

Vulnerability Assessment Critical Control Points applied to the Food Supply Chain in Vietnam

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Abstract

Fraud prevention and reduction cases are the first step in preventing food fraud. Due to the increasingly deliberate nature of fraud, advanced solutions are necessary so it can be detected in time. This study is focusing on the key contributing factors leading to the increased fraud gap in the food industry. The application of FSSC and BRC food safety standards were measured. In Vietnam, the number of companies that applied FSSC and BRC were respectively 234 and 409. But in the VNR500 list (the 500 largest companies in Vietnam), enterprises only account for 42.9% for FSSC and 3.0% for BRC. Besides this, through contributing factors, control measures also were established to identify the process of assessing and controlling food fraud in Vietnam. Therefore, the implementation of food fraud prevention programs is relatively low. The measures developed will also be the basis for the sustainable development of the business and towards the transparency throughout the global supply chain.

Keywords: food fraud, food industry, food supply chain, vulnerability assessment, global food safety

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I. Introduction

Food fraud, mixing food, and forging food is termed that often appears in the press. Most organizations in this area, such as the Global Food Safety Initiative (GFSI), the Association of Grocery Manufacturers (GMA) in the United States (US), the U.S. Pharmacopeia (USP) and European Parliament reports that food fraud is intentionally added, replaced, mixed, or misrepresented about food, ingredients - food packaging, theft or falsification of materials, food lies about financial gain [13].

The negative impact of its on society is not small such as affecting health - finance - consumer confidence; reducing the brand reputation of true manufacturers, even the reputation of the entire export country. For example, in 2008, Chinese milk was a food safety scandal in which baby milk and infant formula were mixed with melamine to increase protein content. Statistics show that nearly 53,000 children became ill, more than 12,800 were hospitalized, and four died, due to kidney stones and kidney failure. This scandal

causes damage to the reputation of Chinese-made dairy products [8].

Similar other countries, food fraud is also the big problem in Vietnam. It causes the negative impact for Vietnamese society. This study focuses on evaluating the application of relevant standards such as BRC and, FSSC in reducing food fraud. Consumer focusing on different forms of food fraud has also been investigated. The study also focus on food fraud practice and awareness in Vietnam, specifically, the consumers in Ho Chi Minh City.

II. METHODOLOGY

The survey goes through 3 steps:

Step 1: Assess the overall situation of food fraud in Vietnam and the world.

Identify legal requirements related to food fraud prevention in Vietnam, overview of food fraud incidents in Vietnam and the world.

Step 2: Assess the application of food fraud prevention program in Vietnam.

Survey of VNR500, BRC and FSSC portfolio. Assess the rate of application of BRC and FSSC standards compared to other businesses in VNR500.

Step 3: Assess consumers' perceptions of food fraud.

Survey on consumer awareness about types of food fraud. The sample sizes are 1400 people. Survey locations are all districts in Ho Chi Minh City (total is 19 districts).

The age group for the surveyed is from 20-50 years old. The proportion of distribution by age include 20-30 years old (20%), 30-40 years old (40%), 40-50 years old (20%). The sample percentage distribution in districts is from 0.017% to 0.021%. The survey period is in 2019.

Fraud forms were surveyed according to detailed requirements from the FSSC standard [12, 17].

III. RESULTS AND DISCUSSION

1. Supply chain issues in Vietnam and in the world

Counterfeit food means food with the following signs: imitation of quality and utility, counterfeit of the goods brand, designs, origin of goods, and fake label; it includes that using additives and banned food coloring has not yet been certified as conforming to standards and regulations as well as the food is poor quality or is not quality assurance.

Counterfeit of the brand, designs, origin of goods include counterfeit trademarks of other businesses, imitation of industrial design, and copying indications of origin, manufacture, and packaging.

Fake goods label including counterfeit labels of other businesses has been corrected and erased the content on the label, so that many fake foods have appeared in the Vietnamese market. One of them is highly complicated products, for example, dried squid made from synthesized rubber; fake chicken eggs; pig's ears made from gelatin and plastics; beef ribs made from wheat flour.

Many measures to curb counterfeit, fake and, poor quality goods have been implemented by the Vietnamese Government following the Government's decree No. 185/2013/ND-CP and 124/2015/ND-CP on providing the penalties on administrative violations in commercial activities, production of, trading in counterfeit or banned goods and protection of consumer rights and the Government's Decree No. 119/2017/ND-CP on penalties for administrative violations against regulations on standards, measurement and quality of goods [22-24].

In Vietnam, recent food fraud incident that the mixture of coffee waste containing the battery core was purchased by a company in Binh Duong province to mix it into pepper to gain economic benefits. Food fraud have also found in a company that specializes in manufacturing fish balls and beef balls. Inspection results show that the cow ball sample contains only fish DNA or buffalo DNA. Incidents related to weight gain agents for pigs (such as salbutamol, clenbuterol ...) still occur in many places in Ho Chi Minh City and neighboring provinces. There are also incidents involving pigs being pumped with water or given a sedative before slaughter. Another incident related to shrimps, they are pumped agar to gain weight and appearance better. The food supply chain is getting longer, the more vulnerability in the food chain. Control of the food chain is essential to ensure food safety.

Mixing and diluting food ingredients will cause great harm, especially in export field, therefore, there are some cases canceling goods or even being banned from export permanently. A few incidents affecting food fraud have also mentioned.

The incident of horsemeat fraud broke in England in 2013. Ikea meatballs, Burger King Hamburger patties, Cottage pies, and frozen lasagna were a few of the products impacted by the 2013 European horsemeat scandal. In the United Kingdom where horses are viewed as pets, people were somewhat horrified to find that they had been fooled into thinking that horsemeat was ground beef. In some countries, horsemeat is a normal product. It has the same amount of protein as beef, less fat, and poses no threat to human

health. Reportedly a breach of EU traceability regulations, forged invoices, missing records, and other irregularities all contributed to a proposal for a Food Crime Unit (FCU) and investigations indicate that implementation of EU import requirements is not being properly implemented. Spinoff from the horsemeat scandal continues with the jailing of some of the guilty and delays in the publication of a report seemingly embarrassing to some of the governments involved [1,5].

McDonalds has reportedly ceased the fine grinding of “trimmings” or left-over meats with ammonium hydroxide added. The resulting product is now known as “pink slime.” Ammonium hydroxide is added to reduce bacteria in the product which is then added to normal burger in order to increase weight and moisture content. Pink slime is approved by the United States Department of Agriculture (USDA) if used in percentages less than 25% [10].

Labeling is an issue that gets many companies in trouble, either accidentally or due to intentional ingredient omissions. Issues such as undeclared ingredients (milk, egg, sulfites, wheat, diclofenac, gluten, soy, peanut, and salt) may impact human health for those with allergies. In April through June 2015, the FDA listed 43 recalled food products that included everything from cumin to fresh pasta salad [18].

Is the unstandardized use of such “Use By” labels intended to inform or confuse the consumer regarding shelf life and freshness? Are such labels even defined in a general sense by food processors? While such labeling practices are commonly considered a food safety issue, the opportunity for food fraud arises among those who would substitute or promote aging contents for economic gains. How a consumer or retailer could check on the validity of the label dates are missing. The issue has not been recognized as one that provides a potential for food fraud [11, 12].

Weight Fraud: When meat or chicken or fish may be packaged in plastic, Styrofoam, or other tray types and sealed with plastic, the packaging operation often involves the input of a small pad used to absorb the product juices. Unfortunately,

the pad can be premoistened to increase package weight [11-14].

Organically grown products are frequently advertised as such, and at a price higher than nonorganic produce. To the consumer, there is no way to visually determine whether or not the product was organically. Some organic farmers are very strict with regards to seeds, soil, water, and pesticide testing, and other controls commonly imposed for organic certification. Organic farming and the use of “organically grown” terminology, unfortunately, opens the door to all types of fraudulent practices. It is well known that due to the sales price difference between organically grown products and non-organically grown products some “locally grown” farmer’s market entrepreneurs will secure nonorganic products at a lower price, move it to the farmer’s market, and sell it at organic prices [17,18].

2. Survey on how to apply food fraud in Vietnam

In October 2019, the number of companies that applied FSSC and BRC were respectively 234 and 409. Both of these standards require applying for food fraud program.

Table 1. The number of companies that applied FSSC and BRC in Vietnam (2019)

Scheme	Number company	Famous brand in Vietnam
FSSC	234	Dutch Lady, Heineken, Vinamilk, Sabeco, Nutifood, Habeco, Kido, TTC group
BRC	409	Vinamilk, Sabeco

FSSC companies account for about 3.1% compared to food manufacturing companies. The percentage of companies applying FSSC in the list of VNR500 (the 500 largest companies in Vietnam - there are 69 companies producing food and agricultural products) is 42.9%. According to Vietnam Forbes, top 50 of leading companies from 2016-2019 include Vinamilk (US\$ 2234 million), Sabeco (US\$ 486 million), Nutrifood (US\$ 85.2 million), Habeco (US\$ 62.9 million),

Kido (US\$ 58.2 million), TTC group (20.5 million USD). These companies have applied FSSC version 4.1. FSSC version 4.1 has guidelines for applying food fraud in businesses. Food Fraud Prevention Program is implemented for materials, production process, and distribution process as required by FSSC. The recommended vulnerability assessment methodology is applied for businesses that apply FSSC. Some foreign-invested companies such as Heineken, Dutch Lady are also good examples of FSSC applications.

BRC for food safety industry is 312 companies. A number of food companies applying BRC for packaging is 47 ones. Most businesses in VNR500 do not apply BRC standards. Some enterprises of VNR500 applying BRC are Vinamilk and Sabeco. BRC version 8.0 has been implemented by these businesses. According to BRC version 8.0, "The Company shall undertake a documented risk assessment (threat assessment) of the potential risks to products from any deliberate attempt to inflict contamination or damage. This threat assessment shall include both internal and external threats" [2]. The threat from both outside and inside comes from the incentives for economic gain. The threat assessment must consider the following factors: historical evidence of substitution or adulteration; economic factors that may make adulteration or substitution more attractive; ease of access to raw materials through the supply chain; sophistication of routine testing to identify adulterants; the nature of raw material. Companies in HCMC that apply BRC account for 5.9% (24 companies). FSSC has an application rate of 57.2% compared to BRC. The reason is due to market demand. Fishery companies account for a large proportion of the BRC list companies. Seafood companies in Vietnam tend to export to European countries. Seafood companies also account for a high proportion of the VNR500 and the list of companies in Vietnam. Customers in this area often prefer standards such as BRC and IFS. This is the main reason for applying BRC in Vietnam.

3. Survey consumer awareness for food fraud in Ho Chi Minh City, Vietnam

The survey was conducted with food consumers in some districts of Ho Chi Minh City. The sample size is 1400 people. Types of food fraud are described as below, through the investigating user interest in food fraud types (table 2).

Dilution is a definition as the process of mixing a liquid ingredient with high value with a liquid of lower value. Mixing and diluting food ingredients will cause great harm, especially in export field, therefore, there are some cases canceling goods or even being banned from export permanently. Food fraud is intentionally mixing, diluting, replacing, misbranding, stealing, or using poor quality food ingredients for economic gain. Doing this can lead to illness, death, etc,... for users and harm the reputation of the business brand.

This problem has existed for a long time and every year up to 10 - 15 billion USD of food fraud, accounting for about 10% of the total value of products on the market. This has affected food safety, public health, and brands of manufacturers. In 2013, a food fraud "turned from horse meat into beef" shocked Europe. The European retailer provided horsemeat, which shook the whole of Europe and was left on February 13, 2013, instead of taking holidays, all employees of European retail systems had to do products recalls [20]. In Vietnam, the cases of "stealing" goods of export enterprises in 2014 also caused a stir in public opinion. On the other hand, as the case of businesses because of increasing demand and having to buy from unregulated suppliers, the product quality is not guaranteed. A statistical report indicates that, of all food poisoning that is not hygienic, the most common cause is bacterial. Data from the Global Food Safety Forum shows that up to 61% of food poisoning cases are related to biosafety issues. Specifically, there are 4% of cases of unsafe food hygiene due to ingredients, 4% are due to counterfeit goods, 4% due to allergens. This information makes retail distributors feel worried because the food is controlled with strict procedures but when it reaches the consumer, it still violates food safety. This is a pressing issue forcing countries in Europe and the US to enact new laws, which strictly regulate food fraud. Specifically, imported goods must ensure the quality management

system standards such as BRC, FSSC 22000, IFS [1, 7, 15].

Table 2. Percentage of user interest in types of food fraud in Ho Chi Minh City, Vietnam

No.	District	Population	Dilution	Substitution	Concealment	Unapproved enhancements	Mislabeled	Counterfeiting	Grey market production/ theft/diversion
1	Dist. 1	142,000	26.7	33.3	26.7	56.7	53.3	76.7	3.3
2	Dist. 2	180,000	27.5	37.5	15.0	7.5	60.0	62.5	0.0
3	Dist. 3	190,000	45.0	30.0	25.0	22.5	55.0	40.0	0.0
4	Dist. 4	175,000	42.9	25.7	8.6	8.6	54.3	57.1	2.9
5	Dist. 5	159,000	36.7	46.7	26.7	10.0	40.0	50.0	6.7
6	Dist. 6	233,000	28.0	38.0	14.0	16.0	46.0	60.0	2.0
7	Dist. 7	360,000	24.3	38.6	18.6	17.1	62.9	50.0	2.9
8	Dist. 8	424,000	38.8	21.2	11.8	10.6	52.9	47.1	3.5
9	Dist. 9	397,000	23.8	27.5	11.3	11.3	56.3	55.0	1.3
10	Dist. 10	234,000	48.9	35.6	11.1	20.0	44.4	37.8	2.2
11	Dist. 11	209,000	30.0	17.5	12.5	15.0	32.5	50.0	2.5
12	Dist. 12	620,000	40.8	4.8	11.2	0.0	44.8	55.2	3.2
13	Thu Duc	592,000	30.0	10.8	5.8	12.5	47.5	37.5	2.5
14	Go Vap	676,000	31.4	10.7	20.0	8.6	51.4	41.4	2.1
15	Binh Thanh	499,000	27.1	28.2	11.8	10.6	47.1	49.4	2.4
16	Tan Binh	474,000	37.8	36.7	11.1	21.1	47.8	55.6	3.3
17	Tan Phu	485,000	26.0	14.0	17.0	30.0	55.0	25.0	2.0
18	Phu Nhuan	163,000	22.9	17.1	17.1	14.3	57.1	57.1	2.9
19	Binh Tan	784,000	16.9	6.9	11.3	13.1	36.9	39.4	2.5
	Total	6,996,000	30.6	20.8	13.9	14.2	48.9	46.9	2.5

Food safety systems have also developed supplier evaluation programs to control food fraud. Some potential solution: (1) Being more proactive in addressing economic fraud - Many companies have implemented ways to combat global fraud threats, but more needs to be done; (2) Finding new ways to share information and foster collaboration; Defining a formal way to collaborate with industry, government, academia and non-governmental organizations and increase global participation; (3)

Joining the government as facilitators: Government can set up global standards and share information about emerging threats, which is important for addressing threats [12, 13].

Expanded by globalization, the supply chain era and global consumer base have the same requirements. Consumer awareness related to dilution processes helps better food safety guide the development of future controls. Consumer awareness promotes market orientation. The higher

consumer awareness, the more effective manufacturers need to establish and the more effective measures to control food fraud on-site and on the food chain. Some examples for dilution such as watered-down products using non-potable/unsafe water or olive oil diluted with potentially toxic tea tree oil. Blended with a low-cost, non-toxic component to gain economic benefits focused on food fraud. Adding inexpensive, toxic ingredients to foodstuffs emphasizes food defense.

Food consumers understanding of diluting account for 30.6%. In Vietnam, the highest rate is in district 10 (48.9%). District 10 is a place where many students from technical universities. The survey results show that the user awareness about dilution techniques in Binh Tan district is the lowest (17.1%). The percentage of consumers who are knowledgeable about fraud techniques related to dilution varies among districts and the level of knowledge among the population in these districts.

Dilution found in honey, vegetable oil, juice, etc. Honey is one of the popular counterfeit products. Codex Alimentarius (1981; CA), the internationally accepted standard for food made by FAO, envisages the aforementioned biological aspects of honey production and definition: "Honey is a natural sweetener produced by honey bees from the nectar of plants or secretions of living parts of plants or insect secretions drawn on living parts of plants, to which bees [3]. Collecting, transform by combining with its special substances, place in the nest hole, dehydrate, store and leave in the honeycomb cake when fully cooked". According to historical documents, honey has been a fraud for a long time [4]. Many reasons lead to this: (1) Honey is becoming a scarce and expensive product to produce; (2) Opportunities for high profits by fraud; (3) The official method, EA-IRMS (AOAC 998.12), cannot detect all possible ways of making fake honey [19]. Types of fake honey: (1) Diluting with different types of syrup, for example, from corn, cane sugar, sugar beets, rice, wheat, etc.; (2) Harvesting unripe honey, followed by dehydration using technical equipment, including vacuum dryers and other drying equipment; (3) Using ion exchange resins to remove residue and lighten honey color; (4) Concealing and / or misrepresent the geographical and / or botanical origin of honey; (5) Artificial feeding of honey bees during the honey season. In honey, there is not only one, but

many types of sugar. Most are fructose (about 40%), glucose (30%), the rest are about 20 other sugars such as maltose (7%), sucrose (1%), and water (18-20%). Sugar with a sweetness of 1, but fructose is sweeter about 1.5 times. Therefore, when counterfeiting honey, people also use more fructose or high fructose sugar (HFCS). HFCS sugar is often used in soft drinks, confectionery... due to its low price. On July 25, 2019, in the EU, twenty-two percent of the tested imported honey samples in controls carried out by the Canadian Food Inspection Agency turned out to be diluted with exogenous sugars such as sugar cane and rice syrup [6].

According to a study of Children's Drink Fact in 2019, about two-thirds of the 34 most popular bottled fruit juices on the U.S. market do not contain any fresh fruits or juices but still print fruit pictures up to 85% packaging surface [6]. Drink containing fruit juice do not also exceed the rate of 5%. Most of these bottled fruit juices write "natural sources of Vitamin C" or "100% Vitamin C" but they do not contain any fruit juice, most of which is added. The number of food choices consumer may have depended greatly on suppliers, seasons, and origin locations. It is not known how widespread food fraud is throughout the world. Those who commit food fraud do so intentionally and they want to avoid detection and prosecution. However, the vast majority of food fraud incidents do not pose a public health risk. There seems to be no product that is excluded from being potentially fraudulently produced, labeled, or otherwise manipulated. The list represents only a few products that can be fraudulently impacted through ingredient substitution, ice and water dilution or weight increase, salt, counterfeiting, false claims, drugs, misleading labels, flame-retardants, cost-reducing blending, improper or dirty packaging, and other means. Some sensitive food for food fraud such as honey, olive oil, coffee, juices, fish, alcohol, dairy products, vitamins, meat, and poultry. The famous dilution-related incident is the use of melamine in dairy. In 2008, diluted dairy products from China were found to include melamine used as a substitute for milk. As the demand for milk outstripped the supply, product was watered down with melamine as a way to increase the product and enhance profits. Melamine, with its high nitrogen content, was added to the watered-down milk to artificially

inflate the protein content. 290,000 infant illnesses, 860 hospitalizations, 6 known deaths, and a \$3 billion loss to industry resulted. Melamine is an organic compound; the chemical formula is $C_3H_6N_6$, white, crystalline powder, slightly soluble in water. Melamine is known to be harmful if swallowed, inhaled and, absorbed through the skin. Eyes, skin and, respiratory tract can irritate when exposed to melamine if prolonged contact with melamine can cause cancer and affect the reproductive organs. The toxic dose of melamine is quite high with LD50 being more than 3 g/kg of body weight. Melamine is only allowed to be used in industrial production (toys, furniture, appliances ...) with many advantages such as high adhesion, good heat resistance, corrosion resistance, no taste ... Besides; Melamine is also used to produce fertilizers [8].

Substitution is the process of replacing an ingredient or part of the product of high value with another ingredient or part of the product of lower value. The percentage of consumers who are aware of food substitutions is 20.8%. The districts with the highest percentage of consumers aware of food substitution are those with the focusing on foreigners or markets. Consumers in districts 5, 7, 2, and Tan Binh have respectively 46.7%, 38.6%, 37.5% and 37.6%. The districts with the lowest knowledge of food substitution are Binh Tan and District 12. The percentages are 6.9% and 4.8% respectively. This ratio reflects the difference in product knowledge depending on the location of the district and date to form the districts. New districts such as District 12 or Binh Tan, the ratio of awareness for food fraud is lower. The reason is the presence of immigrants from the countryside. There are two situations where the consumer does not recognize the counterfeit product or the consumer knows it is counterfeit and still buys it. The second reason is that the preference for cheap products and low income is the deciding factor. Consumers are confused with the diverse commodity market. Not only is the technology of producing fraud food becoming increasingly sophisticated, but the way of trading fraud food in e-commerce time also makes the fraud food more difficult to control. Counterfeit and shoddy goods are "moving" very strongly from urban areas to rural areas and remote areas where many poor people live. In 2018, in Vietnam, counterfeit products were discovered, and the administrative sanctions were 98.37%, only 1.63%

was handled through the courts. All of these factors increase food fraud. Some example of substitution such as sunflower oil partially substituted with mineral oil or hydrolyzed leather protein in milk.

On July 24, 2019, in the EU, Avocado was replaced by "calabacitas", a bright green squash, in taco-restaurants in Mexico City [6]. Last year's higher price of avocados has likely caused the problem. The price increase is attributed to a poor harvest due to adverse weather conditions and the high demand for avocados, which today are present in many foods. The problem is likely not confined to restaurants in Mexico.

Concealment is the process of hiding the low quality of food ingredients or products. Users distinguishing the concealment of food quality is quite low 15.7%. Users distinguishing the hidden food quality is quite low 13.9%. Knowledge of concealment accounts for a high proportion, including districts 1, 3, and 5. These are 26.7%, 25.0%, and 26.7% respectively. The ability to distinguish this concept towards users of District 4 and Thu Duc is the lowest. The ratios are 8.6% and 5.8% respectively. Through some surveys in Vietnam show that currently, counterfeit goods, fake goods, poor quality products are presenting in many segments of the market, from groceries on the markets in remote areas to the street food areas, from urban areas to high-end supermarkets in big cities like Hanoi and Ho Chi Minh City to "challenge" customer's sophistication. Some examples for concealment such as poultry injected with hormones to conceal disease or harmful food coloring applied to fresh fruit to cover defects.

In Vietnam, some food fraud issues have been discovered for fresh pork by adding additives and toxic preservatives to prolong freshness (such as borax). Some banned anesthetics are injected into pigs before slaughter. During the breeding process, the facilities also fed the pigs' weight gainers containing lots of corticoid chemicals. Beef is one of the popular cattle-food products, so for the gain of profitability in the business, there is a situation of beef impregnated with chemicals or people use the method of soaking, impregnating chemicals into pork for like beef to deceive consumers. Shrimp is pumped with jelly powder to gain weight and look good. Fruit soaked is injected by toxic chemicals.

These examples are often concealment cases found in Vietnam.

Unapproved enhancements are the process of adding unknown and undeclared materials to food products in order to enhance their quality attributes. Only 14.2% of people in the districts understand the concepts and types of unapproved enhancements. The highest rate is in District 1 (56.7%). District 1 is a gathering place for office workers. Accessing the lowest level of unapproved enhancements is district 12. This district has a high proportion of immigrants. Several cases related to unapproved enhancements have been notified in Vietnam. Some typical examples are also presented in Vietnam newspapers. For all kinds of rice paper, rice noodles, noodles, spring rolls ... if only made from raw materials, the finished product will not have a nice color, when eaten, it is not crunchy and left to quickly mold, stale ... To overcome the manufacturer has added a chemical that is often called borax. Cooked or processed foods such as pies, ham, canned foods, dried fruits, beers, canned juices, frozen foods, etc. often have a chemical to preserve called sulfite. Sulfite is considered as food freshening chemical. Synthetic colors used to dye red, such as Sudan or Rhodamine, have also been found in products like cakes, sweets, etc.

Mislabeling is the process of placing false claims on packaging for economic gain. The situation of unlabeled goods or unclear labels is a serious problem in Vietnam. Survey results at the market found. Jams like dried coconut jam, pumpkin jam, ginger jam, dried apples, melon seeds, etc. only in large plastic bags, no coverage, no labels, and no expiry date are quite common. This problem leads to many food safeties issues. No traceability and quality. Losses of brand reputation. Food fraud on the products origin and origin on labels. Serious impact on consumers' health due to toxic chemicals and contamination. Some other cases involving mislabeling can be described here. The product expires and is intentionally sold to consumers. Delete old expiry dates and reprint new expiry dates to prolong product circulation. Do not record shelf life on the label. Do not verify shelf life when announcing on labels. The percentage of consumers' interest in this issue in Ho Chi Minh City is 48.9%. The highest rate of user interest is 62.9% (district 7). The lowest rate is 40.0% (district 5).

A grey market is a market in which goods have been manufactured by or with the consent of the brand owner but are sold outside of the brand owner's approved distribution channels—an activity that can be perfectly legal. “Smuggling goods” is also mentioned on the Government's decree No. 185/2013/ND-CP and 124/2015/ND-CP in Vietnam legal [22, 23]. Smuggling is an example for a grey market. They include goods banned from import or temporarily stopped from import under laws; Imported goods under the list of goods are imported with conditions, without having import licenses or documents issued by competent state agencies according to regulations being accompanied with imported goods when circulating into the market; Imported goods are not being transported through stipulated border gates, not being done with customs clearance according to laws or being fraudulently declared in terms of quantities or categories when conducting customs clearance; Imported goods are circulated into the market without accompanied with invoices, documents according to legal provisions or with invoices or documents but such invoices or documents are invalid according to legal provisions on management of invoices; Imported goods must be stuck with import stamps according to legal provisions, but have no stamp on goods as required by laws or be stuck with fake or used stamps. The user's level of knowledge about this form of fraud is an average of 2.5%. A high percentage is residents in District 5 (6.7%). Residents in districts 2 and 5 are not aware of this type of fraud. In 2018, the level of food fraud under this type in Vietnam also notified. Smuggling is mainly in the group of goods such as garments, pharmaceuticals, functional foods, cosmetics, mobile phones, sugar, alcohol, beer, soft drinks, and household goods like sing electronics, refrigeration, cigarettes, and firecrackers. Not all steps in the supply chain illustration above lend themselves to some of the food fraud definitions noted. Substitution of products at distributor, packing, chiller, palletizing, and shelf points allow for some products to be substituted for others while truck transportation offer opportunities for food theft.

Food is the number one product stolen during transportation and resold during fenced markets. With over \$30 billion of cargo stolen annually, food and drink represent the hottest targets. Generally, food shipment thefts are by “deceptive pickup”

(thieves posing as drivers receive loads from unwary shippers) or from unsecured parking. The average loss per incident exceeds \$600,000 and costs shippers and carriers \$30-\$50 million each year [9]. The black market for food heats up during bad economic times and includes just about every type of Food Fraud through the Supply Chain of food you can imagine. Stolen food typically fetches 70 cents on the dollar compared to 30 cents or less for electronics, the second most popular target for thieves. Cheese, eggs, milk, beer, nonalcoholic beverages, produce, and just about any food product can become hijacker targets. The fact that food products may provide a risk/reward return for thieves means that many of them can end up in many retail markets whose managers are working to increase profit margins. Stolen food purchased at 70 cents on the dollar means the retailer has added significantly to net profits. Food theft is accomplished through a variety of ways. Sometimes the driver is involved. On other occasions, well-organized gangs are active in deceptively picking up loads and trailers or stealing the trailer or food container in its entirety. With the top food theft states including California, Florida, Texas, and New Jersey, stolen food becomes fraudulent food that will see later sales to unscrupulous retailers. Food is stolen from warehouses, distribution centers, parking lots, truck stops, and other unsecured locations with Fridays and Saturdays being the favorite days to conduct the theft. When food is stolen, the FDA is “committed to working with the affected firm to minimize the public health risks and ensure an appropriate public health response” and “has developed streamlined procedures to rapidly respond to reports of theft and ensure consistency as we work with firms that have experienced a cargo or warehouse theft [9].

Counterfeiting is the process of copying the brand name, packaging concept, recipe, processing method, etc. of food products for economic gain. Counterfeiting is of special interest to consumers (46.9% on average). The rate of interest of consumers is very high in District 1, District 2, and District 6 (76.7%, 62.5%, and 60.0% respectively). In the first nine months of 2019, the nationwide functional forces detected, arrested, and handled 149,502 cases of smuggling, trade fraud, and counterfeiting, and collected 12,388 billion VND 709 million into the state budget, prosecuted 1,635

cases (up nearly 40% over the same period in 2018), with 1,908 subjects (up 44% over the same period in 2018). In Vietnam legal (185/2013/ND-CP and 185/2013/ND-CP) "Counterfeit goods" include Goods without having valuable use or effects [23, 24]; having valuable use or effects but do not match with sources by nature, names of goods; having valuable use or effects which do not match with the registered or notified valuable use or effects; Goods having determined contents of main substances or in nutrients or other basic technical characteristics which have only reached a level of 70% and lower in comparison with the quality criteria or technical standards have been registered or notified to apply or to print on labels or packing of goods; Medicines preventing or treating people, domestic animals without pharmaceutical substances; or with pharmaceutical substances but do not match the registered contents; or not sufficient the registered catalogues; with other pharmaceutical substances which are different from the pharmaceutical substances stated on the labels or packing of the goods; Insecticides without active elements; or contents of active elements of 70% and below in comparison with the registered or notified quality criteria or technical standards; or not sufficient the registered active elements; or with active elements which are different with those stated on labels or packing of the goods; Goods with labels or packing which have forged names or addresses of other entrepreneurs; trade names or product names; circulation registration codes, bar codes or the goods packing of other entrepreneurs; Goods with labels or packing faking indications on origin or place of manufacturing, packing, assembling goods; Goods have been forged in term of intellectual property rights; and Forged stamps, labels or packing.

IV. CONCLUSION

The survey results show that the application of FSSC and BRC food safety standards in Vietnam is quite low. Therefore, the implementation of food fraud prevention programs is relatively low. Enterprises in the VNR500 list account for 42.9% for FSSC and 3.0% for BRC. This shows that the application of FSSC is being emphasized in the group of the largest companies in Vietnam.

BRC standards are focused on exporters. Among them, only 0.5% of enterprises in the VNR500 list apply BRC. Most of them is fishery companies.

Consumer focus on food fraud practices has been investigated. The highest concentration ratio is for mislabeling and counterfeiting (48.9% and 46.9%, respectively). Districts 1, 2, and 5 have a high proportion of consumers focusing on food fraud in Ho Chi Minh City, Vietnam.

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