,13% Fish
- 1,51% Beverages Water

on the Codex Alimentarius, European and US regulations, but are adapted when necessary to acknowledge the local conditions and religious norms of Saudi Arabia and of the GCC (USDA, 2017a; FAO/WHO, 2019).

The primary legislation that applies to all imported products coming into Saudi Arabia is the GCC Common Customs Law. Although standards and regulations are established regionally by the GCC Standardization Organization (GSO) and nationally by the Saudi Standards, Metrology and Quality Organization (SASO), SFDA is the sole government agency that is authorized and responsible for the implementation of such regulations in Saudi Arabia.

Since 2011, SFDA has been collaborating with SASO and other concerned ministries in drafting a new unified Saudi food law, by developing and updating legislations to meet human, plant and animal health and safety as well as product quality requirements. The new Saudi food law has been put together by renewing existent inspection policies and applying international standards to comply with the World Trade Organization (WTO) membership requirements, such as the Sanitary and Phytosanitary (SPS) Agreement and the Technical Barriers to Trade (TBT) Agreement specifications. The Saudi food law defines the responsibilities and functions of SFDA as the national authority entrusted with controlling, regulating, and overseeing all aspects of food safety at all stages of the food supply chain (Al Kandari & Jukes, 2012).

3.2.3   Connection with international organizations for food standards. Saudi Arabia has a longstanding history with the Food and Agriculture Organization (FAO) for over 60 years. Their collaboration has helped boosting the food security and agricultural industry to reduce the dependability on foreign food imports (FAO, 2017). The country is also a member of the Codex Alimentarius Commission (CAC), of the World Health Organization (WHO), of the World Organization for Animal Health (OIE), and a contracting party to the International Plant Protection Convention (IPPC). Concerning animals, plants, and their products, a variety of Sanitary and Phytosanitary measures are implemented. SPS measures are based on the WTO's specifications and harmonized at the GCC level under the Veterinary Quarantine Law and the Plant Quarantine Law, and the corresponding Executive Regulations provide details of their implementation in Saudi Arabia (Development Solutions, 2017).

All plants or plant products contaminated with pests listed in the Approved United Pest List of the GCC are prohibited from importation (MEWA, 2019). With regard to the Maximum Residues Levels (MRL) of pesticides, Saudi Arabia adopts the Saudi and GSO standards of MRLs. However, if an MRL is not indicated

in the Saudi nor in the GSO standards, a reference must be made to the Codex Alimentarius standards, and if not mentioned in the CAC standards, a reference may be made to the European or the US standards.

3.2.4   Trade agreements. Saudi Arabia has been negotiating bilateral trade agreements with several countries and regional entities. At the regional level, Saudi Arabia is a member of the GCC and is, therefore, part of the Customs Union signed in 2003 with the other five members (GCC, 2019). At the international level, Saudi Arabia is a member of the WTO since 2005 (WTO, 2019). It has a free trade agreement with the European Free Trade Association (EFTA) through the GCC, and other negotiations with Europe are on-going. Saudi Arabia and the US signed a Trade and Investment Framework Agreement (TIFA) in 2003 leading to the establishment of legal protections for investors, improvements in intellectual property protection, efficient customs procedures, and greater transparency in governmental and commercial regulations (US International Trade Administration, 2018). Often, international agreements also include official visits undertaken by SFDA's representatives to foreign food establishments wishing to import food products, especially meat and meat products, to Saudi Arabia (SFDA, 2019).

3.2.5   Food supply chain actors. To ensure a functional and effective food control system at the national and international level, the collaborative efforts of all three levels of the supply chain (i.e. micro level, meso level, and macro level) are fundamental (Springer-Heinze, 2007). The food industry at the micro level represents the main source that operates and fosters the food supply chain, whereas the institutions that are responsible to manage and control its safety are found at the macro and the meso level (Nanyunja, 2015). Figure 2 shows the main actors active at the micro, meso, and macro levels of the Saudi food supply chain.

3.2.5.1   Micro level
3.2.5.1.1 Farming and producing industry. During the last two decades, a modern and fully industrialized farming sector has been established to diversify the national economy and reduce the dependence from foreign food imports. With the extensive public investments in the agricultural industry, the domestic food production has been increasing. However, the reality of water scarcity has led to a greater emphasis on smaller-scale farming.

The government has instituted several plans to mitigate the effects of agricultural production on the country's water reserves, by emphasizing on organic and controlled-environment agriculture (i.e., greenhouse farming; Oxford Business Group, 2015). It has

Micro Level: Food Supply Chain Operators

Producing	Processing	Distributing	Retailing	Consumption
• Agriculture • Crops and livestock farming • Aquaculture	• Processing • Manufacturing • Slaughtering • Packaging • Labelling	• Transportation • Domestic wholesale • Import trade • Export trade	• Re-processing • Storage • Domestic retailing • Horeca	• Home preparation of food • Consumer consumption

Meso Level: Food Supply Chain Supporters

Research Centers	Trade Agencies	Associations & Societies	Investment Institutes	National Projects
• KACST • Saudi Society for Food and Nutrition • Universities	• Saudi Export Development Authority • Saudi Chambers of Commerce and Industry	• Consumer Protection Association • Saudi Organic Farming Association • Saudi Aquaculture Society	• Public investments • Government allowances • Free-interest loans	• Saudi Vision 2030 • National Transformation Program 2020

Macro Level: Food Supply Chain Enablers

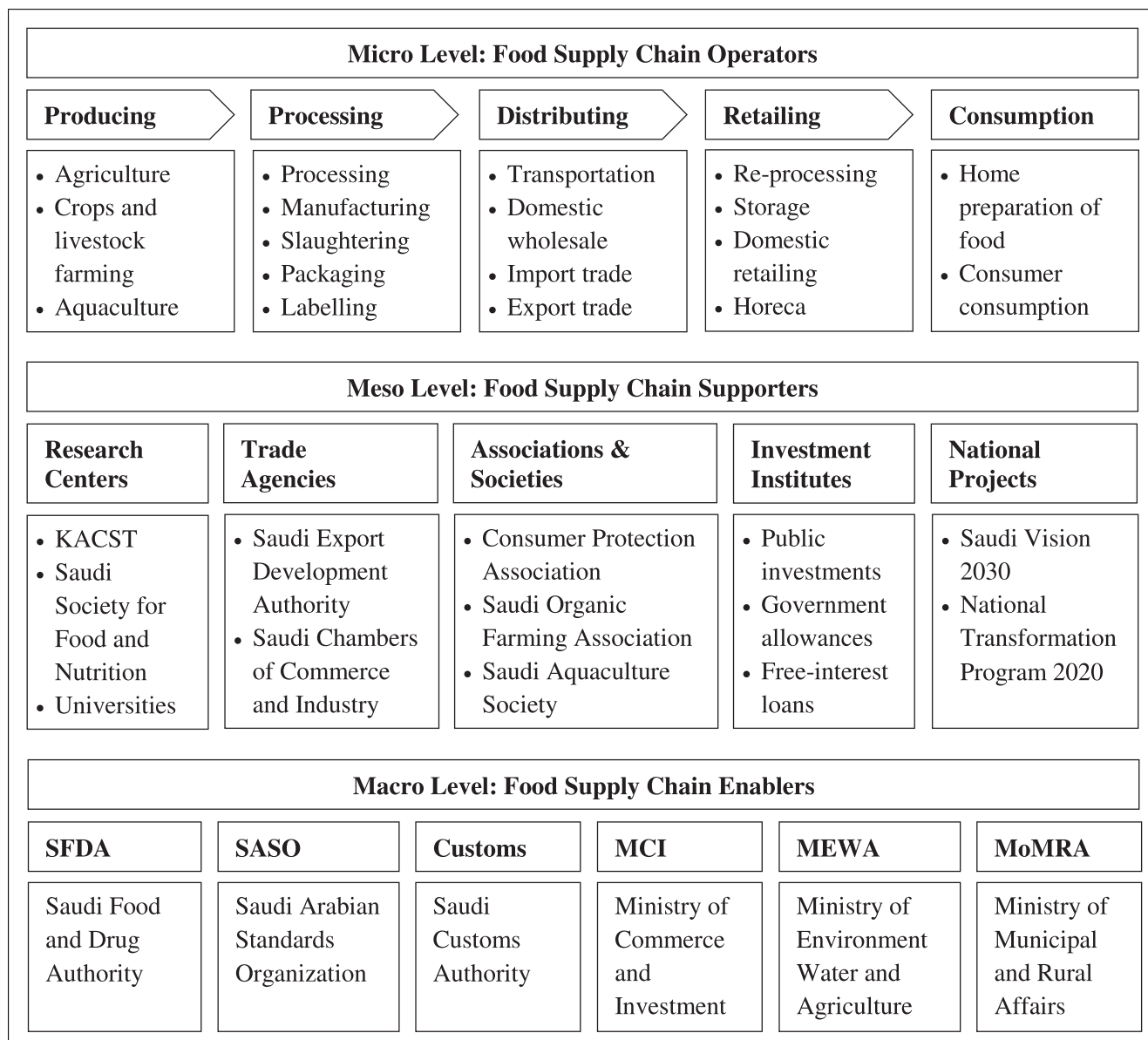| SFDA	SASO	Customs	MCI	MEWA	MoMRA
Saudi Food and Drug Authority	Saudi Arabian Standards Organization	Saudi Customs Authority	Ministry of Commerce and Investment	Ministry of Environment Water and Agriculture	Ministry of Municipal and Rural Affairs

Figure 2–Overview of main actors and related activities identified at the micro, meso, and macrolevels of the Saudi food supply chain. KACST, King Abdulaziz City for Science and Technology.

also launched an extensive program to promote modern farming technology, turn wide areas of the desert into arable fields, set up rural roads, irrigation networks, storage and export facilities, and encourage agricultural research and training institutions.

To rationalize the use of irrigation water, the cultivation of most types of water-intensive cereals is now prohibited, including animal feed, whereas certain types of water-intensive fruits and vegetables (i.e., watermelon, melon, potatoes, onions, tomatoes, corn, olives, squash, and grapes) are allowed to be cultivated but not to be exported for food security reasons. The agricultural production currently concentrates mostly on dairy products, seafood, livestock, and on the cultivation of drought-tolerant fruits and vegetables. Even though the country imports large quantities of meat and dairy products to ensure product diversity, Saudi Arabia is now self-sufficient in the production of dates, meat, milk, and poultry eggs, and even exports these products to foreign markets, along with certain types of fish and vegetables (Development Solutions, 2017; MEWA, 2019).

From the beginning of 2019, farming establishments are required by law to obtain the Saudi GAP (Good Agricultural Practices) certificate, which has been introduced mandatorily to improve the quality and safety of the agro-food produced for domestic consumption and exported. This public certificate is obtainable through the Ministry of Environment, Water and Agriculture (MEWA) following an inspection of the farm premise which must reoccur yearly. The Saudi GAP has helped to raise the efficiency of the national agricultural sector by focusing on risk-based methods of production to avoid contamination in the primary sector. It allows the creation of a local network that links farmers and trademark owners in the production and distribution of safe food, which enhances consumer confidence in national products. The certificate covers the standards of food safety, traceability, environmental biodiversity, plant health, animal welfare, employees' hygiene, and safety, to which all national farms must comply (MEWA, 2019; SFDA, 2019).

3.2.5.1.2 Processing and manufacturing industry. Considerable public investment has been allocated towards the development of the domestic food manufacturing and processing sector. The marketplace for food processing within the country consists of both domestic and international operators working across a wide range of product categories. Foreign companies and investors can run food facilities by collaborating with local agents or domestic firms in joint ventures (Development Solutions, 2017). The food industry is mostly reliant upon processing and packaging of imported raw foods from international agricultures (Alsaleh, 2007). Operators can take advantage of a combination of available policy instruments, such as direct access to capital in the form of interest-free loans to import food processing ingredients and raw materials.

By joining the WTO in 2005, Saudi Arabia opened its doors to the global market (WTO, 2019). The competition from international food processing firms has been challenging the Saudi food industry since then. To become more competitive, food manufacturing companies are increasingly using advanced technologies to execute their food processing activities, especially the larger-size firms, some of which have become leading food giants producing and exporting their product across all the GCC area. The success of the processing food industry may be attributed to the high-quality standards and marketing policies adopted.

Factories must implement and monitor Food Safety Management Systems (FSMS), based on the HACCP (Hazard Analysis Critical Control Point) guidelines, Good Manufacturing Practices (GMP), ISO 9001, and/or ISO 22000 standards, which do not contradict the local Islamic Halal requirements (Al Halaseh & Sundarakani, 2012). Halal Certificates and Halal Slaughter Certificates are required for food companies processing any animal-derived products, either of local or imported origins. Certificates can be obtained through the recognized Islamic Centers issuing Halal Certificates worldwide approved by the Muslim World League.

Besides the mandatory food safety standards and regulations that all food companies are required to comply with, local private food quality certifications are increasingly being acquired by Saudi businesses to become more competitive with international brands. The "King's Prize for the Ideal Factory" and the "Saudi Quality Sign" are among the quality accreditation marks that have gained most popularity within the Saudi food industry (Alsaleh, 2007).

3.2.5.1.3 Trading and distributing industry. Saudi distributors and importers have developed an organized marketing network of centralized purchasing across the country, which coordinates among varied business players, satisfying the national demand for food commodities and diverse produce. Foreign food suppliers meet regulatory and tariff barriers when selling food products directly to consumers in the Saudi market. As a result, distributors prefer to sell their food products, which they mostly purchase from abroad, to their Saudi agents, and those, in turn, sell them under either Arabian or foreign brands to wholesalers, who resell them to small retails and to final consumers (Rahman, 2017).

Working alongside with the public sector, several private logistics and distribution operators offer consolidated services including transportation to market, custom and border clearance, freight forwarding and domestic transfer, cold storage, distribution, and final delivery (Development Solutions, 2017). Saudi Arabia has a good network of infrastructures and connections to international markets, eased by several land borders, sea-ports, and air access. The government has recently announced important infrastructural development projects as part of the country's economic diversification initiatives (Saudi Vision 2030, 2019). Accordingly, significant

public investments will be allocated towards the further improvement of sea, air and rail links within the country.

Regarding regulation on food contact materials, specific HACCP requirements are mandatory for all companies and operators transporting or in contact with food products. Moreover, the transportation, handling and storage of Halal food should occur with tools that are free from any contamination of non-Halal products. The implementation and maintenance of proper hygiene and sanitation at all steps of the food supply chain must be monitored by importing and national food operators and is regularly controlled by the responsible national authorities (Al Halaseh & Sundarakani, 2012).

3.2.5.1.4 Wholesaling and retailing industry. The increasing demand for the food service and retailing industries is being driven by high levels of disposable income among Saudi consumers. Both industries are becoming increasingly consolidated with the growing presence of hypermarkets and restaurant chains owned and managed by domestic and international firms (Development Solutions, 2017). The food retail, wholesale, and distribution networks are highly fragmented with no supplier holding a decisive market share. Traditional retailers and independent grocers, mostly family-owned businesses, collectively account for the majority of sales, offering an assortment of imported and domestic products. Whereas such traditional and independent markets are suited to small-quantity and day-to-day purchasing habits, supermarkets, and hypermarkets increasingly fill a niche in the society with patterns similar to European shopping centers and malls, offering a larger variety of products and a destination for social and family outings (Farrelly & Mitchell, 2015). Unlike many comparable markets, discount and low-cost shops are not predominant in Saudi Arabia since Saudi consumers are mostly value-oriented.

Similarly to food and beverages retailers, also the presence of food service outlets is rapidly growing, with fast foods, restaurants, and coffee shops offering increasingly high-quality and even luxury service as well as a large variety of world cuisines. The number of food service chains is estimated to keep growing with the recently planned opening of the Saudi borders to international leisure tourists for the first time (Saudi Vision 2030, 2019).

National food retail and service establishments are regularly inspected to ensure their implementation of FSMS, HACCP programs, risk control procedures, and monitoring systems, in accordance with international ISO standards. Specific parameters are monitored by the appointed inspectors, including food establishment maintenance, water source used in manufacturing, cleaning and disinfection programs, machinery and equipment maintenance, employee hygiene, and pest control (MoMRA, 2017). Regarding legislation on allergens, every food service outlet must list on their menus all the allergens ingredients (e.g., gluten, fish, crustaceans, mollusks, eggs, mustard, sesame seeds, peanuts, nuts, milk, celery, soybeans, and their products; SFDA, 2019).

3.2.5.2 Meso level
The meso level of the Saudi food supply chain consists of several governmental and private institutions of various nature dedicated to supporting the activities and functioning of the food industry at the micro level as well as the food safety control activities of the public sector at the macro level. To this purpose, the meso level institutions can be distinguished between operational service providers, offering direct assistance and expertise to chain operators and enablers (such as scientific research centers, trade promotion agencies, accounting, and investment institutes), and support

service providers, benefitting the supply chain through technical preparatory activities (such as business associations, governmental development projects, chambers of commerce; Nanyunja, 2015; Springer-Heinze, 2007).

3.2.5.2.1 Scientific research centers. Among the principal research centers, King Abdulaziz City for Science and Technology (KACST) is a scientific governmental institution that enhances scientific applied research, cooperating with the relevant authorities in identifying national priorities and policies to build scientific and technological bases in view of the development of industries, such as the domestic agricultural and food industry. KACST comprises all the facilities and equipment of scientific research, such as laboratories, means of communication, information sources, and science databases (KACST, 2019).

Another national institution specialized in food safety research activities is the Saudi Society for Food and Nutrition (SSFN). SSFN is an administratively and financially autonomous scientific society sponsored by King Saud University in Riyadh and hosted by its Food Science and Nutrition Department within the College of Food Science and Agriculture (SSFN, 2016). SSFN's objectives include the development of scientific knowledge in the fields of food sciences and nutrition, providing scientific and technical advice as well as the exchange of scientific information and research outcomes between its society and other relevant institutions both inside and outside the country (Al Mutairi et al., 2015).

3.2.5.2.2. Trade promotion agencies. Public and private trade promotion agencies are present to ease the import/export processes between Saudi Arabia and third countries. Among the governmental trade institutions, the Saudi Export Development Authority supports exporters in the purpose of increasing their competitiveness, by promoting the international expansion of their products and removing trade barriers (Saudi Exports, 2019).

Furthermore, the Council of Saudi Chambers of Commerce and Industry is the representative of the Saudi business community in all its various groups, sectors and regions, with the objective of developing and protecting financial and human resources in the national business sector (Council of Saudi Chambers, 2019).

Besides the governmental trade and business institutions, private trade promotion agencies are present in the national embassies to encourage the creation of business partnerships and assist the logistics of goods and services import/export between Saudi Arabia and the countries they institutionally represent. The trade promotion sections of the embassies offer information and support to interested companies by identifying possible business partners as well as arranging bilateral meetings and institutional visits, among other activities.

3.2.5.2.3 Consumer and business associations. Associations and societies in Saudi Arabia are generally created by resolution of the Saudi Council of Ministers and run, therefore, under the supervision of a responsible ministry. The Consumer Protection Association (CPA) is a nongovernmental independent body that supports the efforts of public bodies in matters related to consumer protection. It proposes legal developments for consumer protection and stands for the interests of consumers within local and international bodies. The Saudi CPA was created to play a leading role in consumer education. It focuses on consumer affairs by defending them and protecting their interests and their right to access foods free from adulteration, fraud, and counterfeiting (Al Mutairi et al., 2015).

On the businesses side, the Saudi Organic Farming Association (SOFA) is a financially independent civil society organization with a legal status working under the supervision of MEWA, with the aim of supporting the provision of organic food, increasing the awareness of consumers towards it and the conservation of natural resources. The Saudi Aquaculture Society (SAS) is another financially independent national society operating under the supervision of MEWA, working to develop a sustainable and globally competitive aquaculture industry, capable of providing safe and high-quality products with competitive prices, generating a profitable return on investment (SAS, 2019).

3.2.5.2.4 Investment institutes. Saudi Arabia offers profitable conditions for national businesses to grow and for international firms to invest and partner with Saudi operators in various sectors of the national economy, such as the food industry. To reduce dependability on the income of oil exports, the government is working to create a favorable and business-friendly environment attracting foreign investments and business partnerships, aiming towards the development of a diversified national industry. To this purpose, the government has created several finance projects, funds, and investment institutes to support the growth of specific sectors.

Among the funds, the Saudi Industrial Development Fund (SIDF) provides financial aid in the form of long and medium-term loans to investors active in industry development. The Saudi Agricultural Development Fund (ADF) sustains the modernization of the national agricultural sector by giving free-interest loans and credit facilitation to local farmers. The Public Investment Fund (PIF) is among the largest sovereign wealth funds in the world owned by Saudi Arabia, investing in specific governmental and private projects in various sectors of the economy through loans, guarantees, and allocation of public funds (Saudi Vision 2030, 2019).

Among the investment institutes, the Saudi Credit Bank gives interest-free loans to small enterprises and employers to encourage them to run their businesses independently. The Saudi Agricultural Bank is a public credit institution specialized in providing financial support for various agricultural activities, by offering interest-free loans to farmers, allowing them to secure industry prerequisites, such as agricultural machinery and equipment. Furthermore, the Islamic Development Bank fosters the economic development of member countries and Muslim communities participating in equity capital and granting loans for projects and enterprises.

3.2.5.2.5 Governmental development projects. To reduce Saudi Arabia's dependence on oil and diversifying the national economy, the government has announced in 2016 an ambitious multilateral plan known as Saudi Vision 2030, launched to reinforce economic and investment activities, and develop public service sectors, including health, education, infrastructure, recreation, and tourism. As part of its objectives, the fostering of the national food industry represents a central theme with the main purpose of protecting vital resources, building safe and strategic food reserves, promoting partnerships with countries endowed with natural resources, and fostering sustainable agriculture and aquaculture, reducing resource wastage (Saudi Vision 2030, 2019).

Moreover, in the short-term, the National Transformation Program (NTP) 2020 is aimed to establish the necessary infrastructures to realize Saudi Vision 2030 by increasing coordination and planning among the local macro and meso level institutions. Some of NTP 2020 objectives include the enhancement of economic sustainability, the development of food security, and the promotion of sustainable use of water resources within the country.

3.2.5.3 Macro level

3.2.5.3.1 Saudi Food and Drug Authority. SFDA has defined a strategy for developing the food control system that follows a modern and globally accepted scheme based on risk analysis and an integrated farm-to-table approach (Al Kandari & Jukes, 2012). To this purpose, SFDA's food sector is organized in nine executive departments, which define its principal competences and responsibilities: (1) imported food control, (2) local market control, (3) technical regulations and specifications, (4) research and testing laboratories, (5) risk assessment, (6) crisis monitoring and management, (7) awareness and communication, (8) pesticides, and (9) animal feed.

The authority coordinates the Gulf Rapid Alert System for Food (GRASF), an electronic system designed to facilitate the rapid exchange of food safety-related information, notifications and alerts among the concerned governmental bodies within the GCC countries, in order to take necessary and preventive measures for protecting consumer's health (SFDA, 2019).

As part of its strategic plan 2018 to 2022, SFDA has launched the Food Facilities Evaluation Program to assess all national food and beverage establishments against food safety requirements. During frequent inspections throughout the year, based on the level of conformity to food safety and health standards, companies will be assessed and corrected on their FSMS performances, and consequently graded and classified into four categories, from A+ for excellent scoring facilities to C for good scoring ones. Establishments that do not meet the minimum requirements will be liable to close their activity. A+ facilities will be rewarded by being published on SFDA official portal as top companies for food safety compliance, to increase consumer confidence in national food brands, encourage transparency, reduce malpractice, and motivate higher performances among the domestic food industry (SFDA, 2019).

SFDA has also introduced an electronic self-assessment form on its portal to enable food industry specialists to self-assess their facilities in line with the nationally adopted food safety and health requirements, allowing a mechanism of self-monitoring that identifies and corrects cases of non-conformity, besides facilitating the inspection tasks of the responsible authorities.

Another service offered by SFDA and made available to the public on its portal is the electronic system launched in 2019 to report cases of food poisoning by citizens, residents, health facilities, and health practitioners. The system has been introduced to collect statistics on foodborne diseases occurrences, monitor the most vulnerable food categories reported, provide the public with information and advice on food poisoning incidents, and ultimately reduce food contamination outbreaks in the country after having registered in 2017 a total of 889 cases of food poisoning. To this purpose, SFDA has started taking strict penal action against companies found to sell harmful, adulterated, or banned foodstuff, with penalties that reach up to 10 million of Saudi Riyals in fines (corresponding approximately to over 2.5 million of US Dollars) as well as a maximum of 10 years of imprisonment (SFDA, 2019).

3.2.5.3.2 Saudi Arabian Standards Organization. SASO, currently known also as the Saudi Standards, Metrology and Quality Organization, is a technical governmental body that governs the executive and organizational tasks related to standards, metrology, and quality. Its responsibilities include: determining Saudi standards of products and services, measurements, calibration, and procedures of conformity evaluation; accrediting laboratories and certification bodies; setting methods of sampling, testing, and technical inspection; defining quality systems (Al Mutairi et al., 2015).

SASO has extended its role in food safety legislation, with tasks that include the annual approval, updating and modification of domestic standards following the WTO specifications. SASO's main reference points in setting Saudi standards are the specifications, guidance and recommendations issued by CAC, of which Saudi Arabia is a member since 1968 (FAO/WHO, 2019). The standards are selected and adopted after the necessary modifications are made to reflect local conditions and religious norms. SASO functions to protect consumers and the environment. It also seeks to enhance the competitiveness of products through the application of the best international practices in line with the Islamic laws (SASO, 2016).

To ease the entry procedures for imported products, SASO has launched Saber, an electronic service provider for obtaining Certificates of Conformity for products destined to the Saudi market under applicable national standards and specifications rules. The system is an online verification tool, which connects importers, SASO-approved certification bodies, Saudi Customs and related trade authorities in a single online platform. Saudi Arabia's purpose for starting this program is to accelerate shipments clearance, reduce counterfeit, easily track products and raise the number of SASO-standard-conforming products in the market (Saber by SASO, 2019).

3.2.5.3.3 Saudi Customs Authority. The principal role of the Saudi Customs Authority, also known shortly as Saudi Customs, concerning food safety consists in preventing any food products that could harm human health or contravene Saudi standard specifications from entering the country (Al Mutairi et al., 2015). To this purpose, Saudi Customs shares its border control responsibilities with SFDA and the Ministry of Commerce and Investment (MCI). Although the latter two entities ensure that the imported food products comply with the national and regional standards by executing inspections and lab tests on food samples at the border posts (MCI) or across the country (SFDA), Saudi Customs supervises the control of documents, licenses and certificates relative to the imported food and its importing companies. To facilitate importers and the responsible bodies, the Saudi Customs' online portal offers several electronic services that include: documents verification, search of customs tariffs, access to periodic reports, request of clearance for restricted goods, inquiries on violations, payment of fines, review of customs fees, VAT report, request for returns or destruction of nonaccepted goods, registration of data for imported goods (Saudi Customs, 2019).

Due to the current fragmentation of multiple public entities responsible for the safety control of the food supply chain, particularly at the border posts, the government has decided to unify all the electronic services for importers under a single system, known as Fasah. Created to facilitate trades across the borders, Fasah is a comprehensive integrated program that allows the electronic exchange of data relative to customs procedures between all relevant parties active in the import and export from the public and private sectors following the laws and regulations applied. Fasah speeds up and automates the process of clearance and inspection of imported products, by exchanging requests for examinations and results along with the necessary documents among Saudi Customs, SFDA and other involved ministries, including MCI and MEWA (Fasah, 2018).

3.2.5.3.4 Ministry of Commerce and Investment. Besides its key role to enhance the potential of the commerce and investment sectors in view to achieve sustainable economic development, MCI has also other specific tasks regarding the control of the food supply chain, such as conducting examinations and lab tests

on imported food products at the border posts. For this purpose, MCI is equipped with scientific testing laboratories in the main border posts of the country, where analysis on all processed and packaged imported food items are performed to guarantee their compliance with national and regional food safety standards and regulations.

MCI is also responsible for issuing certificates of origin for national food commodities as well as for exported plant and animal products, ensuring their registration in the receiving countries, examining trademark requests, combating counterfeit, and detecting irregularities according to the system. Furthermore, in the matter of food security, MCI estimates the country's needs for food commodities, preparing the necessary plans to provide them at ordinary times for all the regions from the best national and international sources at the lowest prices (MCI, 2019).

3.2.5.3.5 Ministry of Environment, Water and Agriculture. MEWA works to achieve sustainability of the national environment and its natural resources, in a manner that would ensure water security, food security and, ultimately, good life quality. In order to achieve such objectives, MEWA has been organized in seven directorates, which define its main tasks and responsibilities: (1) Directorate of Environment, (2) Directorate of Water Affairs, (3) Directorate of Water Services, (4) Directorate of Agriculture, (5) Directorate of Land and Survey, (6) Directorate of Animal Resources, and (7) Directorate of Planning and Development.

The Ministry is equipped with scientific laboratories across the country to execute veterinary diagnoses, agricultural quarantines for plants and livestock, and research activities based on the periodic inspections of national farms (MEWA, 2019). Other duties of MEWA along the food supply chain include: providing subsidies, loans and equipment to farmers in coordination with the Saudi Agricultural Development Fund; training farmers to adopt modern farming practices and fishing techniques; preparing uncultivated lands suitable for agriculture and granting them to citizens to foster national cultivation; preserving the agricultural environment as well as the aquatic ecosystem; providing irrigation water suitable for agriculture through wells and dams; conducting applied research aimed at introducing advanced approaches in the fields of agriculture, veterinary, livestock, and fisheries.

3.2.5.3.6 Ministry of Municipal and Rural Affairs. The Ministry of Municipal and Rural Affairs (MoMRA) is the central government organization entrusted with the supervision and regulation of all the municipalities and city halls across the country's cities, towns and villages. MoMRA has a legislative and enforcement role in the sector of food safety, being responsible for setting policies related to public health, regulating food and health inspections, controlling commercial adulteration, supervising slaughterhouses, managing food poisoning outbreaks, conducting food and water sampling, as well as the registration of food and health premises (Al Mutairi et al., 2015).

MoMRA has developed a number of rules, regulations and technical requirements regarding the sectors over which it has competence, such as health, municipal, and rural affairs. The regulations cover the correct maintenance of food establishments and their machinery, along with the safety and hygiene of employees. The Ministry has the responsibility of inspecting regularly all the national food and beverage establishments along the food supply chain, ensuring their compliance to the national and international food safety standards applied in Saudi Arabia (MoMRA, 2017).

3.3 Control practices of imported food

3.3.1 Border controls. Tables 1 and 2 show the areas of competence and control duties executed by SFDA in collaboration with the designated ministries, emphasizing how they currently cooperate and share responsibilities along the food supply chain (SFDA, 2018, 2019).

At the border posts, SFDA collaborates with Saudi Customs and MCI on monitoring and control duties regarding the inspection, testing, and approval of imported packaged food. Regarding the import of plant-based products and livestock, MEWA is also involved in ensuring that the plants imported comply with the set MRLs of pesticides and animals' health requirements. Imported livestock, plants, seeds, pesticides, animal feed, fresh fruits, and vegetables are placed in quarantine at the borders and analyzed in third party laboratories in the country. The list of licensed private food laboratories is available at SFDA's official website (https://bit.ly/2T6e5Os; SFDA, 2019).

Concerning the inspection of imported food, SFDA has set up sampling and analytical laboratory facilities at all land, air and seaports of entry within the country (SFDA, 2018). SFDA's laboratories distributed across the country and at the border posts carry out physical, chemical, and microbiological analysis of food samples according to risk assessments. Such analysis include tests and research on: additives and substances used in animal feed; biological hazards and food-borne diseases; chemical, biological, and molecular contaminants; migration from food contact materials; flavorings and processing aids; plant protection products and pesticide residues.

As detailed in Figure 3, SFDA undertakes the following inspection checks on the imported food products: (1) documentary check and verification of food products; (2) identity check of food products in conformity with documents and certificates; (3) physical examination of food in conformity with labeling and temperature rules; and (4) laboratory test if required by the inspector depending on the conditions of the products (SFDA, 2019).

Due to governmental decisions, some countries are banned for the import of meat products since national authorities reported cases of foodborne outbreaks or contagious diseases on their livestock. The list of banned countries for the import of meat products is elaborated and managed by SFDA, and is available to the public through SFDA's official online portal (bit.ly/2TOoNMm; SFDA, 2019). Furthermore, according to Islamic laws and Halal requirements, alcohol is prohibited for import and consumption on all grounds, which implies that specific tests are undertaken by the responsible authorities at the borders even on acidic food products that may develop any amount of alcohol over time, such as tomato-derived products. The import and consumption of pork products are also completely prohibited, including any amounts of pork bones, skin, connective tissues, lard, or fat used as ingredients to process other food products (e.g., gelatin applied in candies).

3.3.2 Requirements for imported food. Foreign food companies willing to distribute their food products in the Saudi market need to undertake a series of procedures and registration processes through SFDA to ensure their compliance with food safety and Halal requirements. SFDA issues circulars, instructions, and bans on food products addressed to the Council of Saudi Chambers of Commerce and Industry to inform stakeholders and importers. The authority registers both the food products as well as the importing enterprises (SFDA, 2019).

On one side, regarding the registration of foreign importing food enterprises, specific documentation is required by SFDA according to the type of importing subject. Specifically, foreign

Advance note from importer to SFDA on intention of importing food items in Saudi Arabia

Arrival of food items to the entry border (sea / land / airports)

Electronic requirements prior to applying for the service:

1. Registration of importer
2. Food product registration
3. Registration of custom clearance

Visit SFDA portal at: https://bit.ly/2TOoNMm

Is there a ban from the importing country / exporting company / product?

No   Yes

Documents required for the clearance of food items:

1. Inspection Request Form showing the list of food items
2. Copy of import statement
3. Copy of the bill of food items
4. Health certificate from Governmental Food Authority in the country of origin confirming the conformity of the food items to the approved specifications
5. Halal slaughter certificate for meat, poultry and poultry derived products issued by an Islamic Society accredited by the Islamic World League

Do the submitted documents meet the requirements?

Possible actions:

1. SFDA stores the food items in the border port until the importer provides the required documents
2. The importer submits a form certifying to submit afterwards the original documents

Yes   No

Do the shipped food items meet the requirements?

Yes   No

Are the food items ready for inspection?

Actions required:

1. The importer makes a pledge not to act on the food items until inspected
2. The food items should be prepared for inspection
3. An appointment for inspection has to be set with the SFDA inspector

Yes   No

Is the appearance of the food items acceptable?

Yes   No

SFDA selects samples of food items and send them to the lab for testing

Is there any suspicion / need to inspect / test samples of the food

Yes   No

Do the results of the analysis confirm that the food items meet the requirements?

SFDA accepts the food items to enter in the market of Saudi Arabia

Yes   No
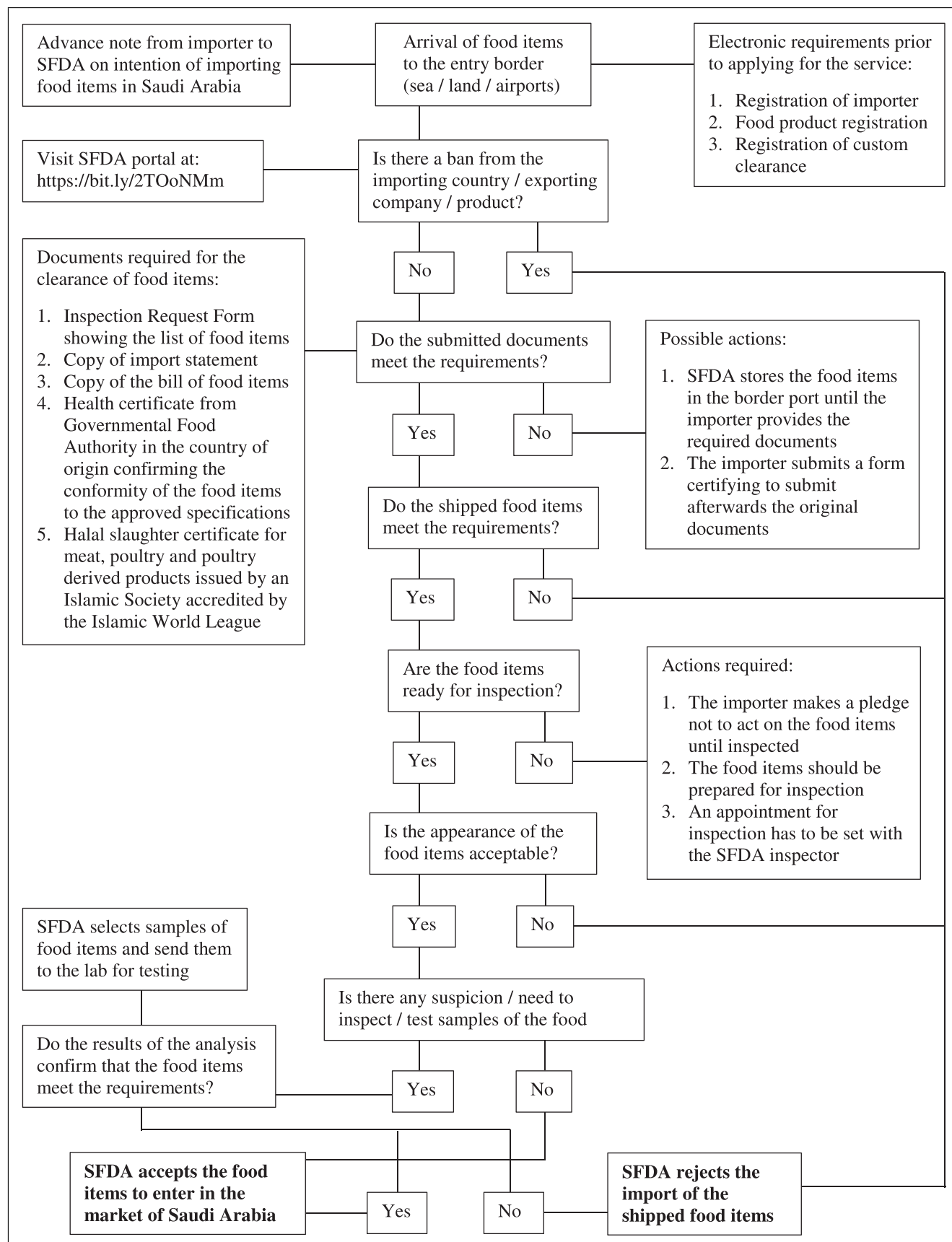
SFDA rejects the import of the shipped food items

Figure 3–Regulatory process of food import and clearance undertaken by SFDA at the national border posts. *Note.* Figure created from the information retrieved from the Saudi Food and Drug Authority website (SFDA, 2019).

Table 1–Share of responsibilities among Saudi macro level institutions along the food supply chain based on product category.

	Importing companies	Livestock/crop farms	Processing plants	Slaughter houses	Distribution warehouses	Retail / restaurants	Exporting companies
Animal Products	SC + MCI+ SFDA	MEWA	SFDA		SFDA	MoMRA	SFDA
MeatFish	SC + MCI+ SFDA	MEWA	SFDA	MoMRA	SFDA	MoMRA	SFDA
FruitVegetables	SC + MEWAMCI + SFDA	MEWA	SFDA		SFDA	MoMRA	MEWA
Bottled water	SC + MCI+ SFDA		SFDA		SFDA	MoMRA	
Animal feed	SC + MCI+ SFDA	MEWA	SFDA		SFDA	MoMRA	SFDA
Pesticidesadditives	SC + MCI+ SFDA	MEWA	SFDA		SFDA	MoMRA	SFDA

Note. Table created from the information retrieved from the Saudi Food and Drug Authority Strategic Plan 2018-2022 (SFDA, 2018).
Abbreviations: MCI, Ministry of Commerce and Investment; MEWA, Ministry of Environment, Water and Agriculture; MoMRA, Ministry of Municipal and Rural Affairs; SC, Saudi Customs; SFDA, Saudi Food and Drug Authority.

Table 2–Types of monitoring tasks undertaken by Saudi macro level institutions along the food supply chain.

	Border posts	Livestock / crop farms	Slaughter houses	Processing plants / warehouses	Retail / restaurants
SFDA	Documents and food check			Inspections on food products	
SC	Documents verification				
MCI	Food samples laboratory test				
MEWA	Plant inspection and quarantine	Inspections on plants and animals			
MoMRA			Inspections on establishments		Inspections on establishments

Note. Table created from the information retrieved from the Saudi Food and Drug Authority website (SFDA, 2019).
Abbreviations: MCI, Ministry of Commerce and Investment; MEWA, Ministry of Environment, Water and Agriculture; MoMRA, Ministry of Municipal and Rural Affairs; SFDA, Saudi Food and Drug Authority; SC, Saudi Customs.

establishments must produce: (1) a registration certificate issued by their Ministry of Health, (2) an industry certificate issued by their Ministry of Industry or Commerce, and (3) quality certificates such as ISO 22000 and/or ISO 9001 and/or GMP and/or HACCP. Saudi local importers must produce: (1) a commercial certificate and (2) an authentication letter. Saudi customs brokers must produce: (1) a customs license and (2) an authentication letter.

On the other side, for the registration of food products to be imported in Saudi Arabia, a series of requirements are imposed by SFDA on importers: (1) importers must create an account with SFDA and register their food products; (2) imported food must meet all the requirements, regulations and standards applied in Saudi Arabia; (3) importers must have a commercial register that includes food trade; (4) original invoices must be certified from the appointed authority in the country of origin. Furthermore, besides the bill of landing or airway bill and the certificate of origin for all imported food products, importers must produce specific certificates regarding food safety, plant or animal health, product quality and Halal standards, according to the product category, listed in Table 3 (USDA, 2017b).

4. DISCUSSION

Through a legislative renovation and the financial support of the government on the growth of the national food industry as well as of the national food control system, many challenges regarding the supply of safe and quality food products have been addressed. Significant progress has been achieved starting with the decision of centralizing all the food control and regulatory activities under a single expert authority (SFDA), adhering to the main international food standards and regulations (i.e., CAC, WTO, OIE,

IPPC), and stipulating trade agreements with various countries. However, Saudi Arabia still faces several remaining issues that government and industry need to address to ensure the constant safety of the food supply chain and guarantee compliance with local standards of imported food.

First, despite the effort of government and industry in fostering the domestic agro-production, the country's heavy reliance on foreign food imports continues to represent a major challenge, making Saudi Arabia vulnerable, especially when it comes to guaranteeing food safety, quality, and Halal status of imported food and raw material. Many typologies of food hazards can enter the food supply chain at a variety of points, including the borders, which makes it particularly challenging for the responsible authorities to ensure the control over the entire supply chain. Several socio-economic phenomena contribute to making this challenge even harder, including the continuously growing population and the forthcoming opening of national borders for leisure tourism (Saudi Vision 2030, 2019), which will enhance the already high domestic request for diverse food products.

Second, another significant challenge for the safe supply of food is represented by the climate conditions, characterized by extremely high and dry temperatures during most of the year, which cause a considerable problem not only for the domestic agro-production but also for the necessary processes of transportation, distribution, and storing of food. The situation becomes even more challenging when fresh food is being distributed over long distances or imported from outside the country, facing extensive waiting times at the entry ports for sampling, testing, and border controls. To this purpose, strict controls on the food companies' implementation of regulations regarding food transport

Table 3–Certificates required by the responsible authorities to import agro-food in Saudi Arabia according to product category.

Certificates required to import agro-food in Saudi Arabia		
Product	**Certificate type**	**Requesting authority**
Livestock	Health Certificate	MEWA
	Pedigree Certificate	Importing Company
	Animal Health Report	MEWA
Bovine, poultry meat and products	Health Certificate	SFDA
	Halal Certificate and Certificate of Islamic Slaughter	SFDA
	Animal Protein Feed Free Certificate	SFDA
Dairy products	Health Certificate	SFDA
	Veterinary Certificate	SFDA
	Certificate of Radioactivity Measurement	SFDA
Eggs and egg products	Health Certificate	SFDA
Fish and seafood	Health Certificate	SFDA
Fruit and vegetables	Phytosanitary Certificate	MEWA
Processed foodstuffs	Health Certificate	SFDA
	Biotech Health Certificate	SFDA
	Novel Foods	SFDA
Planting seeds	Phytosanitary Certificate	MEWA
	Seed Analysis Certificate	MEWA
	Biotech Health Certificate	MEWA
Grain and feed	Phytosanitary Certificate	MEWA
	Grain Analysis Certificate	MEWA
	Certificate of Weight or Packing list	Importing Company
	Fumigation Certificate	MEWA
	Biotech Health Certificate	MEWA
Forest products	International Conformity Certification Program	SFDA

Note. Table created from the information retrieved from the United States Department of Agriculture website (USDA, 2017b).
Abbreviations: MEWA, Ministry of Environment, Water and Agriculture; SFDA, Saudi Food and Drug Authority.

temperatures and processes need to be regularly undertaken by the responsible authorities to ensure full compliance and overall safety of the food products distributed.

As shown in Figure 1, fresh meat products are the second most imported food category in Saudi Arabia (ITC, 2018). There are multiple challenges in terms of food safety that such products face when imported. To start with, the mentioned difficulties in transportation under critical climate conditions must be dealt with by the food operators and the border control authorities. Few effective techniques have been developed by researchers worldwide on meat temperatures for transportation, such as the long-term meat preservation using chilled and frozen storage combinations, resulting in superior management and preservation of quality traits during product distribution (Coombs, Holman, Friend, & Hopkins, 2017). Moreover, the verification of the Halal requirements by the responsible control authorities can even lengthen the waiting times at the border posts for meat and animal-derived products. In particular, meat-derived products and food products containing animal-derived ingredients coming from non-Muslim countries may contain hidden quantities of non-Halal raw materials, such as gelatins based on pork bones, skin, connective tissues, lard, or fat. The border control authorities should regularly undertake more in-depth physical checks and laboratory tests on imported packaged food products which labels may suggest the presence of non-Halal ingredients, such as animal fats, monoglycerides, diglycerides, enzymes, and rennet. On this matter, few scientific studies have been carried out in Saudi Arabia and lab techniques have been developed for the detection of porcine contaminants on imported meat products based on an improved deoxyribonucleic acid (DNA) extraction method (Alaraidh, 2008). The border control authorities should adopt such and similar techniques to ensure better compliance with local food requirements and protection of Muslim consumers. Currently, concerning perishable imported

foods, as illustrated in Figure 3, SFDA takes samples at the border posts for testing, allowing importers to arrive timely at destination with the main cargo, with the pledge that such products will not be distributed in the country before the results of the tests consent it (SFDA, 2019).

Third, the transition from the multiple to the single agency approach towards a centralized food control system has been started by the Saudi government in 2003 with plans to be completed by 2020. The transition has progressed steadily over the last few years, but in practice the process is still not completed and on-going (SFDA, 2018). The centralization of all food-related activities under SFDA has helped in preventing and avoiding earlier inconsistencies among various institutions, such as the overlap of responsibilities, inconsistent law enforcement, missing coordination and miscommunication in control duties, administrative burden, and lack of clarity in regulations development (Al Kandari & Jukes, 2012). However, still several ministries and governmental agencies are responsible for specific control and regulatory tasks along the food supply chain, as it can be noted from Tables 1 and 2.

Specifically, Table 2 shows the inspection process along the food supply chain, which is one of the control activities that is still largely fragmented between institutions. Although SFDA handles the periodic inspection of the food safety conditions in manufacturing factories, warehouses, and distribution centers, MoMRA currently partners with SFDA in checking that other requirements, such as establishment and employees' working conditions, are met at the factory level in slaughterhouses, food retail, and food service outlets. MEWA also collaborates with SFDA in ensuring that food safety standards are met at the farm level, with periodic inspections on plants and livestock. Moreover, at the border posts, SFDA works with Saudi Customs and MCI on control duties regarding the inspection, sampling, testing, and approval of imported food products. To ensure maximum efficiency in the control of the

food supply chain and the flow of information about the safety, authenticity, and quality status of the domestic and imported food products, macro level institutions must maximize their coordination and communication in the fulfilment of their respective tasks until the process of centralization of food control activities under SFDA will be completed.

Fourth, direct consultation with field experts and operators pointed out that the communication and collaboration among public institutions as well as between governmental and nongovernmental food organizations found at the three different levels of the supply chain seem to be limited. In particular, a lack of cooperation exists between macro level and meso level institutions responsible for risk assessment, risk management, and risk communication of food hazards. The investigation of food poisoning outbreaks and authenticity issues, such as food fraud, is fundamental to implement necessary policies and reforms to better manage risks and further prevent the widespread of food-related illnesses. For this purpose, the collaboration between scientific research centers, such as KACST, and regulatory institutions, specifically SFDA, needs to be valorized and reinforced. Furthermore, a functional public–private partnership between micro level and macro level organizations should be enhanced, starting with the expansion of the electronic services offered by SFDA to food companies aimed at improving food safety performances along the national food supply chain. Finally, to increase efficiency, digital systems, and electronic services to streamline import and export data sharing between local as well as foreign food companies and the responsible control authorities should be always translated in English, since, currently, many relevant online pages are only available in Arabic.

5. CONCLUSION

In the fight to prevent foodborne outbreaks and to achieve an effective and enduring food control system of the national supply chain, the increasingly profitable market of Saudi Arabia has been facing a variety of challenges that are yet to be addressed and overcome. The root cause of the country's vulnerability is the limited local agro-production due to the strenuously arid climate conditions, which challenge the local food industry, making food processing businesses highly dependent on foreign food products and raw materials imports. This particular operating environment compels the governmental control and regulatory institutions to dedicate significant resources in terms of finances and policies to establish a functional food safety governance and food control system, where particular attention is given to food imports.

The process of centralization of all the food control and regulatory activities under a single expert authority, namely SFDA, started by the local government to strengthen the national food safety governance, is yet to be completed and perfected. The fragmentation of the food control system among various bodies still represents an issue especially at the borders, with multiple public institutions sharing responsibilities along the supply chain depending on the particular food sector as well as the specific monitoring task.

Speeding up and completing the transition from multiple to single agency approach is vitally important for Saudi Arabia not only to reduce the administrative burden but also to achieve a consistently safe national supply of food that is also compliant with the local food regulations and the religious Halal standards. To this purpose, although efficient border controls are fundamental to ensure safety, quality, and authenticity of imported food and their compliance to international and national standards, trade agreements with world governments and food organizations, including official visits to importing countries, are crucial to guarantee national food security and prevent food safety hazards and food fraud threats even before imported products arrive at the borders. The increased use of electronic services to streamline the data collection, sharing and analysis of imported and local food is also playing a major role in improving the compliance to safety standards while reducing some administrative burden. Therefore, priority should be given to enhance the efficiency of such digital systems, since they assist, virtually, the centralization of all the food control authorities and activities by uniting them under a single online portal.

AUTHOR CONTRIBUTIONS

W.S. Alrobaish drafted the first version of the manuscript, designed the study, collected the data, and interpreted the results. L. Jacxsens, P. Vlerick, and P.A. Luning revised critically and extensively all the sections of the paper and contributed to its final drafting.

CONFLICTS OF INTEREST

All authors state that they have no competing interests to declare.

Appendix A–: Statistical trade data of food imported in Saudi Arabia

	Food product and description	Total imported value in 2017 (thousand €)	Share in total value (Figure 1)	Exporting countries (Top 5)		Imported value / country in 2017 (thousand €)	Share in value / country
1	Cereals *HS Code 10* All cereals including wheat, barley, oats, corn, and rice	2,289,310	21.4%	1	India	677,602	29.6%
				2	USA	310,454	13.6%
				3	Argentina	250,959	11%
				4	Germany	188,083	8.2%
				5	Ukraine	128,887	5.6%
2	Meat *HS Code 02* Meat and edible meat offal	1,680,885	15.71%	1	Brazil	1,045,675	62.2%
				2	Australia	145,396	8.6%
				3	India	137,069	8.2%
				4	France	123,303	7.3%
				5	New Zealand	67,447	4%
3	Dairy *HS Code 04* Dairy produce, birds' egg, natural honey, products of animal origin	1,648,018	15.41%	1	New Zealand	280,995	17.1%
				2	UAE	193,358	11.7%
				3	Denmark	191,005	11,6%
				4	Netherlands	126,414	7.7%
				5	Germany	102,087	6.2%
4	Fruits *HS Code 08* Edible fruits and nuts, peel of citrus fruit or melon	1,334,332	12.47%	1	USA	164,679	12.3%
				2	Egypt	152,877	11.5%
				3	South Africa	140,392	10.5%
				4	Philippines	125,205	9.4%
				5	India	122,678	9.2%
5	Coffee and spices *HS Code 09* Coffee, tea, mate' and spices	807,964	7.55%	1	Ethiopia	131,789	16.3%
				2	UAE	127,286	15.8%
				3	India	120,034	14.9%
				4	France	115,242	14.3%
				5	China	40,500	5%
6	Sugar *HS Code 17* Sugar and sugar confectionery	742,077	6.93%	1	Brazil	311,528	42%
				2	UAE	115,988	15.6%
				3	India	37,532	5.1%
				4	Egypt	31,256	4.2%
				5	Pakistan	26,479	3.6%
7	Oil *HS Code 15* Animal or vegetable fats and oils and their products	627,904	5.87%	1	Malaysia	188,976	30.1%
				2	Indonesia	71,971	11.5%
				3	Oman	64,766	10.3%
				4	UAE	62,055	9.9%
				5	Spain	44,594	7.1%
8	Vegetables *HS Code 07* Edible vegetables and certain roots and tubers	588,295	5.5%	1	Egypt	142,977	24.3%
				2	China	75,830	12.9%
				3	UAE	64,365	10.9%
				4	Jordan	42,754	7.3%
				5	India	41,383	7%
9	Cocoa *HS Code 18* Cocoa and cocoa preparations	476,494	4.45%	1	UAE	125,042	26.2%
				2	Egypt	42,268	8.9%
				3	Turkey	34,876	7.3%
				4	Italy	33,219	7%
				5	Netherlands	33,199	7%
10	Fish *HS Code 03* Fish and crustaceans, mollusks and other aquatic invertebrates	335,179	3.13%	1	Vietnam	51,678	15.4%
				2	UAE	48,393	14.4%
				3	Myanmar	35,918	10.7%
				4	Norway	27,876	8.3%
				5	Yemen	27,700	8.3%
11	Beverages and Water *HS Code 22* Beverages, water and vinegar	162,515	1.51%	1	France	18,738	11.5%
				2	China	17,340	10.7%
				3	Portugal	15,475	9.5%
				4	Switzerland	15,418	9.5%
				5	Kuwait	12,544	7.7%

Note: Table created from the information retrieved from the International Trade Centre website (ITC, 2018).
Abbreviation: HS, harmonized (commodity description and coding) system.

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