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**ALINE MIRILLI MAC CORD**

# PUBLIC MANAGEMENT, AGRICULTURE AND FOOD SECURITY: THE MODERNIZATION OF THE BRAZILIAN PLANT AND ANIMAL HEALTH PROTECTION SYSTEM

Dissertation presented to the School of International and Public Affairs, Columbia University in the City of New York, as a partial requisite to obtain the title of Master of Public Administration.

Advisor: Prof. Arvid Lukauskas

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## ABSTRACT

**Management, agriculture and food security: the modernization of the Brazilian Plant and Animal Health Protection System.**

This paper presents information to clarify important issues related to the Brazilian provision of food to the world and the activity of plant and animal health protection. The focus here is to demonstrate the importance of keeping and improving a strong system to protect the sanity of Brazilian agriculture products, which are essential supply to the world and have growing importance as more consumers press for better nutrition. To assess those issues, the paper will bring information from the international organizations related to world trade, food, competitiveness and development, as well as the primary data produced by Brazilian Ministry of Agriculture, Livestock and Supply and the Brazilian SDA. The research explains what is plant and animal health protection in Brazil and its importance to Brazilian competitiveness and international food security, as many countries are dependable of Brazilian products - including some of the most vulnerable populations in the world. It also presents the modernization actions of the Plant and Animal Health Protection Plan, a US$ 400 million program conducted by the Brazilian Ministry of Agriculture, Livestock and Supply.



**Keywords:** Public management. Public policy. International food market. Brazilian exports of food. Global Food Security. Plant and Animal Health Protection. Agriculture.

*I dedicate this paper to those who supported me all the time: my dear family Henrique, Eliane, Bruno and Clory. I am also thankful to my loyal friends and coworkers at the Ministry of Agriculture, Livestock and Supply and at the Ministry of Planning, Budget and Management of Brazil.*

*It would be impossible to build anything without your trust on me.*

**Aline M. Mac Cord**

## TABLES, GRAPHICS AND BOXES

## ABREVIATIONS

| | |
|---|---|
| FAO | Food and Agriculture Organization of the United Nation |
| GATT | General Agreement on Trade and Tariffs |
| GCEC | Global Commission On the Economy and Climate |
| GCI | Global Competitiveness Index |
| GDP | Gross Domestic Product |
| HDI | Human Development Index |
| ITC | International Trade Centre |
| MAPA | Ministério da Agricultura, Pecuária e Abastecimento |
| SDA | Secretaria de Defesa Agropecuária |
| TPI | Trade Performance Index |
| UN | United Nation |
| WHO | World Health Organization |
| WTO | World Trade Organization |

**SUMARY**

# 1 INTRODUCTION

This introductory chapter presents the work structure and the importance of keeping a strong and updated plant and animal health protection system to protect the sanity of Brazilian agriculture production of food products. The leading role of Brazil in the world provision of food and the commitment of the country with the international agreements on food security indicates the sensitiveness of this issue. A comparative view of Brazilian agriculture and livestock production with other global players helps to clarify the need of comprehensive policy package for agriculture, which includes the modernization of Brazilian plant and animal health protection system.

This chapter also presents the research questions, possible hypotheses and the methodology adopted for this work.

## 1.1 PRESENTATION

The world still faces the challenge of eliminating hunger, 16 years after the commit with the UN Millennium Goals. About 795 million people are undernourished globally, down 167 million over the last decade, according to the Food and Agriculture Organization of the United Nation (2015). The Global Commission On the Economy and Climate (GCEC) projections for food demand in 2050 indicates the tendency of growing pressure on food supply system, with 9,3 billion people to feed and the rising need for quality and safe food. Brazil is one of the world´s main producer of food and must be up to this challenge.

The focus of this paper is not to analyze the mechanisms by which the global community will fight hunger. The intention here is to demonstrate the importance of keeping and improving a strong plant and animal health protection system to protect the sanity of Brazilian agriculture products, which are essential supply to the world and have growing importance as more consumers press for better nutrition. The leading role of Brazil in the world provision of food and the commitment of the country with the international agreements on food security indicates the sensitiveness of this issue.

First, it is important to understand that the structures and systems for protecting animal and vegetal health may be different in each country. In the United States, there is

no institution centralizing all of the Brazilian *Secretaria de Defesa Agropecuária* – SDA (roughly translated by “Secretariat of Agriculture Defense”) activities. The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) covers some of Brazilian SDA´s responsibilities, but some other institutions also share equivalent responsibilities, like the services provided by the Food and Drug Administration (FDA) in its Food and Animal & Veterinary Sections. The Brazilian concept for the Ministry of Agriculture, Livestock and Supply´s SDA not only centralizes activities that, in US structure, are shared by the USDA´s Aphis and the FDA. It also applies the expression inaccurately translated for “Agriculture Defense”, which does not have the same meaning, as in Brazil it is not related to homeland security, but suggests the importance of the activity of protecting Brazilian production of heathy food.

Thus, in this paper, the term “Agriculture Defense” refers to the Brazilian concept to represent the activity that includes the animal and plant health protection, the suitability of the inputs used in agriculture and the health and technological safety of agricultural products, which are responsibility of the *Secretaria de Defesa Agropecuária* in Brazil (SDA). The SDA is also the central command of the *Sistema Unificado de Atenção à Sanidade Agropecuária* (SUASA) – which is the Brazilian Unified System for the Agricultural Health.

Finally, the main objective of this paper is to explain why it is necessary to maintain an updated system of protection of animal and plant health in Brazil and how the effectiveness of this activity affects the world community.

## 1.2 WORK STRUCTURE

**Introduction.** The paper explains the importance of plant and animal health protection as a public good and the volunteerism issue, as global public goods are prone to free riding. This Chapter 1 thus presents the structure of the work done, the questions it aims to answer and the possible hypotheses. It also presents the importance to study the plant and animal health protection, as Brazilian economy is strongly based on food production.

**Public Goods.** If everyone benefits, whether contributing or not, why would any individual help to provide the good while others only benefit from it? When discussing an

essential public good, however, this logic is not effective, because any failure to supply this public good would have deep consequences. Indeed, and as I explain in Chapter 2, the threat of a possible menace to the production of healthy food in Brazil, can be challenging as the country is a major global player in food supply. This chapter presents the problem of food insecurity and malnutrition in the world, especially in the Least Developed Countries. Demographic projections suggest that the populations of some countries, mostly in Africa, will grow alarmingly in the next decades.

**International community.** After this introductory discussion of the food security problem, Chapter 3 will briefly present the role of international institutions, such as WTO, FAO, WHO and UN, in which global challenges are discussed. It examines the 20th century, when food security entered on the international agenda and food-exporting countries increasingly coalesced as a group. The Chapter will also explain why Brazilian food production is so important to global food security. Any negative impact in those already instable economies would result in famine, migration, conflicts and several waves of impact worldwide. Thus, the Brazilian responsibility in supplying those markets raises the responsibility for providing low cost, safe and accessible food.

**Modernization.** The last part of this paper indicates the important efforts in course to protect the health of Brazilian production of food. Chapter 5 explains the challenge of developing and implementing a plant and animal health protection strategic plan for modernization. It is important to discuss the introduction of a more meaningful performance management system. The design of modernization measures is costly, and the collection, analysis and use of performance indicators requires continuous investment of organizational resources.

## 1.3 RESEARCH QUESTION

This paper aims to present information that may clarify two important issues related to both the Brazilian provision of food to the world and the activity of plant and animal health protection.

First, if Brazilian production of food incurs in a loss in quality, healthiness of quantity of goods produced, will it generate externalities to the world? To understand

this first question, it is necessary to identify stakeholders that could be affected by a supply shock in food products, and assess the possible impacts of those effects.

The second issue raises other group of questions: do the activity of animal and plant health protection need modernization? If so, what are the possible impacts of food provision if those efforts are not effective? How the modernization of the animal and plant health protection service provided by the Brazilian SDA could both reduce the risks of diminishing Brazilian production of food and even enhance the country's capacity as a world provider of food? To answer this group of questions, the paper presents the modernization efforts under course and explain the expected impacts of those actions.

## 1.4 HYPOTHESES

There are some possible hypotheses that this paper investigates to answer to those questions. The hypothesis that reducing the Brazilian production of healthy food would affect the world positively will not be considered, since the provision of quality goods improve the global welfare. Thus, there are two other possible outcomes:

a) Reducing the Brazilian production of healthy food would not affect the world;

b) Reducing the Brazilian production of healthy food would affect the world and generate negative externalities.

The second issue raises other possibilities, as the modernization of the SDA must be assessed in two different times: the present needs of the animal and plant health protection service and the future challenges. Thus, the immediate hypotheses are:

a) There is no need of modernization now nor in the future;

b) There is no need of modernization now, but it will be necessary to the future efficiency of SDA's activities;

c) The modernization efforts are needed now and will be necessary to the SDA effectiveness in the future.

## 1.5 METHODOLOGY

To answer those questions and assess the proposed hypotheses, the paper will bring information from the international organizations related to world trade, food, competitiveness and development, as well as the primary data produced by Brazilian Ministry of Agriculture, Livestock and Supply and the Brazilian SDA. There will be also researches of other sources if other clarifying information are necessary.

In relation to the main sources of this paper, it is necessary to point the limitations encountered, as ITC Trade Map warns of the distortions in database, such as smuggling and non-reporting, which are problems in some countries. Re-exporting the products to other markets also might conceal the product original producer in the mirror statistics table; thus, importing statistics of Brazilian products might be higher than registered. In addition, trade statistics, like any other type of information, are not free of mistakes and omissions. Nevertheless, the statistics derived from that data are a very useful source of information on international trade, as the information used came from the official imports data informed by each country and provide an important view of reality.

The other information presented also raise some concerns about the different methodologies applied by each institution consulted to access the indexes that are used in this paper (GCI, HDI, Hunger index, Trade statistics). Although some differences, they have a common approach and are consistent across all the countries, thus, the data is useful to the intent of this paper.

## 1.6 JUSTIFICATION

### 1.6.1 Plant and animal health protection and Brazilian Competitiveness

Brazil is one of the biggest food exporters in the world, trading an amount of 100 billion dollars in 2013, 33% of national exports. The Global Competitiveness Index 2015-2016 indicates that Brazil occupies a 128th position in the rank despite its seventh

position in Market size. The details of the sixth pillar, though, suggest that the worst efficiency problems are the imports as percentage of GDP, while the agricultural policy costs rank the best (WORLD ECONOMIC FORUM, 2015).

Thus, the importance of agricultural in Brazilian competitiveness, as the food exports represent one third of the country's commercial balance and generates 24% of national jobs, according to the report from the National Confederation of Agricultural and Livestock (CNA, 2012). Accordingly to the International Trade Centre´s trade statistics for international business development (TRADE PERFORMANCE INDEX, 2014), in 2014, Brazil ranked first place in net exports and second place in world market share for fresh food.

This paper will explain that the plant and animal health protection plays an essential role on the protection of Brazilian agricultural production, and thus it is vital to Brazilian competitiveness. It is imperative to understand its importance in order to invest on its modernization and effectiveness.

### 1.6.2 A comparative view of Brazilian agriculture and livestock production

In order to propose standards for the analysis of Brazilian production to those who are not familiar with such high numbers, let's compare it with another well know player on the food production market, such as the United States of America. The goal here is to give a perspective of size and characteristics of those two countries in terms of agricultural production.

Those countries are a reasonable comparison since those exporters are among the strongest players in world market for food. Accordingly to ITC's Trade Performance Index (2014) the comparison between Brazil and the United States in terms of competitiveness, places Brazil on the second place in world market share for fresh food, right after US, which occupies the first place. Brazil also occupies the tenth place in world market share for processed food, while US has the second larger world market share.

TABLE 1 - TRADE PERFORMANCE INDEX (BY SECTOR): BRAZIL (2014)

| INDICATOR'S DESCRIPTION | FRESH FOOD (VALUE) | FRESH FOOD (RANK) | PROCESSED FOOD (VALUE) | PROCESSED FOOD (RANK) |
|---|---|---|---|---|
| Number of exporting countries for the ranking in the sector | 177 | | 165 | |
| Value of exports (in thousand US$) | 56,542,900 | | 24,955,921 | |
| Export growth in value, p.a. (%) | 10% | 59 | 0% | 134 |
| Share in national exports (%) | 25% | | 11% | |
| Share in national imports (%) | 3% | | 2% | |
| Relative trade balance (%) | 78% | | 63% | |
| Relative unit value (world average = 1) | 0.9 | | 0.8 | |
| Net exports (in thousand US$) | 49,554,758 | 1 | 19,463,001 | 4 |
| Per capita exports US$/inhabitant) | 278.9 | 45 | 123.1 | 68 |
| Share in world market (%) | 7.03% | 2 | 3.22% | 10 |

Source: ITC Trade Map (2015)

Brazil is the first ranked in the world market as exporter of sugar, coffee, orange juice, soy and chicken, and occupy second and third positions in meat, corn and cotton among other products. Products like sugar, meat and coffee are directly sold to more than 80 countries, while Brazilian chickens reach more than 135 countries around the world.

Tables 1 and 2 present more information that can be assessed to present an overview of the differences between those countries. In net exports, Brazil figures the first place in net exports of fresh food, with a total value of US$49,554,758 thousand, followed by the US, which places the second position with US$32,924,593 net exports of fresh food. The net exports value for processed food though, presents a larger difference, as Brazil occupies the fourth position in net exports for processed food, with US$19,463,001 thousand net exports, and the US ranks 162nd with a negative net value of US$8,841,084.

TABLE 2 - TRADE PERFORMANCE INDEX (BY SECTOR): UNITED STATES OF AMERICA (2014)

| INDICATOR'S DESCRIPTION | FRESH FOOD (VALUE) | FRESH FOOD (RANK) | PROCESSED FOOD (VALUE) | PROCESSED FOOD (RANK) |
|---|---|---|---|---|
| Number of exporting countries for the ranking in the sector | 177 | | 165 | |
| Value of exports (in thousand US$) | 105,927,284 | | 56,943,109 | |
| Export growth in value, p.a. (%) | 5% | 95 | 8% | 73 |
| Share in national exports (%) | 6% | | 3% | |
| Share in national imports (%) | 3% | | 2% | |
| Relative trade balance (%) | 18% | | -7% | |
| Relative unit value (world average = 1) | 1.2 | | 1.4 | |
| Net exports (in thousand US$) | 32,924,593 | 2 | -8,841,084 | 162 |
| Per capita exports US$/inhabitant) | 332.0 | 37 | 178.5 | 55 |
| Share in world market (%) | 13.17% | 1 | 7.34% | 2 |

Source: ITC Trade Map (2015)

Nevertheless, the diversity of US economy in comparison with Brazilian production is clear, as food (fresh and processed) represent 33% of Brazilian exports and only 9% of US total exports.

### 1.6.3 A comprehensive policy package for agriculture

Given the multifaceted nature of competitiveness, the policy package for enhanced export competitiveness requires actions in many levels (SAMEN, 2014). The agriculture-related actions by the government may include: declaration of a commitment to export accordingly to the accepted international sanitary standards and to specific requisites of some countries; the protection of national borders from disease and plagues coming from abroad; fast and effective measures to contain and mitigate risks for national production; a coherent policy framework in promoting healthy and sustainable practices in production facilities; adequate inspections and certificates for internal and external

markets; adequate appliance of fines, clear and easy trade procedures for internal and external markets; incentives to support exporting products originated from agribusiness.

Overall, the policy package should be multifaceted and comprehensive, covering constraints at the borders, behind the borders (supply side), and beyond the borders (market access issues).

Addressing constraints at the borders implies a focus on sanitary inspections that will block the entrance of diseases and plagues, as well as better customs facilitation, clear rules and modern processes.

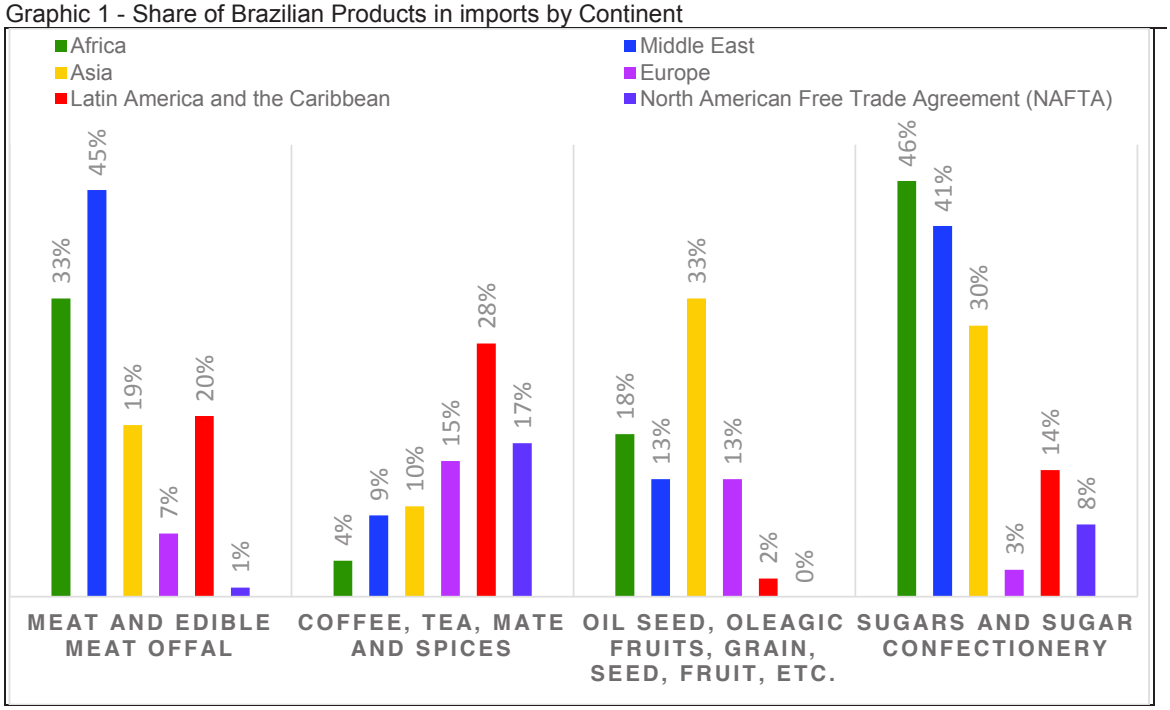
Addressing constraints behind the borders implies addressing supply-side barriers affecting infrastructure conditions, sanitary vigilance, production processes, incentives, technology, regulation of pesticides and additives and waste disposal.

Addressing constraints beyond the borders implies addressing market access impediments to export growth. That includes certifying the quality and characteristics of the exported product for specific markets, the international certification of disease-free areas and the bilateral, regional, and multilateral commercial negotiations. Expanding exports to respond to increased regional and global market demands requires increased supply of goods, modern technology of production, adequate trade-related institutions and good policies. Hence, a multifaceted approach is essential for a successful export development strategy (SAMEN, 2014).

### 1.6.4 The importance of plant and animal health protection

The successful continuity of Brazilian agribusiness depends of the existence of a plant and animal health protection system to block the vulnerabilities of a large extension of land and multiple international borders, climate diversity and the risks of entrance or dissemination of plagues and diseases that could compromise present production and reduce markets. For its importance, the plant and animal health protection activity requires high credibility, excellence patterns and efficiency in all of its actions.

Graphic 1 - Share of Brazilian Products in imports by Continent




Source: ITC Trade Map 2015

Graphic 1 demonstrates that Brazilian products have a strong presence in the world. Africa and Middle East are heavy consumers of Brazilian meat and sugar, while more than one fifth of Latin America imports of meat, coffee, tea, mate and spices come from Brazil. More than one third of the imports of oil seed, oleagic fruits, grain, seed, fruit or sugar in Asiatic countries also come from Brazil. Nevertheless, despite the considerable presence in European imports, the penetration power of Brazilian food products in NAFTA markets seems limited to coffee, tea and sugar products.

Brazil is one of the main suppliers of products of vegetal and animal origin because of the country's investments in research, genetics and nutrition. More than that, the plant and animal health protection system in Brazil is a solid institution that work with a well-trained and specialized body, which do inspections, analyze lab samples, apply fines and promote actions to prevent and eliminate plagues and diseases from crops and livestock. The aim is to boost the accountability of technical and commercial relations worldwide, offering products of good quality, safe and price competitive.

## 2 PLANT AND ANIMAL HEALTH PROTECTION AS A PUBLIC GOOD

As explained in Chapter I the plant and animal health protection is an important set of actions developed to block the risks of entrance or dissemination of plagues and diseases that could compromise present production and reduce markets. This Chapter presents a conceptual view of the plant and animal health protection as pure public good and discusses its utility. It presents the activity of inspection through this optic and explains why it is an activity that is typically executed by the government. Finally, it raises the issue of food security as a global public good and the challenges about it.

Plant and animal health protection as the example par excellence of a pure public good (KAUL, 2012), demonstrating that it is:

- Nonrivalrous: that is, the consumption, or enjoyment, of food or products which are under the protection afforded by the plant and animal health protection of a country does not detract from another resident's consumption of that protection. The protection is indivisible, and its enjoyment by an additional person involves no marginal, or additional, cost;
- Nonexclusionary: no one in the country can be excluded from benefiting from the protection of the plant and animal health protection, regardless of whether he or she contributes directly to the plant and animal health protection budget. Every citizen benefits from the food security provided by the plant and animal health protection.

Although the private sector is closely related to the activities of plant and animal health protection, the government provides it directly, financing its costs through taxation and fines. National producers benefit from the plant and animal health protection by protecting their crops and livestock from diseases and plagues that might come from abroad, as well as the consumers – national and international – benefit by assuring the provision of safe food. International market for food products is very strict to sanitary guarantees and if the national plant and animal health protection fails, there will be many markets that will close the door to Brazilian products. That grows in importance if we consider that Brazilian commercial balance is heavily based on the exports of food products and that many countries become dependable of Brazilian products as well –

Brazilian producers provide 80% of the international market for orange juice, for instance (SDA, 2016). In addition, plant and animal health protection also cares for the correct use of chemicals in the soil and prevents environmental impacts that could come from irregular crop additives and result in public health issues.

The “utility” conferred by plant and animal health protection expenditures – food security, commercial protection, healthy production, lesser environmental impact – is taken for granted. The term “protection” has positive connotations. However, there is a price for protecting crops and guaranteeing food to the world.

One characteristic of a public good is that although people or nations may value it differently, they receive it equally. The perception is built on the answers to many important questions that each person might value differently. First, does the benefic effect outweigh the danger of pesticide use or genetically modified organism (GMO)? How protected can be people who eat that food? Second, what private benefits and positive externalities does the expenditures on by plant and animal health protection bring? Increased economic activity and income from commercialization, exporting, and other related activities? Scientific and technological progress? International recognition of quality for Brazilian food products? Is the investment in plant and animal health protection the most efficient way of protecting this economic activity and welfare? What are the alternatives and the opportunity costs? There is a third set of questions to ask when evaluating the plant and animal health protection as a public good: what are the negative externalities? Did the World Trade Organization (WTO) provoke the creation of the G-20 through the negative externality of non-tariff barriers to food products and the need to invest in free-areas of plagues and diseases? Do undue sanitary barriers to protect markets generate negative externalities on international trade? What are the economic costs of the plant and animal health protection to taxpayers? In terms of alternative, what would be the costs of not protecting national crops and livestock? Even when technically there is proven safety in food production, do the people feel there that it is safe to consume those products? All of those questions influence the evaluation each person do on the public good received.

## 2.1 THE BRAZILIAN SDA AND DOMESTIC PUBLIC GOODS - THE INSPECTION ACTIVITY

Consider the challenge of a *domestic* public good like sanity of food products, and that this public good had to be supported voluntarily. How much would citizens contribute to keep the city safe from unhealthy or contaminated food?

Many people would probably figure that each own contribution would make little difference to the overall plant and animal health protection. In a population of thousands of people, each one's contribution seems to be only a tiny fraction of the total as not to matter. Each person probably knows that, if everyone failed to contribute, their city would be more vulnerable to menacing plagues and diseases that could exterminate food production or make it unhealthy to consumers. Everyone would be worse off as a consequence, but the temptation to contribute very little to protect their own production would thus be stronger. Free riding is a tendency, because each such person could apprehend that if others invest on the health safety of his or her crops and livestock, the neighborhood would be protected enough for keeping the area safe, thus, it would not be necessary to contribute themselves in their own properties.

For this reason, the Brazilian government has the responsibility to act through the Secretaria de Defesa Agropecuária (SDA) not only on emergencies against the spreading of diseases and entrance of plagues in the area, but also to inspects farms, production facilities and transportation, to monitor risk areas and to control borders in order to block possible harmful agents to enter the country. Probably more people would condition their choice of providing better safety conditions to the health of their own crops and livestock on the behavior of the SDA of ensuring that each person is contributing properly. That is, each such person may be inclined to contribute more only if they feel assured that others would contribute as well, and also because the fear of being fined for not taking safe sanitary measures[1].

Inspections, reinforced by a system of fines and compliance norms, facilitates the supply of public goods. It helps to overcome the deficiencies of volunteerism.

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[1] That was an actual demand from the production sector presented to the Brazilian government on the workshop held this year in the city of Petrolina, which focused on the fight against the plagues on the São Francisco fruit production area.

### 2.11 The failure of volunteerism

Consider the challenge of supplying a local public good as simple as the food, which in centuries past provided sustain to an entire community, in which all its members coordinate their joint activities to keep it healthy. How would the maintenance of the village production have guaranteed against contamination and disease control?

As Barrett (2007) argues, volunteerism failed even in a village setting, as demonstrated in a case where the public good provided was a simple clock. Volunteerism then has proved to be an unreliable source, as noted by a decree from 1618:

> Some years ago in Arzberg [Germany], they had a clock made which strikes a bell. The residents of Nichtewitz and Kaucklitz are supposed to contribute, the owners of a hide of land 1/2 Reichstaler, gardners 1 local taler, but they are unwilling to do so. Previously their excuse was that they couldn't hear the clock. Now they have admitted that they can hear it but still they don't want to pay: they are to pay their share; where they don't the authorities shall make them (DOHRN-VAN ROSSUM, 1996, p. 154-155).

Thus, official intervention was needed to ensure that the public good was provided. In 1618, the authorities represented a duke, prince or emperor: today, the public authority represent the country, the state or the city.

Imagine that citizens were asked in a referendum whether to support a secretariat of plant and animal health protection to do inspections on every food production facility to check if they are producing healthy products. It is probable that the same people who would do nothing voluntarily would vote in favor of the referendum, even knowing that then they would have to invest in their property's sanity or else they would be fined. The reason is that it would also enforces *everyone* to invest in sanity or to pay fines. The combination of voting and paying fines thus ensure that the national public good is supplied in greater abundance because individuals would not feel they could receive unequal odds or benefits. This combination makes the citizens better off *collectively* and it is the government's power that induces local and national public goods to be supplied.

Local and national public goods are often supplied by means like taxation, regulation, fine application, or even physical enforcement. During a sanitary health emergency, cattle suspected of being infected, and of posing a danger to others, can be

placed under quarantine. Even in the absence of a crisis, governments routinely require that cattle be vaccinated against foot and mouth disease, as an example. This is not just to protect these livestock. It is to prevent the conditions that would allow an epidemic to emerge and threaten national food production, which represents also a public good.

## 2.2 FOOD SECURITY AND PUBLIC GOODS

Although the apparently broad aspect of plant and animal health protection, its consequence as food security is also present as a public good. How does food security meet the formal as well as substantive criteria of being a public good? Unlike the broader range of plant and animal health protection, it unarguably meets the public goods criteria from a substantive (welfare) as well as a formal perspective. It is a state that everyone aspires to or wishes to maintain thus it can be said to be a universal public good. In terms of being nonexclusionary, if a country has food security, it is a benefit that no resident can be excluded from enjoying. It is the best state of society for human survival and a necessary condition for the satisfaction and welfare of society's members. Without food security, one might not survive. It is a prerequisite for the pursuit of happiness and social and human development and it is fundamental to achieve peace. At the international level, global food security benefits all, much like the public good of peace. Where there is food security, everyone can feel safe of hungriness.

With the openness of international commerce for food products, if there is enough production to supply the world, everyone everywhere can enjoy the benefits of food security, the enjoyment of one not detracting from that of another.

The food security provided by international trade strengthens international peace, which is in turn an enabling institution of the market mechanism and an essential element of the first fundamental theorem of welfare economics.

Many countries are dependable of Brazilian products. Brazil is responsible for 62% world market share of frozen fowls, which represent more than 90% of the market share for countries like Chad (90%), Mozambique (91%) and Iran (96%). Chinese imports of

meat and edible offal originate 75% from Brazil. The responsibility of keeping Brazilian production safe and healthy affects millions of people over the world[2].

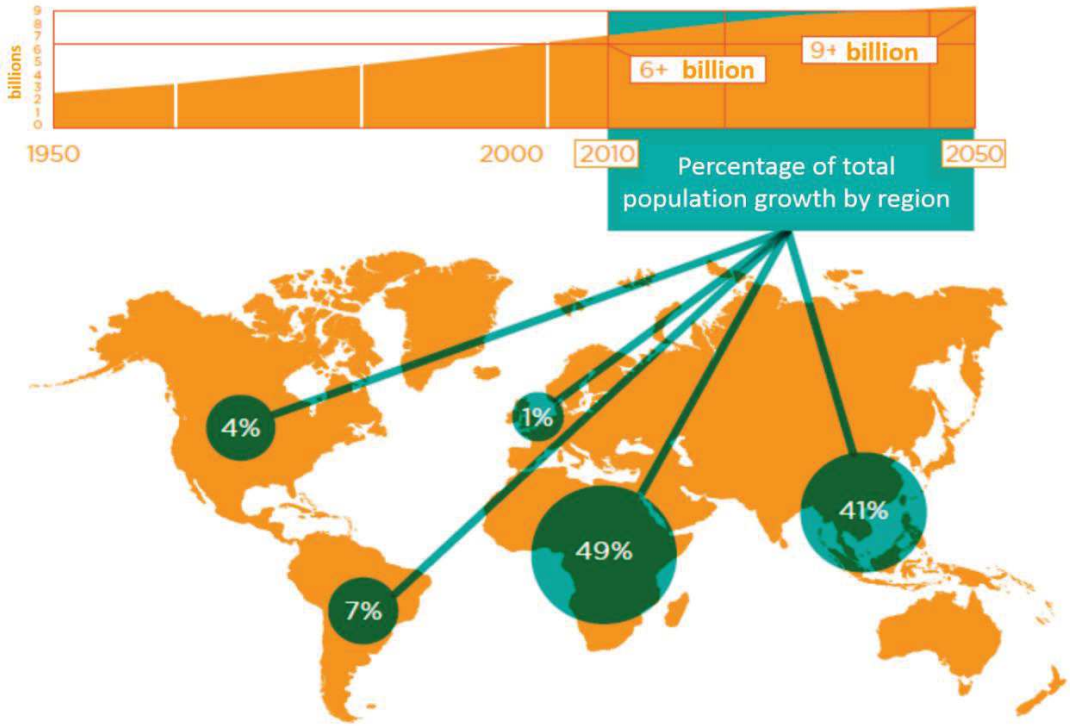
## 2.3 FOOD INSECURITY, MALNUTRITION AND HEALTH

Around 12% of world's population were at risk of hunger and malnutrition in 2006. At rising temperatures, the impacts are likely to turn large parts of the world too hot or too dry for agricultural production, mostly in Africa, Asia or Western Australia. Approximately half of the population of sub-Saharan Africa is undernourished. Malnutrition is a challenge - it was highly associated with child deaths in developing countries. Inadequate nutrition prevents their brains from developing fully and, ultimately, limits their ability to make a living (STERN, 2006).

The plant and animal health protection is essential to global food security. Some of the most needed countries rely on Brazilian production to feed their population. If Brazilian exports are affected and those markets are not supplied, food prices will rise and the population will suffer even more. Food prices, agricultural development, hunger and crisis are related because when food prices are high, hunger triggers violence, and nations in conflict are more likely to experience hunger. As Buffett (2013) explains, "Conflict creates hunger, hunger creates conflict".

[2] ITC calculations based on UN COMTRADE statistics.

Graphic 2 - Population Growth Projections 2010 - 2050




Source: UN data from Global Harvest Initiative GAP Report (2011)

The expected rise on world's population to 9,3 billion people in 2050 will press the demand for food in the entire world. Brazilian population will also rise to 215 million people that must be fed. That data also signs the opportunity of growth for the Brazilian agricultural and livestock production, which is already responsible for more than 22% of the country's GDP. More than 80% of the global demand growth for agricultural products in the next 15 years will come from developing countries. By 2050, the world's farms will need to produce 70% more calories than in 2006, mainly due to population growth, rising incomes and improving diets in developing countries (GCEC, 2014). Meeting this demand is critical to food security and it will also generate huge opportunities for agricultural businesses.

If those projections are right, and the present technologies in agriculture production do not change in the next years, the only possible solution to feed the world would be to

intensify use natural resources, especially water. In this context, Brazil would be one of the few countries that still have potential natural resources to grow.

The Brazilian SDA not only provides technical support and regulates the sanitary policies to plague and disease control but also aims the sustainability of agricultural and livestock production on national and international markets. Along with food production, Brazilian agricultural products include fibers and biomass for renewable energy – worldly recognized as one of the most efficient energy generators with the use of ethanol (ATKINSON, 2012) as Clean Development Mechanism (CDM), accordingly to the Kyoto Protocol.

Thus, as presented in this Chapter, the SDA is responsible for the plant and animal health protection actions in Brazil, which are a set of policies and actions to block the risks of plagues and diseases in food production. This is activity is essential, as food security is a global public good.

# 3 THE INTERNATIONAL COMMUNITY

In the previous chapter, food security was presented as global public good. This chapter will present the international discussion on food security, the difficulties of building a free global trade of food products and the strength of Brazilian production in the world. It also presents the vulnerabilities of the least developed countries to food insecurity and the international agenda to fight hunger. Those analyses are essential to reach the answer for the research question proposed previously on this paper and to develop a better understand about the impacts that a possible shortage on Brazilian supply of food to the world would have in the global food security. It will also indicate if there would be a possible negative externality, especially for the population of the Least Developed Countries (LDC).

## 3.1 INTERNATIONAL COMMERCE OF AGRICULTURAL PRODUCTS

The first global discussions about the opening of markets to international trade took place after the World War II. The approval of the General Agreement on Trade and Tariffs (GATT), in 1947, set rules on international commerce. Countries that signed that agreement could not raise unfair barriers to international trade, could not discriminate national or foreigner producers in domestic market or practice dumping, subsidies or other measures to unbalance commerce.

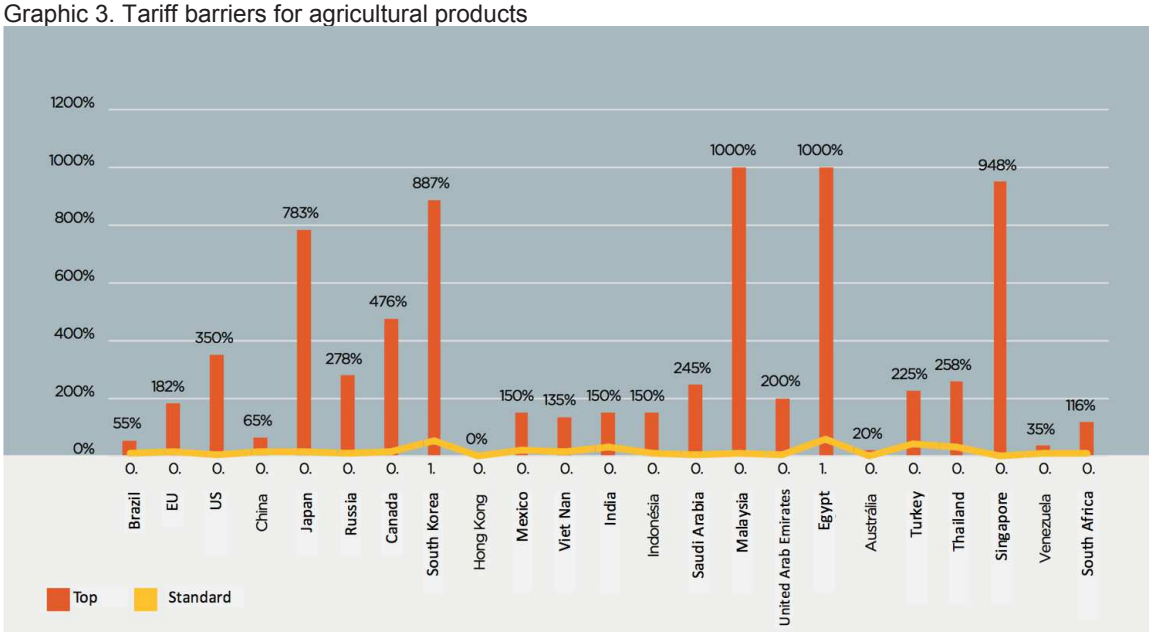
Agricultural commerce was not included in the GATT's negotiation. The international trade of products of agricultural and livestock origin was regulated with barriers and protection from foreign producers, with the imposition of higher tariffs, quotas and other prohibitive measures. Those unfair and restrictive measures were still allowed on agricultural products even when other industries had been already imposing the opening of markets for almost 50 years. There would be necessary several international negotiations until the Agricultural Agreement and the Application of Sanitary and Phytosanitary Measures (SPS Agreement) were signed in 1994 by 123 countries at the World Trade Organization (WTO).

The SPS aims to ensure that sanitary and phytosanitary measures, developed by WTO member countries, do not become unnecessary obstacles to trade. It presents the

rules of trade for the agricultural sector and establishes that it is under by GATT´s norms. The SPS also sets some reduction of subsidies to domestic producers and exporters, as well as the consolidation and reduction of all tariffs, among other measures.

The SPS Agreement regulates every sanitary and phytosanitary measures that might impact on international trade, but guaranties the right to impose sanitary and phytosanitary measures to protection of human, vegetal or livestock health. Thus, although the SPS agreement prevents or limits subsidies, it also creates a powerful filter for trade by creating technical barriers. This is the reason why exporting countries, like Brazil, must build strong and up-to-date plant and animal health protection systems to ensure the quality of products and overcome those barriers.

Graphic 3. Tariff barriers for agricultural products




Source: Ministry of Agriculture, Livestock and Supply of Brazil (2016)

The agreement trigged a change in the features of protectionist actions, especially in countries which used the opportunity of building sanitary barriers not only as it was supposed to be applied – in legitimate protection of nation´s health – but actually to close national markets to more competitive products from abroad.

Thus, the World Trade Organization (WTO) provoked the creation of the Cairns Group of Fair Trading Nations through the negative externality of non-tariff barriers to food products and the need to invest in free-areas of plagues and diseases. The Cairns Group is coalition of the 20 main agriculture-exporting countries, which seek the abolition of export subsidies and other trade-distorting practices. They seek to improve market access for agricultural exports at the World Trade Organization (WTO) as well as it also works with like-minded groups such as the G20 group of developing nations.

TABLE 3 - SHARE OF BRAZILIAN PRODUCTS IN IMPORTS OF BRIC, MERCOSUR AND OECD

Share of Brazilian Products in imports

| PRODUCT | BRIC | MERCOSUR | OECD |
|---|---|---|---|
| **Live animals** | 0% | 81% | 0% |
| **Meat and edible meat offal** | 24% | 64% | 5% |
| **Dairy products, eggs, honey, edible animal product** | 0% | 17% | 0% |
| **Products of animal origin** | 2% | 9% | 3% |
| **Coffee, tea, mate and spices** | 5% | 54% | 17% |
| **Oil seed, oleagic fruits, grain, seed, fruit, etc.** | 41% | 3% | 9% |
| **Meat, fish and seafood food preparations** | 0% | 11% | 3% |
| **Sugars and sugar confectionery** | 48% | 42% | 3% |
| **Cocoa and cocoa preparations** | 0% | 31% | 0% |
| **Vegetable, fruit, nut, etc. food preparations** | 6% | 5% | 6% |
| **Miscellaneous edible preparations** | 3% | 27% | 2% |
| **Residues, wastes of food industry, animal fodder** | 1% | 10% | 9% |
| **Tobacco and manufactured tobacco substitutes** | 18% | 34% | 5% |

Source: ITC Trade Map (2015)

Enhancing export competitiveness is a challenge for the acceleration of growth in the developing world. As the International Monetary Fund admits, “high barriers to imports and domestic subsidies on agricultural products in advanced economies remain a significant obstacle to export expansion for many developing countries.” (IMF, 2015). Higher barriers also difficult access to food and affect prices in international market, prejudicing consumers. International trade negotiations at the bilateral, regional, and multilateral levels may reduce market access constraints and open opportunities to tap into regional and global markets.

TABLE 4 - SHARE OF BRAZILIAN PRODUCTS IN IMPORTS OF BRIC COUNTRIES

| | Share of Brazilian Products in imports | | | | |
|---|---|---|---|---|---|
| **PRODUCT** | **CHINA** | **INDIA** | **RUSSIA** | **BRIC'S IMPORTS FROM BRAZIL (VALUE IN 2015)** | **BRIC** |
| **Meat and edible meat offal** | 15% | 0% | 49% | 2,475,574 | 24% |
| **Products of animal origin** | 0% | 0% | 19% | 10,946 | 2% |
| **Coffee, tea, mate and spices** | 3% | 1% | 8% | 112,217 | 5% |
| **Oil seed, oleagic fruits, grain, seed, fruit, etc.** | 43% | 0% | 19% | 17,242,264 | 41% |
| **Sugars and sugar confectionery** | 45% | 85% | 25% | 1,586,610 | 48% |
| **Vegetable, fruit, nut, etc. food preparations** | 11% | 3% | 6% | 162,682 | 6% |
| **Tobacco and manufactured tobacco substitutes** | 15% | 3% | 24% | 543,659 | 18% |

Source: ITC Trade Map (2015)

The barriers to imports affect especially the most needed countries, because it affects the global prices for food and build difficult access to markets in both directions – not only the most vulnerable economies meet barriers to their exports but also their domestic production is affected by the unfair competition. The Least Developed Countries (LDC) not only need to develop their economies but also demonstrate high levels of malnutrition, as we will focus later on this paper.

The unnatural effects on food prices due to unfair barriers, which require specific investments and over controlled certifications, reflect its results in the whole commercial chain that will also compete with high domestic subsidies for local production in many developed markets. Thus, the global welfare would improve if countries that are naturally more competitive in food production could supply those markets with high quality goods by cheaper prizes. That would save all of the government spenditure in the maintenance of this subsidized model and also keep more beneficial production prices to the world.

TABLE 5 - BRAZILIAN SHARE IN IMPORTS OF DIFFERENT MARKETS

| | **DEVELOPED MARKET ECONOMIES** | | **DEVELOPING MARKET ECONOMIES** | | **LEAST DEVELOPED COUNTRIES (LDCS)** | |
|---|---|---|---|---|---|---|
| **Product** | imports from Brazil (Value in 2015) | **Share of Brazilian Products in imports** | imports from Brazil (Value in 2015) | **Share of Brazilian Products in imports** | imports from Brazil (Value in 2015) | **Share of Brazilian Products in imports** |
| **Meat and edible meat offal** | 2,545,482 | **4%** | 11,570,563 | **23%** | 339,825 | **21%** |
| **Products of animal origin** | 163,020 | **3%** | 93,663 | **3%** | 11,339 | **8%** |
| **Coffee, tea, mate and spices** | 5,437,018 | **16%** | 1,068,988 | **9%** | 3,413 | **1%** |
| **Cereals** | 778,049 | **3%** | 5,239,186 | **7%** | 182,500 | **2%** |
| **Oil seed, oleagic fruits, grain, seed, fruit, etc.** | 3,074,474 | **10%** | 20,037,060 | **32%** | 5,696 | **1%** |
| **Meat, fish and seafood food preparations** | 1,156,193 | **4%** | 311,245 | **3%** | 66,136 | **15%** |
| **Sugars and sugar confectionery** | 584,585 | **3%** | 7,017,160 | **33%** | 1,452,713 | **38%** |
| **Vegetable, fruit, nut, etc. food preparations** | 2,623,450 | **6%** | 349,155 | **2%** | 3,666 | **0%** |
| **Residues, wastes of food industry, animal fodder** | 3,463,499 | **9%** | 2,864,982 | **8%** | 122,777 | **12%** |
| **Tobacco and manufactured tobacco substitutes** | 1,157,612 | **5%** | 1,376,711 | **8%** | 15,323 | **2%** |

Source: ITC Trade Map (2015)

At the first sight, Table 5 demonstrates the competitiveness of Brazilian products of different characteristics in different markets. The market share of Brazilian products in the imports of developed economies is stronger in products like coffee, tea, mate and spices (16%) or oil seed, oleagic fruits, grain, seed, fruit, etc. (10%). The most important markets for Brazilian products in Least Developed Countries are those of meat and edible meat offal (21%), Meat, fish and seafood food preparations (15%) and Sugars and sugar confectionery (38%). Developing Market Economies also import a large share of food products of Brazilian origin such as Meat and edible meat offal (23%), Oil seed, oleagic fruits, grain, seed, fruit, etc. (32%) and Sugars and sugar confectionery (33%).

Table 5 also signs the different characteristics from each market profile. Although the market share of some products from Brazilian origin might be larger in the least developed countries, like Meat, fish and seafood food preparations (15%, versus 4% of market share of Brazilian products in developed economies), the value of the imports is much lower, even comparing products of the same category. The reason for it lies not only on product sophistication, but also mostly because of the size of those markets. Selling 15% of the imported Meat, fish and seafood food preparations in LDC countries actually signs that the quantity of total imports of those products is much more restrict. Thus, 4% of developed markets for these products represent a market value of US$1,156,193 that is 17.5 times the value these products that are destined to LDC countries[3]. Considering the situation of vulnerability of people in those places and the endemic hunger and malnutrition problem in those economies, importing cheap food products would be strategic to feed the people if domestic production is not enough. On the other hand, efforts to enlarge the market share on developed economies seems to be more profitable and stable. If, for some reason – crop plagues and cattle diseases, for instance –, there is a shortage in Brazilian supply of those products, producers will most likely protect their most valuable market share and sacrifice LDC economies, which will suffer from the shortage and from the higher prices in world market. Thus, LDC

[3] See Apendix A, B and C for “Developed Countries and Territories”, “Developing Countries and Territories” and “Least Developed Countries and Territories (LDC)”

countries are much more vulnerable to any supply shock in food products and any rise in food prices in international markets.

## 3.2 ACCESS TO FOOD AND THE INTERNATIONAL AGENDA

In 1970, the Nobel Peace Prize was awarded to Norman Borlaug in Oslo, Norway. The prize was not celebrating a breakthrough in agricultural science, although Dr. Borlaug had revolutionized crop breeding – the Nobel Peace Prize was in recognition for advancing peace by fighting hunger. The Nobel committee understood that hunger and conflict are knotted together. As Buffet (2013) explains, not only does war often cause hunger and famine, but hunger itself can spawn violence by making people miserable, desperate, and angry.

Food shortages entered officially the international agenda in the 1974 World Food Conference in Rome, due to the harsh weather that reduced global production of food two years earlier. The images of the starvation of millions of people from Africa rushed through the world. There was a consensus that the UN should assess proposals to mitigate the problem in the national and international levels. The delegates understood the urgency of the problem and that the priorities for action should include not only the improvement of food production but also reducing poverty and promoting better income distribution. Hunger and malnutrition result from the difficulties of access to food products, both logistically and economically: food must be supplied in affordable prices to avoid starvation.

In that conference, governments examined the global problem of food production and consumption, and adopted the Universal Declaration on the Eradication of Hunger and Malnutrition, which stated that "every man, woman and child has the inalienable right to be free from hunger and malnutrition in order to develop their physical and mental faculties". The agenda included measures for increasing food production and consumption in developing countries; strengthening world food security; and international trade and agricultural adjustment.

Another outcome of the World Food Conference in Rome was the creation, in 1977, of the International Fund for Agricultural Development (IFAD), a specialized agency of the United Nations, established as an international financial institution.

Emmerij, Jolly, and Weiss (2001) note that many of the priorities recommended by the conference to increase food security were implemented in subsequent years:

> Although some might argue that this decision marked the failure to reform the FAO, the IFAD was an attempt to rope in such new donors as Saudi Arabia by offering them weighted voting akin to that enjoyed by major Western donors in the Bretton Woods institutions. And for a time, additional resources were available. Competition may also have served to stimulate the FAO4 to react more effectively (EMMERIJ; JOLLY; WEISS, 2001, p. 99).

The 1992 International Conference on Food and Nutrition and the 1996 World Food Summit in Rome, sponsored by the World Health Organization (WHO) and by the Food and Agriculture Organization of the United Nations (FAO), revisited the importance of global action on food and nutrition and set the goal of halving the number of people hungry and without adequate access to food, estimated at that time to be about 840 million.

As food production and international market for food were in the international agenda, the SPS Agreement signed in 1994 aimed to regulate sanitary measures that affect markets and might have impact on prices in international trade for food. Its effects were limited, though, because of the difficulties to prove which sanitary barriers are a subterfuge to protect markets instead of rightful measures to protection of human, vegetal or livestock health. The World Trade Organization sequentially arbitrates disputes on the merit of those barriers and the measures that might be taken to compensate losses in international commerce.

## 3.3 THE MILLENNIUM DEVELOPMENT GOALS

The Millennium Summit was held in 2000 at United Nations Headquarters in New York and resulted in the signature of 189 countries to support the United Nations Millennium Declaration. They agreed on the essential dimensions of development and set shared goals that are focused on a target date of 2015. The Millennium Development Goals had aims to halve extreme poverty and hunger and to reduce under

[4] Food and Agriculture Organization of the United Nations (FAO).

five mortality by two thirds – goals that are connected, since malnourishment is one of the main causes of children mortality.

An enhanced provision of global public goods is essential to achieve these goals and food provision becomes critical as raising people from poverty also enhances their demand for better nutrition. The objectives captured by the MDGs could be consolidated under four different dimensions, which would provide continuity. Eradicating hunger and ensuring food and nutrition security, thus, would comprise the four pillars of food availability, access, utilization and stability, including sustainable food production and consumption systems (UN, 2012). Brazil has a huge responsibility, as the world's main provider of fresh food, to guarantee healthy and competitive products, as this is crucial to raise people from poverty. The benefits of investing in global access to food are high, because every dollar invested in stopping chronic malnutrition also returns $30 in higher lifetime productivity (COPENHAGEN CONSENSUS, 2012).

The year 2015 marks the deadline of the Millennium Development Goal targets. As the result in developing countries, the share of undernourished people in the total population has decreased from 23.3 percent in 1990–92 to 12.9 per cent and more than half the countries monitored have reached the MDG hunger target (FAO; IFAD; WFP, 2015). In 2015, the Millennium Development Goals (MDGs) evolved into the Sustainable Development Goals (SDGs). The post-2015 agenda is a universal agenda, driven by the idea that this can be the first generation in human history to end hunger and ensure that every person achieves a basic standard of wellbeing. (UN, 2013). Therefore, a new development agenda brings forward the spirit of the Millennium Declaration and the MDGs, with a practical focus on things like hunger, which remains an everyday challenge for almost 795 million people worldwide (780 million people living in the developing countries). Hence, hunger eradication must remain a key global commitment. (FAO; IFAD; WFP, 2015).

## 3.4 HDI, COMPETITIVENESS AND HUNGER

Much of the population of sub-Saharan Africa is undernourished, most of it in countries which present the lowest Human Development Index (HDI). In correlation, the same countries usually place the lowest also in the Global Competitiveness Index (GCI)

rank and place specifically bad in the Agricultural Policies evaluation. Those countries must focus their efforts into feeding their people. Countries like Chad presents more than one third of its population undernourished and 14,8% of its children die before completing 5 years-old. That country ranks in 185$^{th}$ position in the Human Development Index Rank (HDI) and the 139$^{th}$ position in the Global Competitiveness Index (GCI). Its agriculture policy costs are also inefficient, figuring the 101$^{st}$ position in the world rank. All of these characteristics are correlated and indicate a poverty trap, which makes the country and its citizens vulnerable to any fluctuation in the international food prices, because it is very dependable from international supply of goods. Cheaper food in international market means more possibilities of feeding people with imports as well as it reflects directly on the international donations and other provisions that international organizations might offer as charity or aid.

TABLE 6 - HDI, COMPETITIVENESS AND HUNGER IN SUB-SAHARAN COUNTRIES

| COUNTRY | HDI RANK 2014 | AGRICULTURAL POLICY COSTS RANK 2014 | GCI RANK 2014 | % UNDERNOURISHED IN POPULATION IN 2014 | % UNDER 5 YEARS MORTALITY RATE IN 2014 |
|---|---|---|---|---|---|
| **Niger** | 188 | 078 | - | **9,50** | **10,40** |
| **Chad** | 185 | 101 | 139 | **34,40** | **14,80** |
| **Guinea** | 182 | 110 | 140 | **16,40** | **10,10** |
| **Sierra Leone** | 181 | 105 | 137 | **22,30** | **16,10** |
| **Mozambique** | 180 | 109 | 133 | **25,30** | **8,70** |
| **Guinea Bissau** | 178 | 135 | - | **20,70** | **12,40** |
| **Liberia** | 177 | 086 | 129 | **31,90** | **7,10** |
| **Senegal** | 170 | 078 | 110 | **24,60** | **5,50** |
| **Djibouti** | 168 | 008 | - | **15,90** | **7,00** |
| **Sudan** | 167 | - | - | **-** | **7,70** |
| **Togo** | 162 | - | - | **11,40** | **8,50** |
| **Mauritania** | 156 | 121 | 138 | **5,60** | **9,00** |
| **Nigeria** | 152 | 020 | 124 | **7,00** | **11,70** |
| **Cabo Verde** | 122 | 039 | 112 | - | - |

Sources: UN Development Programme (2015); World Economic Forum (2015); UNICEF/WHO (2012)

Sub-Saharan countries, as many others that also figure the lowest HDI position and the least nourished population, must be considered when we assess the importance of providing global food security. Those countries present difficulties to produce and access food, causing death of children due the harmful effects of the poor diet in health, by weakening the immune system and, thus, the resistance to infectious diseases. Stern (2006) predicted that more than 400 million people could be suffering from chronic hunger in 2015.

## 3.5 BRAZILIAN FOOD PRODUCTION AND INTERNATIONAL FOOD SECURITY

Some of those sub-Saharan countries have high level of dependency on Brazilian exports of food. Products of Brazilian origin are responsible for 95% of the imports of sausages and similar products, of meat in Sierra Leone and 93% in Liberia. Sierra Leone also imports 28% of its rice and near 100% of products of animal origin from Brazil. Frozen fowl of Brazilian origin represent 91% of Mozambique´s imports and 90% of Chad´s (TRADE MAP, 2014).

TABLE 7 - SHARE OF BRAZILIAN PRODUCTS IN IMPORTS IN AFRICA – MAGHREB AND SUB-SAHARA

| PRODUCT LABEL | SHARE OF BRAZILIAN PRODUCTS IN AFRICA´S IMPORTS | SHARE OF BRAZILIAN PRODUCTS IN MAGHREB´S IMPORTS | SHARE OF BRAZILIAN PRODUCTS IN SUB-SAHARAN'S IMPORTS |
|---|---|---|---|
| **Meat and edible meat offal** | 33% | 42% | 32% |
| **Products of animal origin** | 9% | 0% | 11% |
| **Coffee, tea, mate and spices** | 4% | 7% | 2% |
| **Oil seed, oleagic fruits, grain, seed, fruit, etc.** | 18% | 18% | 18% |
| **Meat, fish and seafood food preparations** | 9% | 1% | 11% |
| **Sugars and sugar confectionery** | 46% | 84% | 34% |

**Source: ITC Trade Map (2015)**

Brazilian production is also responsible for 75% of imports of meat, fish and seafood preparations in Sierra Leone, 54% in Guinea and 67% in Liberia. Niger, Togo,

Senegal, Guinea and Liberia have nearly 75% of their imports of sugars and sugar confectionery coming from Brazil, while in Cabo Verde, Guinea-Bissau, Nigeria and Mauritania this number rises to 85% (ITC TRADE MAP, 2015).

Although it is not correct to imply that those countries would not have any food if it were not from Brazilian supply, it is reasonable to admit that, even with local food production, substitute products and alternative suppliers, the price or the quality of food would suffer. There is also a component of immediate need – the reason why Brazilian share of imports in those countries are so high is also the reason why it would not be so easily replaced without affecting food provision – low cost, safe and accessible food. The Brazilian responsibility in supplying those markets raises the responsibility for keeping the sanity of Brazilian production of food. Any negative impact in those already instable economies would result in famine, migration, conflicts and several waves of impact worldwide.

Between 250–550 million additional people may be at risk of hunger with a temperature increase of 3°C – more than half of these people concentrated in Africa and Western Asia. Projections on climate change is also predicts that, by 2085, 25% to 42% of world's current diversity of plant species could no longer have any suitable habitat (STERN, 2006). Those global menaces must be faced by the main world providers of food as a call, since the responsibility to feed the world will possibly become restricted to even fewer suppliers.

## 3.6 THE BRAZILIAN PLANT AND ANIMAL HEALTH PROTECTION RESEARCH

The Brazilian government has developed in the last four decades a strong agricultural research system that is the base of Brazilian modern production and the heart of its plant and animal health protection system. As an essential part of these technologies, official laboratories exam and attest for crop and animal sanity. The efforts to keep Brazilian production and consumers protected eliminates many international plagues and diseases, which are a menace vegetal, animal and human health.

Brazil entered in the history of world production of apple and pear in 2014, when it became the first country ever to eradicate the moth *Cydia pomonella* in the world. The Minister of Agriculture, Livestock and Food Supply, Neri Geller, signed the official

declaration of this important achievement of the Brazilian Agriculture Defense. “This is the eradication of a severe pest that affects many countries, such as Uruguay, United States and Argentina" (EMBRAPA, 2014).

Brazil is also a major player in beef exports. Among the sanitary-based barriers that affect beef exports in the world, two of them are most relevant to Brazilian beef exporters and producers: BSE (Bovine Spongiform Encephalopathy or "Mad Cow Disease") and FMD (Foot and Mouth Disease). According to OIE (World Organization for Animal Health), Brazil´s risk status for BSE is "Negligible", the safest of all. The FMD eradication was focused on a specific program of the Brazilian government. The PNEFA - National Program for Eradication and Prevention of Foot and Mouth Disease is approaching its objective to make Brazil a country 100% free of FMD. Today, only a strip of land in the north of Brazil is not free yet. The main regions for beef cattle production are located inside the FMD-free zone (BRAZILIAN BEEF, 2016).

All of those efforts protect the Brazilian competitiveness, food security, national jobs and international commerce balance. Thus, in the position of a major player in the international market of food, Brazil has also an enormous responsibility on this role, by maintaining food safety and improving food security worldwide. Thus, investing in modern technologies and management techniques has a pivotal role in the Brazilian position as global food supplier.

This Chapter presented the discussion about barriers on the international commerce of food and the difficulties of building a free global trade of food products. It demonstrated the share of Brazilian products on the least developed countries and how a shock of supply could affect negatively the nutrition and lead to food insecurity and hunger, especially on those vulnerable countries. Next chapter will present the need of keeping a strong and updated plant and animal health protection system to protect the sanity of Brazilian agriculture production.

# 4 THE MODERNIZATION OF THE BRAZILIAN PLANT AND ANIMAL HEALTH PROTECTION SYSTEM

The last chapter explained the how a shortage in supply would affect negatively the nutrition and lead to social instability, food insecurity and hunger, especially on LDC populations. That described the characteristics and the scenery where the plant and animal health protection system must evolve. This new chapter presents specific challenges to the Brazilian Secretaria de Defesa Agropecuária (SDA) in face to the growing pressure on its efficiency and the need to modernize its century-old system. It will also describe the actions taken by the Brazilian government to achieve its long-term goals.

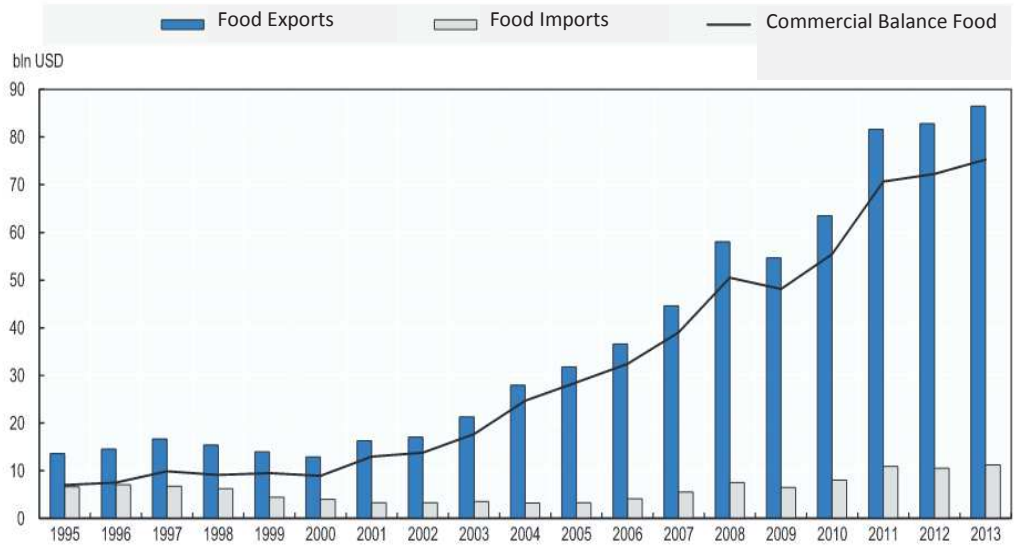
## 4.1 CHALLENGES IN A GLOBALIZED WORLD

Because of the increasing flow of goods and people, consumers demand more transparency of food production system. It is imperative to provide not only safer, nutritious and convenient food, but also transparent information about products and how they are produced. World health is still fighting against malnourishment and hunger while it faces the raising menace of global warming and its effects in food production. Brazilian food production has the responsibility to supply the world and play the role of one of the main providers of food security. At the same time, unfair sanitary barriers and subsidies build market failures. The unfair protection of domestic markets defy Brazilian capacity to modernize and to produce even more competitive products to overcome the limiting impositions of those countries.

The importance of plant and animal health protection has grown accordingly to the raise of Brazilian agribusiness. There has been an extremely fast growth of Brazilian production and trade of food between 1993 and 2013: Exports rise from US$ 15.9 billion to US$99.9 billion and imports move from US$ 4.1 billion to US$16.4 billion. The bureaucratic structure has not received the same amount of investment to rise up to that grow in production and in sanitary risks. It is necessary to improve informational systems, modernize technologies and update the anachronic norms.

As well as other public institutions around the world, the modernization processes are difficult to implement, due to the rigid government structure. The world's technological jump pressures for the modernization that is necessary to answer the expectations of domestic and international markets, delivering better and faster services to society. Some initiatives have been developed along the last decades in an attempt to modernize the Brazilian plant and animal health protection; however, few have been put forward in a modern integrated manner.

Grafic 5 - Brazilian Food exports (1995-2013)




Source: ComTrade/ UN (2013)

The challenge of developing and implementing a plant and animal health protection Strategic Plan is not an easy task. It is important to discuss the introduction of a more meaningful performance management system. The design of modernization measures is costly, and the collection, analysis and use of performance indicators requires continuous investment of organizational resources.

## 4.2 STRATEGIC PLANNING

Cohen and Eimicke define strategic planning as “a regular part of organizational management where you systematically scan the environment, assess the organization’s history, stakeholders, capacity and needs and then routinely modify the organization’s actions in light of changing goals. Strategic planning involves tradeoffs and choices. When you decide what an organization is going to do, you are also deciding what it is not going to do.” (COHEN; EIMICKE, 1998)

Thus, strategic planning is a process of setting measurable goals in response to external demands and direct internal capacities to activities that enable the organization to make progress toward those goals. A performance measurement system determines if goals have been achieved and if the right activities have taken place for that achievement. (COHEN; EIMICKE, 1998) Sometimes, though, it is difficult to define and measure success in public sector, as government’s objectives, such as plant and animal health protection, are difficult to measure.

The Brazilian SDA promoted broad discussion and involvement of many areas in the definition of objectives, goals and initiatives for the development of a strategic plan for the plant and animal health protection. It is important to introduce a modern performance measurement system to understand and improve organizational performance. This requires the understanding of the organization’s resources, work processes and outcomes. It also requires an understanding of the organization’s economic, social and political factors that influence its level of performance. The Total Quality Management (TQM) approach pushed by Deming (COHEN; BRAND, 1993) indicates that managers should measure current levels of performance and work to improve it cyclically. In Brazilian Government, it is also important that these measures contribute to the main objectives of the Ministry of Agriculture, Livestock and Supply as well as the Central Administration guidelines.

The responsibility for the inspection of the food produced and commercialized in Brazil lays on Brazilian SDA, along with the inspection and regulation of fibers and biomass for renewable energy. The plant and animal health protection agents incur several inspections on farms, producers and other subjects of the agribusiness chain, as well as react immediately to dangerous sanitary emergencies and control the borders for

the sanity of imports and exports. The SDA thus work in the provision of public goods of vital importance.

The issue of performance measurement in SDA is closely connected to the response time for delivering plant and animal health protection services in each area of actuation. The concern is that the time it would take to respond to some demands would directly affect producers, exporters and every stakeholder of agribusiness chain, whether by preventing menaces, by imposing emergency sanitary measures or by attesting its sanity. Other issues in measuring performance may be more mundane, but no less important, such as: When does the response to a demand begin and finish in cases where there are several others institutions that share the responsibility for the answer? What constitutes a completed response? Both the start and end of the process must be clearly defined, reported and measured (COHEN; EIMICKE, 2012). Performance management systems must be sensitive to contextual issues and be analytic about reports of data. Despite of its broader actuation, there are other specific fields of work that must be accurately designed and where we can focus in order to seek better performance: strategic projects management and process improvement.

## 4.3 THE BRAZILIAN SDA AND THE MODERNIZATION PLAN

The plant and animal health protection services in Brazil have nearly 100 years-old. In the last four decades, those services have been mostly centralized at the Secretaria de Defesa Agropecuária (SDA), an institution under the command of the Ministry of Agriculture, Livestock and Supply (MAPA). It currently employs almost four hundred public workers in its headquarters, and a thousand more on its 27 regional offices. The SDA is also the central command of the *Sistema Unificado de Atenção à Sanidade Agropecuária* (SUASA) – which is the Unified System for the Agricultural Health, an integrated inspection system covering the Federal government (SDA), State governments and cities. The objective of Suasa is to ensure animal and plant health, the adequacy of inputs and services and the quality and sanitary conditions and technological safety of final products directed to consumers. The SUASA has four sub-systems of inspection and control, covering the Inspection of animal and plant products and farm and livestock Inputs.

The Brazilian Ministry of Agriculture, Livestock and Supply Strategic Plan for the 2006-2015 period, focused on developing performance standards. Nevertheless, recent experiences at the Brazilian Federal Government that lack the necessary strategic view demonstrated that investments in technology and infrastructure are meaningless if not followed by the right trained personnel. In addition, several investments intended to solve punctual problems with IT systems proved to build a complex, costly and unfriendly multiple system, instead of an integrated single IT chain.

The high management of the SDA understood the importance of building the foundations for the development of a new strategic plan for plant and animal health. This was a joint effort of the SDA staff, and means a commitment to a future in which the plant and animal health protection operates through knowledge. Along the discussions, the work team was inspired and rescued fundamental concepts of the Project "SDA Strong", prepared in 2005, which also draws on modernization proposals worked the late 90s. This quest to study past efforts, and understand why technically relevant works were not carried forward was also a constant concern of the working team.

In addition to the inspiration in previous works, it was necessary to build structures that are more effective. The SDA old structure separate different management lines, which along the years of work presented an increasingly weak integration, which causes operational inefficiency. In 2015, a new management structure for the Ministry of Agriculture and the SDA raised again the discussion of how to organize the many instances of the plant and animal health protection system into focusing to offer better services to society. In the same year was created the first school specializing in agricultural management of the country, Enagro, to qualify the plant and animal health protection system workforce. As plagues and diseases do not respect frontiers, it urged the necessary investment in high-level communications to develop and implement actions in the 27 Brazilian states. The diminishment of transaction costs and the easier exchange of information must reach an improved level to benefit the entire system management.

It was months later that the new strategic plan for plant and animal health protection, called *Plano de Defesa Agropecuária 2016- 2020 (*PDA) would be released. The plan identifies an enhanced Performance Management System for mission-critical

functions as a top priority, embracing the areas of communications, planning and monitoring actions, resources, and training (SDA, 2016). The plant and animal health protection activity is based in science and knowledge. It is vital to build institutional means to support researches and studies and the continual training of all of the SDA personnel. This knowledge must be built in clear rules that allow producers and consumers understand its content and severely punish those who menace or defraud the healthiness of Brazilian products.

## 4.4 THE PLANT AND ANIMAL HEALTH PROTECTION ACTION PLAN

The plant and animal health protection Plan is a long-term vision that should be assured for the next years: it aims to identify priority goals and to invest on the necessary project to support its achievements. To build a successful strategic plan at the SDA, it must be built with participation from all divisions; otherwise, the integration would be impossible. After some discussion with transversal management view, the SDA has built a draft of its strategic proposal and submitted it to a workshop, in 18 and 19 February 2016. The plant and animal health protection Plan Workshop with Managers was promoted by the SDA´s Secretary Luis Pacifici Rangel, who invited the Minister of Agriculture, Livestock and Supply, Katia Abreu, the Executive Secretary, Maria Jaber, the Secretary of International Relations, Tatiana Palermo for strategic presentations.

The meeting reunited more than 60 managers from the many areas of plant and animal health protection to discuss the plant and animal health protection Plan and offer propositions for its implementation. The plant and animal health protection Plan was translated into six thematic areas: Modernization, Evaluations and Monitoring, Legal Frame, Sustainability, Intelligence and Special Projects.

One week later, it was stablished a series of workshops to evaluate the propositions and develop the main ideas of each suggestion. The plant and animal health protection Plan’s Thematic Areas Workshop reunited 20 representatives from the main departments of plant and animal health protection. The outcome was the proposition of a set of 28 strategic projects that should support the six thematic areas. Most of these projects were already in course, but should be shared with other departments and adapted with an integrated view. One of the new projects include a

performance management integrated system for the Evaluation and Monitoring area, which will focus on implementing and monitoring the performance indicators, setting detailed performance reporting and accountability process, as well as providing information for SDA workload statistics (SDA, 2016). One of the key indicators for the performance management is the improvement in response time for delivering the plant and animal health protection services. That concept is shared by the main departments of SDA and was mentioned several times in the workshops. It is necessary to work on innovative standard operating procedures to replace the outmoded ones, and perfect it with stakeholder's feedback.

Graphic 6 - The Process of Generating Value


Source: Secretaria de Defesa Agropecuária (SDA, 2016)

The result of this work is the plant and animal health protection Action Plan 2016-2017 (SDA, 2016), which will guide all the efforts in the next two years. It is important to connect performance measures to the organization's strategy and culture. Performance measures are contextual and need constant evaluation because they are imbedded in the organization's structure, operations and definition of success.

## 4.5 THE PROCESS OF DEFINING PRIORITIES FOR THE SDA

Nine indicators will initially assess the measurement of the plant and animal health protection performance. Due to its diversity and administrative size, a single performance indicator, although usually desirable, is unlikely to provide a clear measurement of performance and it is more difficult to negotiate among so different department's goals. On the other hand, a basket of indicators may accomplish with the many responsibilities of each department of the SDA while SDA´s General Coordination Office for Operations Management is able to direct public efforts in a more integrated way. The performance measure should thus reflect the performance on different areas such as animal and vegetable production, livestock and crop health and impacts of agricultural production in public health – fertilizers and chemical effects in public health.

As well as it happens in other public institutions, the plant and animal health protection has deeply ingrained procedures and protocols that must be assessed and modernized. The challenges are urgent and must be directed simultaneously accordingly to the strategic plan. The discussion raised questions that included border protection, response capacity, and risk analysis challenges. The first important change was the adoption of new transversal view to support the decision making for SDA management – intended to ameliorate the coordination between Federal, State and local agencies and private institutions. The Agriculture Defense Plan 2015-2020 (*Plano de Defesa Agropecuária 2015-2020*) was released on May 6, 2016, in Palácio do Planalto, the Presidential Palace of Brazil, with support of the Brazilian President Dilma Rousseff. The Plan indicates that it is urgent to review norms and procedures, to modernize infrastructure and equipment, and to train the workforce toward improved decision-making based on both scientific knowledge and intelligence analysis. All of this is necessary to face the challenge of growing agricultural sector and the opportunities of international markets expansion.

It is essential, though, to have in mind that current and future demands need new approaches and tool for a better knowledge, intelligence and risk management and the modernization of production areas. That would also open opportunities for public partnerships with public research institutions and universities, as well as the private sector.

## 4.6 ORGANIZATIONAL CULTURE

The performance management system's implementation plan must consider organizational culture. The public benchmark on public institutions demonstrate that organizational culture and standard operating procedures might resist for longer than it is useful. As an example, the Fire Department of New York took more than 25 years to realize its procedures were outdated before they successfully applied their modernization process. Firefighters culture were challenging to change and it requires planned techniques to influence workforce's behavior. Cultural differences exist even inside organizations, nations and regions and they must be understood before implementing performance management systems.

The SDA must consider not only the central headquarters culture, but also the country's 27 SDA Regional Offices and hundreds of inspection bureaus and laboratorial services. It is a challenge that must be considered essential to the process modernization and performance measurement of plant and animal health protection.

## 4.7 FOCUS ON INDICATOR KEYS

The emphasis on a single key indicator can work better because it is simpler to be understood and reduce misinterpretations. SDA will first focus on measuring the activities and tuning the indicators to build helpful parameters of quality standards. A single indicator would help the SDA management to overcome the deeply ingrained standard operating procedures, but the multiplicity of SDA responsibilities makes it difficult to establish a single indicator for plant and animal health protection. Choosing parameters of quality management will direct efforts to improve its processes.

Box 1 - Plant and animal health protection indicator keys

- Compliance index in monitoring the international transit of animals and plants, their products and farm inputs.
- Conformity Index of farm inputs and products of animal and vegetal origin.
- non conformity index of waste and contamination in products of animal and vegetal origin.
- Rate of quarantine pest introduction.
- Response time to suspicious pests.
- Sample Processing Rate.

Source: Secretaria de Defesa Agropecuária (SDA, 2016)

Not all departments of SDA are equally impacted by this single key. It is possible to assess specific indicators to measure animal and vegetable production, livestock and crop health and the impacts of agricultural production in public health – fertilizers and chemical effects. Despite the use of multiple indicators, each department could work focused on the impacts of one or two of them, while the General Coordination Office for Operations Management keeps the focus on integrating the policy in a broader view. The establishment of different indicators for each department was a choice that would lack the simplicity of a single focus, but would enable a more complete view of an institution that must provide services in so many different areas. A pilot test on the effectiveness of these indicators would allow new evaluation and perfection of it.

This chapter described the actions that are under course at the SDA to face the growing pressure on it effectiveness. The challenges to modernize its system must be addressed successfully by the Brazilian government to achieve its long-term goals. The modernization of the SDA protects Brazilian production of food from a shock of supply that could affect negatively the nutrition and lead to food insecurity and hunger, especially on LDC populations.

## 5 CONCLUSION

The Brazilian government has developed in the last four decades an entire ecosystem of supports and policies for large-scale, sustainable agricultural development. Buffet (2013) defends that leaders of countries grappling with food insecurity in some of the most difficult farming regions in the world, such as sub-Saharan Africa, should find reason to hope by observing the work done in Brazil.

This paper presented information to clarify two important issues related to both the Brazilian provision of food to the world and the activity of plant and animal health protection. The focus here is to demonstrate the importance of keeping and improving a strong system to protect the sanity of Brazilian agriculture products, which are essential supply to the world and have growing importance as more consumers press for better nutrition.

First research question aimed to investigate if Brazilian production of food incurred in a loss in quality, healthiness of quantity of goods produced, it would generate externalities to the world. The hypothesis that reducing the Brazilian production of healthy food would not affect the world cannot be accepted valid, since, as presented in Chapters II and III, food security is a global public good and Brazil is one of the main players on food provision to the world.

The reduction of Brazilian production of healthy food would affect the world and generate negative externalities, especially on those countries, which are more vulnerable to food insecurity. A supply shock in food products would raise the prices of food in the entire world and could have devastating impacts in LDC population's nutrition. Famine leads global instability, migration and wars. Thus, the protection of the food production in countries like Brazil is an activity of global importance.

The second issue addresses the modernization of the SDA in two different times: the present needs of the animal and plant health protection service and the future challenges. Here, the findings are more urgent as the modernization efforts are needed now and will be necessary to the SDA effectiveness in the future.

The Ministry of Agriculture, Livestock and Supply (MAPA), one of the oldest institutions of Brazilian Government, established in the 19th century. It employs

hundreds public workers distributed through in its headquarters, and its 27 regional offices – not considering the special operation posts, such as those on the frontier and production areas. The combination of its massive size and the old administration foundations make it solid but unfit to easy and fast modernizing efforts. The scientific breakthrough on communications, production and management pushes the institution to modernity and it must be prepared to attend to new demands. There has been an extremely fast growth of Brazilian production and trade of food between 1993 and 2013: Exports rise from US$ 15.9 billion to US$99.9 billion and imports move from US$ 4.1 billion to US$16.4 billion. This exponential increase in production and trade flow caused an unprecedented pressure on the century-old structure of the Brazilian plant and animal health protection system. The SDA urges to update its operational, financial, regulatory and staff areas in order to reinforce its capacity of action. Thus, it is imperative to invest on the modernization of this institution in order to keep the high standards of protection of the Brazilian production of food.

As presented in Chapter II, the Global Commission On the Economy and Climate projections for food demand in 2050 indicates the tendency of growing pressure on food supply system, with 9,3 billion people to feed and the rising need for quality and safe food. Brazilian population will also rise to 215 million people that must be fed. By 2050, the world's farms will need to produce 70% more calories than in 2006, mainly due to population growth, rising incomes and improving diets in developing countries (GCEC, 2014). Meeting this demand is critical to global food security. If those projections are right, there must be investment on new technologies in agriculture production or the only possible solution to feed the world would be to intensify use natural resources, especially water. In this context, Brazil could be one of the few countries that still have potential to grow. Thus, as Brazil is currently one of the world´s main producer of food, it must be up to this challenge to keep this position and to answer to the huge opportunities for agricultural businesses there might present in the next 35 years. The role of SDA will intensify as Brazilian production does.

Chapter III also explained that all of those efforts to protect the plant and animal health also protect the Brazilian competitiveness, food security, national jobs and international commerce balance. Despite of being a major player in the sector, Brazil is

selling abroad only 20% of national beef production – which indicates the potential to increase Brazilian exports. Any menace to Brazilian production would affect even more intensely those countries that are dependable of Brazilian goods, such those from Africa and many others in Middle East, Asia and in the Mercosur area, which rely on Brazilian exports. If Brazilian production is affected, there will be a negative supply shock of food products in international market, causing prices to spike upward and affecting people who cannot afford to pay the difference. Higher prices will lead to hunger, which will generate wars and immigration among nations. Thus, in the position of a major player in the international market of food, Brazil has also an enormous responsibility on this role, by maintaining food safety and improving food security worldwide.

The Brazilian government has put together smart and motivated agricultural research that is paying off. The plant and animal health protection is the focus of an essential part of those technologies, worked on official laboratories that exam and attest for crop and animal sanity. The country is working hard to keep production and consumers protected and to eliminate plagues and diseases, which are a menace vegetal, animal and human health. Brazil entered in the history of world production of apple and pear in 2014, when it became the first country ever to eradicate the moth *Cydia pomonella* in the world. The country is also a major player in beef exports and presents the safest risk status for BSE (Bovine Spongiform Encephalopathy or "Mad Cow Disease") and FMD (Foot and Mouth Disease) – the main regions for beef cattle production in Brazil are located inside the FMD-free zone.

As Brazil invests in eliminating plagues and diseases, it can turn investment from pesticides to prevention and research, which produces healthier and cheaper products. For that reason, Brazilian plant and animal health protection is also investing in the sustainability of its efforts in the long run.

Chapter IV presented that Brazilian SDA understood the need to draw up a Strategic Plan for plant and animal health protection, with medium and long-term vision, organized in many areas of action and incorporating strategic programs and projects. Those initiatives should work integrated and build the necessary transformation to a modern plant and animal health protection system. The identified problems were not new, but have been worsened as the development of Brazilian agriculture evolved.

Some initiatives have been developed along the last decades in an attempt to modernize the plant and animal health protection management; however, few have been put forward in an integrated manner. The current effort to modernize the Brazilian SDA has focused on performing modern and efficient management, consistent with what producers and consumers deserve. The goal must be to enhance delivery time of services and more effective answer to market demands. The excellence of the sector requires constant attention to keep the largest and most efficient tropical agriculture on the planet.

The performance management system's implementation plan must also consider the people involved in the activities of the plant and animal health protection. Cultural differences exist even inside organizations, nations and regions and organizational culture must be understood before implementing performance management systems. Thus, the SDA must consider not only the central headquarters culture, but also the country's 27 SDA Regional Offices and hundreds of inspection bureaus and laboratorial services spread over the country´s total area of 8.516.000 km². This must be considered an essential challenge to the modernization process and to the enhancement of performance measurement of plant and animal health protection indicators.

## REFERENCES

ABREU, K. **Análise do PIB das cadeias produtivas de algodão, cana-de-açúcar, soja, pecuária de corte e de leite no Brasil**. Brasília: CNA BRASIL, 2012.

AGROANALYSIS-EQUIPE. Agrodrops. **AgroANALYSIS**, v. 35, n. 6, p. 16-19 jun. 2015.

ATKINSON, Ben. The CDM, Kyoto Protocol and the sugar, ethanol and bio-fuels industry. **International sugar journal**, v. 106, n. 1263, p. 175-177, 2004.

BARRETT, Scott. **Why cooperate?:** the incentive to supply global public goods. New York: Oxford University Press Inc, 2007.

BARROS, G. S. A. C.; FACHINELLO, A. L.; SILVA, A. F. (Coords.). **Desenvolvimento metodológico e cálculo do PIB das cadeias produtivas do algodão, cana-de-açúcar, soja, pecuária de corte e leite no Brasil**. Piracicaba: Centro de Estudos Avançados em Economia Agrícola, CEPEA/USP, 2011.

BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. Ministry of Agriculture, Livestock and Supply of Brazil. **Agropecuária Brasileira:** Avanços e conquistas – de 2015 a 2016. Available in: <http://www.agricultura.gov.br/noticias/agropecuaria-brasileira-avancos-e-conquistas>. Access in: 20 maio 2016.

_____. Ministry of Agriculture, Livestock and Supply of Brazil. **Kátia Abreu:** defesa agropecuária brasileira será uma escola para o mundo. Available in: <http://www.agricultura.gov.br/comunicacao/noticias/2016/02/katia-abreu--defesa-agropecuaria-brasileira-sera-uma-escola-para-o-mundo>. Access in: 20 maio 2016.

_____. **O MAPA e as ameaças fitossanitárias**. Available in: <http://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-temporarias/especiais/55a-legislatura/pl-3200-15-regula-defensivos-fitossanitarios-1/documentos/audiencias-publicas/luis-eduardo-pacifici-rangel-secretario-de-defesa-agropecuaria-do-ministerio-da-agricultura-pecuaria-e-abastecimento>. Access in: 23 maio 2016. Informações apresentadas pelo Secretário de Defesa Agropecurária, Luís P. Rangel.

_____. Secretaria de Defesa Agropecuária. Secretaria de Defesa Agropecuária, Ministry of Agriculture, Livestock and Supply of Brazil. 2016. **Plano de Ação da SDA para o Biênio 2016-2017**.

_____. Ministry of Agriculture, Livestock and Supply of Brazil. **Plano de Defesa Agropecuária**. 2016 Available in: <http://www.agricultura.gov.br/noticias/secretario-do-mapa-explica-em-video-metas-do-plano-de-defesa-agropecuaria/1.pdf>. Access in: 20 maio 2016.

_____.**Defesa Agropecuária:** Resultados 2015 e metas 2016. Available in: <http://www.agricultura.gov.br/noticias/secretario-do-mapa-explica-em-video-metas-do-

plano-de-defesa-agropecuaria/1.pdf.>. Access in: 23 maio 2016. Informações apresentadas pelo Secretário de Defesa Agropecurária, Luís P. Rangel.

BRASIL. Presidência da República. **Lei nº 9.712, de 20 de novembro de 1998**. Changed by Lei nº 8.171, de 17 de janeiro de 1991. Available in: <http://www.planalto.gov.br/ccivil_03/leis/L9712.htm>. Access in: 20 maio 2016.

BRAZILIAN BEEF. **(2016) The beef sector:** animal health. Available in: <http://www.brazilianbeef.org.br/texto.asp?id=20>. (Accessed in: 20 maio/5/ 2016.)

BUFFETT, Howard G. **40 Chances:** Finding Hope in a Hungry World. Simon and Schuster, 2013.

COHEN, Steven; EIMICKE, William B. **Management Innovation in Improving Response Time at New York City's Fire Department (FDNY)**. 2012.

COHEN, Steven; EIMICKE, William. **Tools for innovators:** Creative strategies for strengthening public sector organizations. Jossey-Bass, 1998.

DEMING, W. Edwards. **Out of the Crisis**. MIT press, 2000.

DERVIŞ, Kemal. **A better globalization:** legitimacy, governance, and reform. Center for Global Development, 2005.

DOHRN-VAN ROSSUM, Gerhard. **History of the hour:** Clocks and modern temporal orders. University of Chicago Press, 1996.

EMBRAPA. **Brazil is free from codling moth**. 2014**.** Available in: <https://www.embrapa.br/en/busca-de-noticias/-/noticia/1712390/brazil-is-free-from-codling-moth>. Access in: 20 maio 2016.

EMMERIJ, Louis; JOLLY, Richard; WEISS, Thomas George. **Ahead of the curve?:** UN ideas and global challenges. Indiana University Press, 2001.

FAO; WFP. IFAD, The State of Food Insecurity in the World 2015. **FAO, Rome**, 2015.

GHAFFAR, Abdul et al. Changing mindsets in health policy and systems research. **The Lancet**, v. 381, n. 9865, p. 436, 2013.

GCEC. **Better Growth, Better Climate:** The New Climate Economy Report. The Global Commission On the Economy and Climate, 2014.

HODDINOTT, J.; ROSEGRANT, M.; TORERO, M. **Copenhagen Consensus 2012 Challenge Paper:** Hunger and Malnutrition. Washington: International Food Policy Research Institute, 2012.

INTERNATIONAL MONETARY FUND. **IMF Policy Paper – Financing for Development:** Revisiting the Monterrey Consensus. International Monetary Fund, Washington, DC, 2015

INTERNATIONAL TASK FORCE ON GLOBAL PUBLIC GOODS; ZEDILLO, Ernesto. **Meeting Global Challenges:** International Cooperation in the National Interest. International Task Force on Global Public Goods, 2006. Final Report. Stockholm, Sweden

INTERNATIONAL TRADE CENTRE. **Trade Statistics for International Business Development (ITC Trade Map)**. Available in: <http://www.trademap.org/>. Access in: 25 maio 2016.

JAHAN, Selim et al. **Human development report 2015:** Work for human development. UNDP: New York, NY, USA, 2015.

KAUL, Inge; GRUNBERG, Isabelle; STERN, Marc A. Global public goods. **Global public goods**, v. 450, 1999.

KAUL, Inge; FAUST, Michael. Global public goods and health: taking the agenda forward. **Bulletin of the World Health Organization**, v. 79, n. 9, p. 869-874, 2001.

LUKAUSKAS, Arvid; STERN, Robert M.; ZANINI, Gianni. **Handbook of trade policy for development**. Oxford University Press, 2013.

OIE. **Bovine spongiform encephalopathy status of Brazil.** 2012. Available in: <http://www.abiec.com.br/img/Upl/certificado-oie-051212.pdf>. Access in: 20 maio 2016.

OIE. **List of Bovine Spongiform Encephalopathy Risk Status of Member**. 2016. Available in: <http://www.oie.int/animal-health-in-the-world/official-disease-status/bse/list-of-bse-risk-status/>. Access in: 20 maio 2016.

PARRY, Martin; ROSENZWEIG, Cynthia; LIVERMORE, Matthew. Climate change, global food supply and risk of hunger. **Philosophical Transactions of the Royal Society of London B: Biological Sciences**, v. 360, n. 1463, p. 2125-2138, 2005.

SAMEN, S. **Policy Practices and Institutions for Successful Export Development and Diversification in Developing Countries**. Handbook of trade policy for development. Oxford University Press, 2013.

SCHWAB, K.; SALA-I-MARTIN, X.; BRENDE, B. **The Global Competitiveness Report 2015-2016.** World Economic Forum, 2015. v. 5.

STERN, Nicholas, et al. Stern Review: the economics of climate change. **UK Treasury**, 2006.

SUGAYAMA, R. L. et al. **Defesa vegetal:** fundamentos, ferramentas, política e perspectivas. Belo Horizonte: Sociedade Brasileira de Defesa Agropecuária, 2015.

UN COMTRADE. Available in: <http://comtrade.un.org/>. Access in: 25 maio 2016.

UNICEF / WHO (2012). **Information sheet**. Washington, D.C. Available in:

<http://www.who.int/nutgrowthdb/jme_infosheet.pdf.>. Access in: 23 maio 2016.

UN. A new global partnership: Eradicate poverty and transform economies through sustainable development. **Final report of the UN high-level panel of eminent persons on the post-2015 development agenda**, v. 30, 2013.

UNITED NATIONS HUMAN RIGTHS. **Universal Declaration on the Eradication of Hunger and Malnutrition**. 1974. Adopted on 16 November 1974 by the World Food Conference convened under General Assembly resolution 3180 (XXVIII) of 17 December 1973; and endorsed by General Assembly resolution 3348 (XXIX) of 17 December 1974. World Food Conference. Available in: <http://www.ohchr.org/EN/ProfessionalInterest/Pages/EradicationOfHungerAndMalnutrition.aspx>. Access in: 23 maio 2016.

UNITED NATIONS SYSTEM TASK TEAM ON THE POST-2015 UN DEVELOPMENT AGENDA. **Realizing the future we want for all**: Report to the Secretary-General. 2012

## APENDIX A – DEVELOPED COUNTRIES AND TERRITORIES

1. Andorra
2. Italy
3. Australia
4. Japan
5. Austria
6. Latvia
7. Belgium
8. Lithuania
9. Bulgaria
10. Luxembourg
11. Canada
12. Malta
13. Cyprus
14. Netherlands
15. Czech Republic
16. New Zealand
17. Denmark
18. Norway
19. Estonia
20. Poland
21. Faeroe Islands
22. Portugal
23. Finland
24. Romania
25. France
26. Slovakia
27. Germany
28. Slovenia
29. Gibraltar
30. Spain
31. Greece
32. Sweden
33. Hungary
34. Switzerland
35. Iceland
36. United Kingdom
37. Ireland
38. United States

## APENDIX B – DEVELOPING AND TRANSITION COUNTRIES AND TERRITORIES[5]

| | | | |
|---|---|---|---|
| 1. Afghanistan | 2. Albania | 3. Algeria | 4. American Samoa |
| 5. Angola | 6. Anguilla | 7. Antigua and Barbuda | 8. Argentina |
| 9. Armenia | 10. Aruba | 11. Azerbaijan | 12. Bahamas |
| 13. Bahrain | 14. Bangladesh | 15. Barbados | 16. Belarus |
| 17. Belize | 18. Benin | 19. Bermuda | 20. Bhutan |
| 21. Bolivia, Plurinational State of | 22. Bonaire, Sint Eustatius and Saba | 23. Bosnia and Herzegovina | 24. Botswana |
| 25. Brazil | 26. British Indian Ocean Territory | 27. Brunei Darussalam | 28. Burkina Faso |
| 29. Burundi | 30. Cabo Verde | 31. Cambodia | 32. Cameroon |
| 33. Cayman Islands | 34. Central African Republic | 35. Chad | 36. Chile |
| 37. China | 38. Christmas Island | 39. Cocos (Keeling) Islands | 40. Colombia |
| 41. Comoros | 42. Congo | 43. Congo, The Democratic Republic of the | 44. Cook Islands |
| 45. Costa Rica | 46. Cote d'Ivoire | 47. Cuba | 48. Curaçao |
| 49. Djibouti | 50. Dominica | 51. Dominican Republic | 52. Ecuador |
| 53. Egypt | 54. El Salvador | 55. Equatorial Guinea | 56. Eritrea |
| 57. Ethiopia | 58. Falkland Islands (Malvinas)[7] | 59. Fiji | 60. French Polynesia |
| 61. Gabon | 62. Gambia | 63. Georgia | 64. Ghana |
| 65. Greenland | 66. Grenada | 67. Guam | 68. Guatemala |
| 69. Guinea | 70. Guinea-Bissau | 71. Guyana | 72. Haiti |
| 73. Honduras | 74. Hong Kong, China | 75. India | 76. Indonesia |
| 77. Iran, Islamic Republic of | 78. Iraq | 79. Israel | 80. Jamaica |
| 81. Jordan | 82. Kazakhstan | 83. Kenya | 84. Kiribati |
| 85. Korea, Democratic People's Republic of | 86. Korea, Republic of | 87. Kuwait | 88. Kyrgyzstan |
| 89. Lao People's Democratic Republic | 90. Lebanon | 91. Lesotho | 92. Liberia |
| 93. Libya, State of | 94. Macao, China | 95. Madagascar | 96. |

[5] The above list is based on ITC's activities and country programs. All countries and territories are included except members of the European Union (EU) and of the Organization for Economic Co-operation and Development (OECD). However OECD members as, Mexico, Turkey, Republic of Korea and Chile, where ITC is still active with country programs, are also included in the list.

[7] A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

97. Malawi
98. Malaysia
99. Maldives
100. Mali
101. Marshall Islands
102. Mauritania
103. Mauritius
104. Mayotte
105. Mexico
106. Micronesia, Federated States of
107. Moldova, Republic of
108. Mongolia
109. Montenegro
110. Montserrat
111. Morocco
112. Mozambique
113. Myanmar
114. Namibia
115. Nauru
116. Nepal
117. New Caledonia
118. Nicaragua
119. Niger
120. Nigeria
121. Niue
122. Norfolk Island
123. Northern Mariana Islands
124. Oman
125. Pakistan
126. Palau
127. Palestine, State of
128. Panama
129. Papua New Guinea
130. Paraguay
131. Peru
132. Philippines
133. Pitcairn
134. Qatar
135. Russian Federation
136. Rwanda
137. Saint Kitts and Nevis
138. Saint Lucia
139. Saint Vincent and the Grenadines
140. Samoa
141. Sao Tome and Principe
142. Saudi Arabia
143. Senegal
144. Serbia
145. Seychelles
146. Sierra Leone
147. Singapore
148. Sint Maarten (Dutch part)
149. Solomon Islands
150. Somalia
151. South Africa
152. South Sudan
153. Sri Lanka
154. Sudan
155. Suriname
156. Swaziland
157. Syrian Arab Republic
158. Taipei, Chinese
159. Tajikistan
160. Tanzania, United Republic of
161. Thailand
162. Timor-Leste
163. Togo
164. Tokelau
165. Tonga
166. Trinidad and Tobago
167. Tunisia
168. Turkey
169. Turkmenistan
170. Turks and Caicos Islands
171. Tuvalu
172. Uganda
173. Ukraine
174. United Arab Emirates
175. Uruguay
176. Uzbekistan
177. Vanuatu
178. Venezuela, Bolivarian Republic of
179. Viet Nam
180. Virgin Islands, British
181. Wallis and Futuna
182. Western Sahara
183. Yemen
184. Zambia
185. Zimbabwe

## APENDIX C – LEAST DEVELOPED COUNTRIES AND TERRITORIES (LDC)[8]

1. Afghanistan
2. Madagascar
3. Angola
4. Malawi
5. Bangladesh
6. Mali
7. Benin
8. Mauritania
9. Bhutan
10. Mozambique
11. Burkina Faso
12. Myanmar
13. Burundi
14. Nepal
15. Cambodia
16. Niger
17. Central African Republic
18. Rwanda
19. Chad
20. Sao Tome and Principe
21. Comoros
22. Senegal
23. Congo, Dem. Rep.
24. Sierra Leone
25. Djibouti
26. Solomon Islands
27. Equatorial Guinea
28. Somalia
29. Eritrea
30. South Sudan
31. Ethiopia
32. Sudan
33. Gambia, The
34. Tanzania
35. Guinea
36. Timor-Leste
37. Guinea-Bissau
38. Togo
39. Haiti
40. Tuvalu
41. Kiribati
42. Uganda
43. Lao PDR
44. Vanuatu
45. Lesotho
46. Yemen, Rep.
47. Liberia
48. Zambia

[8] UN classification in alphabetic order.