Capítulo 9

Food contaminated by pesticides: an overview of the Brazilian situation

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Abstract

Modern consumers evaluate several food products' attributes before purchasing: price, quality, freshness, taste, practicality and nutritional contents are analyzed in order to provide maximum benefits at reasonable expenditure. Wider spread and easier access to health and food security information brought to consumers new parameters that help rearrange their structures of preferences. New information strategies privilege the use of quality signals, such as labeling, traceability, certification, brand names and adoption of minimum quality standards. The new information strategies recently emerged in response to new behavioral characteristics of the consumer and new competition characteristics of the food market. The main feature of Brazilian fresh markets is the lack of minimum standards and very strong information asymmetries. Consequently, endogenous and exogenous uncertainties are high. The market for fresh food is directed affected by the indiscriminate use of pesticides. The analysis of information gathered by the Program for Pesticide Residue Analysis in Food (PARA) found a very worrying situation in Brazil. In this sense, this paper aim to bring more information about the pesticides contamination in the fresh food markets in Brazil. Transaction Cost Economics is adopted as a theoretical framework to examine the coordination among the agents on the chain and seek sustainable alternatives to reduce the excessive use of pesticides in food production.

Keywords: Pesticides, Agriculture, Food, Health and Environment.

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9.1 Introdution

Modern consumers evaluate several food products' attributes before purchasing: price, quality, freshness, taste, practicality and nutritional contents are carefully analyzed in order to provide maximum benefits at reasonable expenditure. Wider spread and easier access to health and food security information brought to consumers new parameters that help rearrange their structures of preferences.

New information strategies privilege the use of quality signals, such as labeling, traceability, certification, brand names and adoption of minimum quality standards. The new information strategies recently emerged in response to new behavioral characteristics of the consumer and new competition characteristics of the food market.

On the other hand, the use of pesticides in Brazil grows every year to increase the productivity in agriculture. According to the World Health Organization (WHO, 2010), pesticides are chemical compounds that are used to kill pests that damage crops. However, pesticides are toxic to humans and necessitate be using safely and disposing of properly.

Recent researches show that Brazil is the largest consumer of pesticides in the world. In addition, the impacts triggered by the use of pesticides cause several environmental problems such as soil and water contamination, instigating the imbalance of the ecosystem, as well as severe health problems human.

The market for fresh food is directed affected by the indiscriminate use of pesticides. This market is one of the least developed in Brazil in terms of governance systems. There is no product standard, the quality is very variable, and the cooling system is almost nonexistent. The information system is deficient and the transactions between agents are marked by extreme uncertainty and quality control problems. A major attribute of transactions involving fresh produce is temporal and local specificity due to high perishability and low value/weight ratio.

According to the WHO (2010), international conventions provide a means for countries mitigate the exposure to toxic pesticides by population. Successful implementation of these conventions[3] requires information about the incidence of pesticide exposures.

In Brazil, the National Health Surveillance Agency (Anvisa) held since 2001 the monitoring of pesticide residues in some fresh foods through the Program for Pesticide Residue Analysis in Food (PARA). These data are critical to the final consumer be informed about the quality of food consumed.

In this sense, this paper aims to bring more information about the pesticides contamination in the fresh food markets in Brazil. Transaction Cost Economics

3 Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on Prior Informed Consent.

is adopted as a theoretical framework to examine the coordination among the agents on the chain and seek sustainable alternatives to reduce the excessive use of pesticides in food production.

9.2 Theoretical considerations

9.2.1 Characteristics of the fresh food market

Vegetables and fruits are hard to standardize because quality is difficult to measure objectively and varies within the same lot of produce. Also, consumer preferences are heterogeneous, increasing the complexity of defining the quality desired. Uncertainty about the quality is high, as this depends on seeds, production region, climate, season, and other natural resources. It also depends on handling, transport, and storage conditions prior to reaching the final consumer. As produce is highly perishable and sensitive to weather conditions, its prices may be extremely variable, creating endogenous uncertainty. Coordination flaws lead to maladjustments that may result in lower product value, higher costs, production losses and shortage (FARINA; MACHADO, 1999).

Analyzing the fresh off-season fruit market in France, Brousseau and Codron (1997) showed that markets and hybrid governance structures can be complementary in the vertical coordination of the fresh fruit system. Transaction cost economics provides the analytical framework to better understand vertical coordination, which may embrace a diversity of complex arrangements.

According to Williamson (1996), there are three commonly recognized governance structures: market, hybrid contracting, and hierarchy (firm). The hybrid mode arises from a bilateral dependency strong enough to require close coordination but not strong enough to justify full integration. That dependency comes, usually, from asset specificity, measurement problems, or complexity, which, along with uncertainty, increase transaction costs.

A major attribute of transactions involving fresh produce is temporal and local specificity due to high perishability and low value/weight ratio. Both are not enough to command hybrid coordination unless combined to a required quality or delivery time contracted by the downstream segments of the chain. The perishability requires completing certain operations within a precise and often very short time span, which can be a factor of product differentiation that influences the value and ease of sale. Thus, the seller's risk may be extremely high. (Farina and Machado, 1999)

However, without a system that can trace back through the chain, it is difficult to assign responsibility for damages to the product and there is a tendency to

transfer an undue share of market risk from operators to growers through lower prices or return of shipments. Vertical coordination can be a mean of sharing risk and/or sharing income amongst the many agents contributing to the process. (MÉNARD; VALCESCHINI, 2005)

Quality is a key variable in marketing strategies in the fresh food chain. It requires highly specific investments and tight coordination among agents, with respect to the definition of detailed standards, methods of production, and controls for guaranteeing the conformity of products to what is signaled. Hybrid contracts improve quality and quantity control, but the market power imbalance may persist, and the distribution conflict may preclude net benefits, which could be collected by cooperative behavior.

9.3 Pesticides, sustainability and human health

Pesticide residues are the most important food safety concern in the fresh food supply chain. The Brazilian farmer considered the use of pesticides as a fundamental tool to ensure protection against low yields or the destructions of culture, but the excessive use has adverse impact on the environment and human health.

Environmental Protection Agency (2012) defines pesticides as chemicals or any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human diseases or animals that cause harm or interfere in any way in the production, processing, storage, transport or marketing of food, agricultural products and wood products. In general, they are used in agriculture to combat pests, weeds and diseases in plants as well as vector control agents in public health programs and, to a lesser extent, livestock and forestry. According to the World Health Organization (WHO, 2010), pesticides are chemical compounds that are used to kill pests that damage crops.

The pesticides can be organic or inorganic and their formulation can be solid, liquid or paste. The degree of toxicity they are divided into four classes (I, II, III or IV). Class I products are those with greater toxicity and risk to human health.

The use of pesticide in food production has caused serious environmental damage. Its application often not only affects crops, impacting directly on the imbalance in the food chain, damage to aquatic ecosystems (rivers, streams or groundwater), damage to the soil (preservation of natural features) and air. These impacts are sensitive to climate change since optimal pesticide application rates vary with weather and climate conditions.

Another serious consequence for its uncontrolled application is the impact on public health, especially for rural workers, who often handle this chemical without the necessary safety equipment.

According to Pelaez, Terra and Silva (2010) there are more than 366 active ingredients registered in Brazil for agricultural use, with more than 200 different chemical groups that give rise to 1458 formulated products for sale on the market. Herbicides represent 48% of the market, while insecticides and fungicides, respectively 26% and 22%.

The National Information System Toxic Pharmacological shows that pesticides were responsible for 5. 28% of human poisoning notifications in agriculture, totaling 5,253 cases in Brazil in 2009. As for the recorded deaths, the situation is even more alarming, with the record 171 cases, representing a total of 41. 81% of poisoning deaths.

In order to improve the quality of fresh produce, especially to reduce the excessive use of pesticides in production, investments must be made by each of agents, and their performance depends on a well-coordinated action. The effectiveness of this strategy consists in use of signaling mechanisms in the transactions involving products in nature, as the Program for Pesticide Residue Analysis in Food (PARA).

9.4 Program for Pesticide Residue Analysis in Food (PARA)

In order to analyze the food quality National Health Surveillance Agency (Anvisa) started a project to monitor the amount of pesticide residues found in some types of fresh food in 200. According to the National Health Surveillance Agency (2008), the monitored cultures were chosen from the consumption data Search Family Budget Survey, the availability of these foods in distribution networks and the use of pesticides.

The first report published by the National Health Surveillance Agency (2008) brought information between the years 2001 to 2007 covering 16 Brazilian states and 09 cultures. In later years, Anvisa individually published reports of the years 2008, 2009 and 2010. There were 15 states and 17 cultures analyzed in 2008, 25 states and 20 crops in 2009, 26 states and 18 crops in 2010, as shown in Table 1.

Table 1 – Unsatisfactory samples for culture monitored by the PARA between 2001and 2010.

Year / Crop		2001/2002	2003	2004	2005	2006	2007	2008	2009	2010
Pineapple	II							9,5	44,1	32,8
Lettuce	II	8,6	6,7	14,0	46,5	28,7	40,0	19,8	38,4	54,2
Rice	II							4,4	27,2	7,4
Banana	II	6,5	2,2	3,6	3,1	Não	4,3	1,0	3,5	
Potato	II	22,2	8,7	1,8	0	0	1,4	2,0	1,2	0
Beet	II								32,0	32,6
Onion	II							2,9	16,3	3,1
Carrot	II	0	0	19,5	11,9	Não	9,9	30,4	24,8	49,6
Cabbage	II								44,2	31,9
Bean	II							2,9	3,0	6,5
Orange	I	1,4	0	4,9	4,7	0	6,0	14,9	10,3	12,2
Apple	II	4,0	3,7	5,0	3,1	5,3	2,9	3,9	5,3	8,9
Papaya	II	19,5	37,6	2,5	0	Não	17,2	17,3	38,8	30,4
Mango	II							1,0	8,1	4,0
Strawberry	I	46,0	54,6	39,1	Não	37,7	43,6	36,1	50,8	63,4
Cucumber	II								54,8	57,4
Bell Pepper	II							64,4	80,0	91,8
Cabbage	III							8,2	20,5	6,3
Tomato	II	26,1	0	7,4	4,4	2,0	44,7	18,3	32,6	16,3
Grape	III							32,7	56,4	

Unmonitored

Não Analysis not performed

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency2008; 2009; 2010; 2011).

Table 1 shows that all food with result greater than zero, i. e., 94% of the total samples are considered harmful to health, since they are outside the permitted limit or else the presence of the substance has been identified is not authorized by national legislation. This result is quite worrying, because it directly affects rural workers who handle the product and the final consumer who ingests.

It is perceived by the information in Table 1, that some cultures have a high degree of contamination by pesticides. Five important products in the Brazilian diet (lettuce, carrots, chicken, peppers and tomatoes), showed worrying results.

The number of samples contaminated with pesticides in lettuce production increased in the analyzed period (Figure 1).

Between 2008 and 2010, they were found fifteen different substances in the analyzed samples. Noteworthy is the presence of Carbendazim and dithiocarba-

mate in the analyzed samples. As described by the National Health Surveillance Agency (2012), the Carbendazim is an insecticide and acaricide with toxicological classification III, i. e. moderately toxic and is authorized for cotton, citrus, beans, apples, soybeans and wheat.

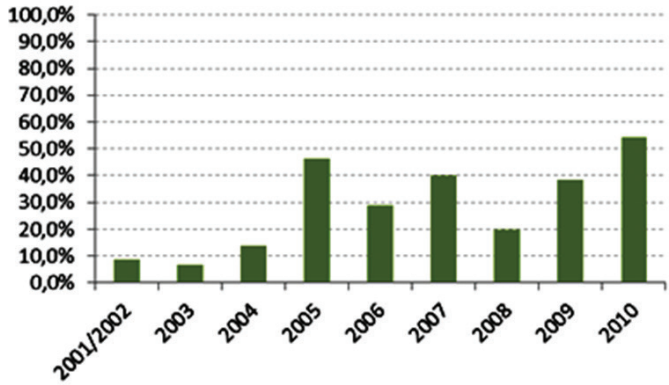

Figure 1 – Amount of contaminants in lettuce crop (%)

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency,2008, 2009, 2010, 2011)

Since the dithiocarbamate is a fungicide with toxicological classification II, or highly toxic and is allowed to crops of rice, potato, tomato, and citrus.

The number of samples contaminated with pesticides in the production of carrot also increased in the analyzed period. (Figure 2)

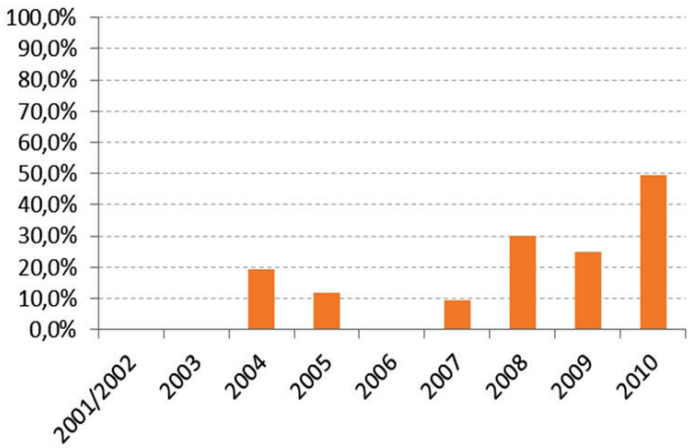

Figure 2 – Amount of contaminants in carrot crop

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency,2008, 2009, 2010, 2011)

Between 2008 and 2010, they were found eight different substances in the analyzed samples. The substances found were Methamidophos and Chlorpyrifos. According to the National Health Surveillance Agency (2012), the Methamidophos is an insecticide and acaricide with toxicological classification I, i. e., extremely toxic and is authorized for cotton, peanuts, potatoes, beans, soybean, tomato and wheat and its use is discontinued process as Resolution RDC No. 01 of 14/01/2011. Moreover, Chlorpyrifos is an insecticide, ant killer and acaricide with toxicological classification II, i. e. highly toxic and is authorized for cotton, potato, coffee, barley, citrus, beans, apples, corn, pasture, sorghum, tomato and wheat.

In the production of strawberry senses a stability number of samples in the period contaminated. Between 2008 and 2010, they were found eighteen different substances in the analyzed samples. (Figure 3)

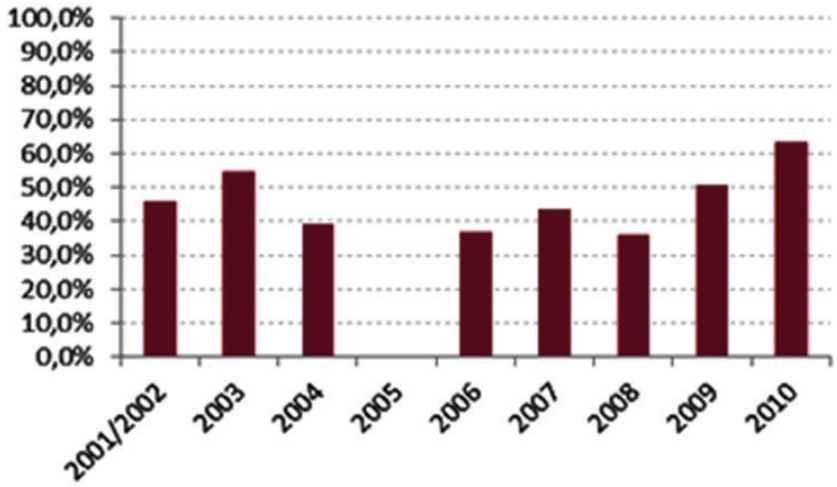

Figure 3 – Amount of contaminants in strawberry crop (%)

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency, 2008, 2009, 2010, 2011)

The substances found were Endosulfan, Prochloraz and Phosmet. Endosulfan is an insecticide and acaricide with toxicological classification I, ie, extremely toxic and is authorized for cotton, coffee, sugarcane, soybean and its use is process discontinuity. The fungicide Prochloraz is a toxicologically I classification, or extremely toxic and is allowed to onion crop, carrot, barley, watermelon, rose, tomato and wheat. Moreover, Phosmet is an insecticide and acaricide with toxicological classification I, i. e., extremely toxic and is authorized for citrus crops, apple and peach (NATIONAL HEALTH SURVEILLANCE AGENCY, 2012).

The situation of bell pepper is most troubling of all. For this product was observed an increase for samples contaminated with pesticides in between 2008 and 2010. In 2010, contamination occurred in 91,8% of samples (Figure 4).

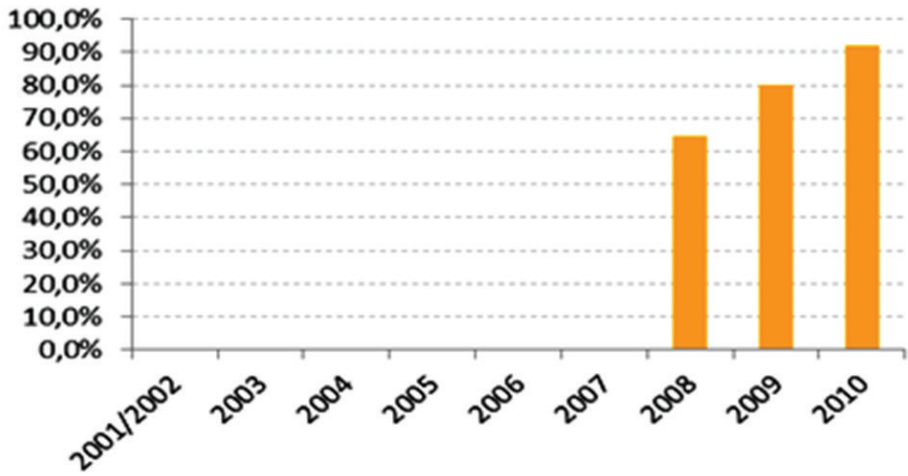

Figure 4 – Amount of contaminants in the bell pepper crop (%)

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency,2008, 2009, 2010, 2011)

Between 2008 and 2010, they were found twenty different substances in the analyzed samples. The substances found were Profenofos, Cypermethrin and Carbendazim.

Prophenophos is an insecticide and acaricide with toxicological classification II, i. e. highly toxic and is authorized for cotton, peanuts, potatoes, coffee, onions, peas, beans, sunflower, cassava, watermelon, corn, cucumber, cabbage, soybeans, wheat and tomatoes. The Cypermethrin is an insecticide and ant killer with toxicological classification II, i. e. highly toxic and is authorized for cotton, peanuts, rice, potatoes, coffee, onions, citrus, peas, beans, snap beans, tobacco, cassava, watermelon, corn, cucumber, cabbage, soybeans and tomatoes. Moreover, Carbendazim is an insecticide and acaricide with toxicological classification III, i. e., moderately toxic and is authorized for cotton, citrus, beans, apples, soybeans and wheat (National Health Surveillance Agency, 2012).

In tomato production was observed a large variation in the amount of samples contaminated with pesticides in last decade. (Figure 5)

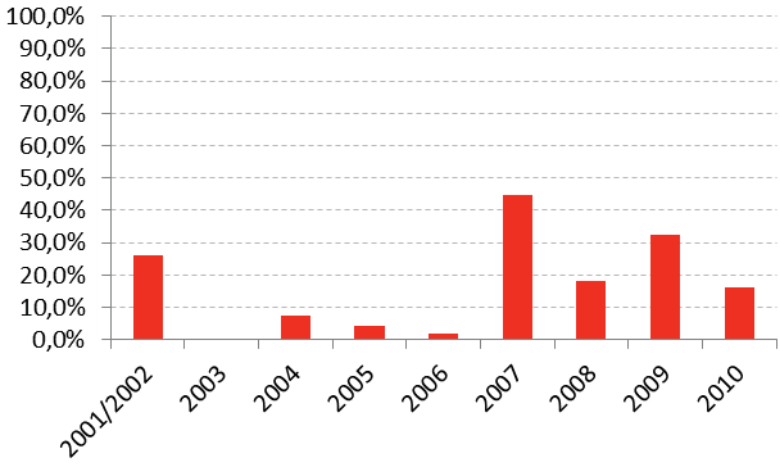

Figure 5 – Amount of contaminants in the tomato crop (%)

Source: Prepared by the authors from Anvisa data (NATIONAL HEALTH SURVEILLANCE AGENCY,2008, 2009, 2010, 2011)

Between 2008 and 2010, it were found seven different substances in the analyzed samples, highlighting the Chlorpyrifos. As National Health Surveillance Agency (2012a), the Chlorpyrifos is an insecticide, ant killer and acaricide with toxicological classification II, i. e. highly toxic and is authorized for cotton, potato, coffee, barley, citrus, beans, apples, corn, pasture, sorghum, tomato and wheat.

9.5 Challenges for public policies

The data indicate a very worrying situation, since 78% of contaminants come from the use of pesticides not authorized by Anvisa. Furthermore, these chemicals are used in cultures where there is no clarity about the maximum allowable quantities or its effects on the physical environment and the risks to the human health.

In this sense, it is necessary ensure that the use of pesticides occurs as defined by the regulatory body and described on the label of the package. The awareness of rural workers about the risks of excessive use of pesticides is also of vital importance. Therefore, a major initiative would promote training of farmers in good agricultural practices as regards the application of pesticides. Such a measure would be important to reduce contamination rates of goods and people.

Another important factor is to expand the information about the excessive use of pesticides in the fields. As discussed by Nelson (1970), limitations in the consumer's information regarding the product quality have negative effects on the market structure. Thus, farmers who produce products within the quality

standards required by regulatory authorities should create signaling mechanisms to consumers.

Ménard and Valceschini (2005) believe that asymmetric information between consumers and suppliers, combined with an increased perception of uncertainty increase requests for control over processes and products.

Improving adequate monitoring infrastructure is another policy that should be encouraged. In this sense, Figure 6 shows the average number of samples analyzed by state, culture and year. The results show a considerable drop in the number of collected samples. According to Anvisa (2012), there are only four laboratories capable of performing these analyze.

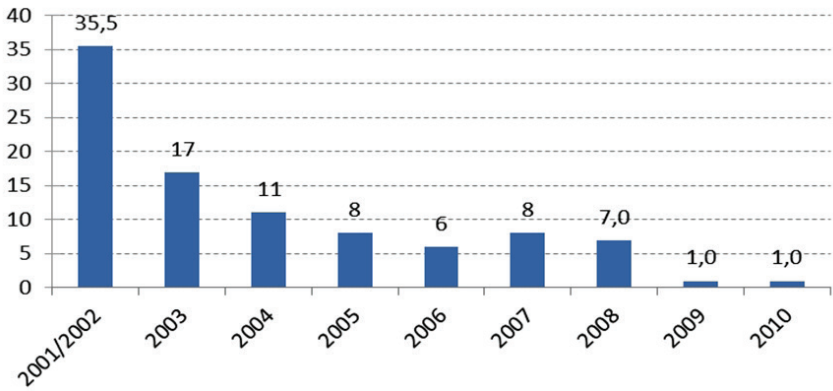

Figure 6 – Average number of samples analyzed by state, culture and year

Source: Prepared by the authors from Anvisa data (National Health Surveillance Agency,2008, 2009, 2010, 2011)

This fact highlights the lack of adequate infrastructure to achieve the objectives of the PARA. It should be noted that in 2009 and 2010 were collected only one sample per state and culture. It is not representative for a program that provides information of great importance to society.

9.6 Conclusion

The main feature of Brazilian fresh markets is the lack of minimum standards and very strong information asymmetries. As a consequence, endogenous and exogenous uncertainties are high.

The analysis of information gathered by the PARA found a very worrying situation in Brazil. In order to improve the quality of fresh produce, especially to reduce the excessive use of pesticides in production, investments must be made in infrastructure and training. Moreover, the effectiveness of policies to reduce

infection rates depends on a well-coordinated action between the agents of the supply chain.

Currently, the lack of efficient mechanisms of information allows the opportunistic behavior of agents appears. This fact is evidenced by the excessive use of pesticides in Brazilian agriculture and the use of products not allowed by regulatory authorities.

The rapid and successful development of hybrid arrangements as endogenous solutions to information and control over the quality problems would be an important way to reduce the uncertainties and, consequently, the transaction cost.

Introduce good agricultural practices implies minimizing the use of agrochemicals and implementation of a traceability system, become more aware farmers on environmental protection and efficient use of resources and ensure the health, safety and welfare of workers.

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