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Full Length Research Paper

Traceability, transparency and assurance (TTA) systems implementation by the Brazilian exporter pork meat chain compared with other countries

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In the last decade, Brazil has been characterized as a new and important player in the world pork meat market. Enlarging its participation and confirming the status of important world competitor will be necessary to observe the international quality standards and to assure the food safety as demanded by foreign consumers, which became still more critical in the last time, after the events related with food contaminations. In that context, the present study aims to measure the levels of availability and effective implementation of programs related to the traceability, transparency and assurance systems (TTA Systems) and to compare the Brazilian results with other important countries, like Europeans, United States and Australia. To reach the objective, a survey research was accomplished with the main actors of the Brazilian exporter pork meat chain (BEPMC), applying the obtained data to the Liddell and Bailey's Model. Results show that Brazil and Australia/New Zealand are in an intermediary position when compared with top ranked European countries as United Kingdom and Denmark. On the other hand, Brazil obtained a higher score than United States, Canada and Japan. The main conclusion is that, although Brazil possesses a reasonable level of availability of TTA Systems, there is a lot to be done by the BEPMC actors in the sense of implementing those programs throughout the pork meat chain as a way to properly assure food safety and enlarge its market share by accessing countries with higher quality and safety standards.

Key words: TTA systems, food safety, Brazilian export pork meat chain, pork meat.

INTRODUCTION

The new consumption habits motivated by the occurrence of cases involving problems of food safety, among them: BSE (bovine spongiform encephalopathy), dioxin, chemical residues, hormones, OMG's, and *Escherichia coli*, contributed significantly to change the orientation of the production in the food chains. The orientation, once based on commodities, became now guided by the consumers' new expectations in obtaining food safety.

Identified the consumer's orientation related to the food safety, the production chains need to promote actions those that satisfactorily attend to the tastes and consumers' preferences. However, due the possibility of presence of asymmetric information between producers and consumers (Akerlof, 1970), actions developed by producers seeking to signal (Spence, 1973) the incorporation of safety attributes into the product may presents a definitive character for the product acceptance, or not, by consumers. Labels and certifications are among the most used signaling mechanisms by the food industry.

Particularly important in the signaling process of food safety and quality, especially meats, are:

(a) The implementation of traceability programs along the production and marketing chain;
(b) The transparency in the productive processes; and,
(c) Mechanisms of product assurance, in terms of food

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safety and quality (traceability, transparency and assurance – TTA (Bailey et al., 2002; Liddell and Bailey, 2001).

Measuring the implementation level of TTA Programs along the production chain is also a way of signaling the trust that the consumer can put on in relation to certain food attributes. Liddell and Bailey (2001) developed a specific model to measure the availability of TTA Programs in the marketing chains of selected countries. The model refers to a pork meat chain classification system for those analyzed countries, taking into account some aspects regarding to the availability of TTA Programs, among them, the 'depth' on which such a program cover the chain's actors.

According to Liddell and Bailey's (2001) study, the level of availability of TTA Programs has been revealed an important competitive factor in the pork meat worldwide market. Those countries with larger depth of availability can supply in a more appropriate way the attributes claimed by consumers, reaching the main markets in terms of amount of sales and profitability.

In the last years Brazil has improved significantly some indicators of competitiveness, as production cost and its global market share. From 1990 - 2007 Brazil passed from 1.5 - 3.1% of the worldwide pork meat production, being one of countries with larger increase in the relative growth rate. The amount of pork meat exported annually indicates that Brazil is consolidating as a new entrant in the world market. In 1995, Brazil was in the eleventh position into the top ranked countries in the quantity of pork meat exported with 1.3% of all exported volume, while in 2005 its position advance to third and its participation in exported volume of pork meat exceeded 8.0%. With an increase larger than 600%, has been the country with larger growth in the world trade participation in the period (FAO, 2009).

However, the Brazilian Exporter Pork Meat Chain - BEPMC exportations meets extremely concentrated in Russia, Hong Kong, Argentina and Uruguay, putting the BEPMC activities on risk. Together, these four importers purchased more than 90% of all pork meat exported by BEPMC in 2000. Recently, the list of countries importing pork meat from Brazil enlarged, but the exportations are yet concentrated just in some markets, like: Russia, Hong Kong, Argentina, South Africa, Singapore and Ukraine, to which BEPMC exported almost 90% in 2007 (ABIPECS, 2009). The risks to which the BEPMC meets exposed can be reduced by enlarging the number of countries buying the Brazilian pork meat. For so much, among other aspects, is essential that the BEPMC meets qualified to supply new markets with attributes and standards claimed by consumers, especially those related to the food safety.

In this context, the main objectives of this work are to measure the level of availability and the effective implementation of TTA Programs along the BEPMC stages. Besides these objectives, it intends to compare the Brazilian position confronting it with some of the main 'players' in the world market of pork meat, according to results presented in the Liddell and Bailey's research.

FOOD SAFETY ASPECTS

A safe food is that that, when being consumed won't bring problems to the health, because its attributes of intrinsic qualities meet in conformity (Spers, 2000). The attributes of a product are its quantitative and qualitative characteristics, to which meet associated to certain perceived risks (Fearne et al., 2001).

However, not all attributes can be perceived or measured by the consumer in the purchase's moment. The intrinsic attributes can only be detected or measured through elaborated analysis. Some examples of those attributes can be illustrated by the absences of: addictive, chemical residues, microorganisms, and other (Liddell and Bailey, 2001; Bailey et al., 2002; Spers, 2000). The central questions in this case are: how can the consumer identify safety's status of a product in the purchase act? How can a marketing chain transmit the intrinsic food safety to the consumer? How to reduce the information asymmetry between producers and consumers?

Some practices are being adopted through the use of systems which seek to produce foods with acceptable attributes of intrinsic quality and safety. Such systems are composer by a set of programs which assure some quality standards described as a strategic function of management concerned with the establishment of politics, standards and systems that preserve the internal product quality (Fearne et al., 2001).

According Holleran et al. (1999), usual forms of quality assurance systems are:

(i) Private international standards, such as the ISO Norms certification;
(ii) National systems of assurance, such as the Food and Drug Administration (FDA) regulations in United States and Food Safety Act in United Kingdom; and
(iii) Owners' quality systems, such as self brand name.

Is noticed that several actions are being taken and different programs were implanted or are in the implantation phase, mainly in United States, Canada and EU. Among the programs those in more evidence are:

(i) The HACCP system (hazard analysis control critical point), that seeks the management and control of the productive processes;
(ii) ISO norms certifications - series 9000 - for quality management and assurance; (iii) traceability programs (Bailey et al., 2002), and
(iv) ISO 14000 norms certifications for environmental management (Sparling et al., 2001). Other programs of

smaller inclusion, restricted to a country or promoted by a certain agency or still for a specific product or purpose, they also exist and can achieve similar results (Northen, 2001; Unnervehr et al., 1999; Zaibet, 2000; Wever et al., 2010).

HACCP Program

As previously stated, the HACCP is the base of the assurance and quality programs in the United States, Canada, Europe and other, besides Brazil. HACCP was developed based on NASA demands in supplying foods totally safe to the astronauts (Sparling et al., 2001). The HACCP was adopted by FAO and 'Codex Alimentarius' as stand for the alimentary safety's management, being a preventive system based on the identification of dangers and control of critical points of the marketing chain. The HACCP program is being accepted globally and is becoming claimed in the international trade of foods as an effective system of assuring the quality and the safety of the foods (Zaibet, 2000).

The HACCP objective is to remove the food risks for health throughout the food processing and marketing stages. The actors involved with this program in each marketing chain level try to identify all the critical points, through which risks can be introduced to the health by foodstuffs and to control those points eliminating associated risk. Thus, HACCP is a system that identifies, prioritizes and control potential hazards in the foodstuffs production, emphasizing the Critical Control Points identification through which microbiological, chemistries or physics contaminations can be introduced in the foodstuffs (Antle, 1996). The Critical Control Points are strictly monitored and controlled to reduce the occurrence chances of some hazard. Being a program based on processes, its plan is only for all the actors and for each specific food produced by a company (Sparling et al., 2001).

At farmers' level it includes check-out of input, maintenance of sanitary procedures and good management practices of the animal sanity. At the processors' level, the focus is on the restraining of contamination during the food processing, transport, storage and distribution. At wholesales and retails' levels, restaurants, stakehouses and other meal sales places the emphasis is on the cleanse procedures, refrigeration, storage, handles and preparation. Among those stages which compose a supply chain, the processors are those that possess the largest use index of HACCP systems. Retailers and farmers are moving fast in the direction to adoption of those practices (Sparling et al., 2001).

According to those authors, in spite of the costs, there are several benefits for the companies that implement the HACCP program. The most significant are the possibility to access new markets by seeking national and foreign requests by regulations and standards and to supply the consumers' demand in relation to quality standards and safety food attributes.

ISO Norms

The set of norms ISO 9000 Series was created in 1987 by ISO - International Standardization Organization, having been up to date in 1994 and, more recently, in 2000. Its creation was an answer the European community's growing pressures about a minimum standardization of the local or imported products. The headquarters of ISO is in Switzerland and it counts with 91 participant countries. In Brazil, the legal representative is the Brazilian Association of Technical Norms - ABNT. The ISO certifications was widely spread and implemented in Brazil from 1990 decade, when the number of certified companies and organizations grew up fast.

The ISO 9000 Series is a set of five norms of individual international standards, but related, on management and assurance of the quality. These norms were developed initially for manufacturing organizations; actually they could be applied to all types of organizations, from slaughterhouses to banks. The ISO 9000 Series focus is on documentation and elements of the quality system, plans of improvements and procedures for maintenance and improvement of the organization processes, with a particular emphasis in the quality standards.

Capmany et al. (2000) stated that the main arguments of North American agribusiness companies in looking for the ISO certification, among others, were:

(a) To obtain a competitive advantage of commercialization;
(b) To place the company in the leadership among the market competitors; and,
(c) To obtain access the news markets.

They also identified the main changes verified by those companies after the certification process, among others, were:

(a) Increase in the consumer's satisfaction;
(b) Improvement in the product traceability;
(c) Increase in the market share; and,
(d) Improvement in the company and the product image.

In agreement with Capmany et al. (2000) and Sparling et al. (2001) highlight that the main benefits of a certification process, are: the acceptance and international recognition, turning the certification ISO a marketing tool that maintain and it facilitates the international trade, and the promotion of product uniformity, improving the consumer's satisfaction.

Traceability, transparency and assurance - TTA systems The negative impacts of the information asymmetry between producers and consumers need to be avoided.

A positive response to this need can be given through the incorporation of the concepts, practices and programs of Traceability, Transparency and Assurance - TTA, throughout the production chain stages.

The concepts that compose the TTA System are defined for Bailey et al. (2002), and Liddell and Bailey (2001) as:

(a) 'Traceability': is the ability to trace the input used along of the process of food production back to its origin. A complete traceability process doesn't request that are just traced the main input, but also the secondary ones, such as used in the feed production and genetic lines;

(b) 'Transparency': refers the condition of the availability for the general public's access, all the information on rules, norms, procedures and practices used to produce foods in each level of the marketing chain. The transparency seeks to supply the consumer of detailed information on the processes used for the foods production, eliminating the "black box" of the production practices and informing the consumers as the products was produced. Moreover, facilitates that procedures are included or excluded with base in the own consumers' suggestions;

(c) 'Assurance': seeks to assure the quality of the products. Is based on three key-elements: i) hygiene management to assure the food safety – so much in Europe as in United States, it is based on the HACCP Programs and ISO Certifications; ii) quality assurance by classification and other actions – includes the measurements of the intrinsic quality attributes (taste, carcass classification, microbiologic contamination, etc...) and extrinsic ones (animal welfare, environmental preservation, social responsibility, etc,...); and iii) to provide mechanisms for products recall.

According to Bailey et al. (2002), there are at least four reasons for food industries to be concerned with the competition based on a TTA System:

(a) The consumers are more and more worried with the input used in the food production;

(b) Possibility of loss in competitiveness based on the fact of another industries introduce the TTA System with more agility and success, winning consumers;

(c) The domestic and/or external consumers' disposition in paying more for products produced under TTA conditions; and,

(d) Safety of the food system can request quickly a tracer method of products and input to its origins.

Liddell and Bailey (2001) developed and applied a classification model seeking to determine the level of availability of the TTA Systems along the pork meat chains in some countries, competitors in the international market, and to identify the levels of the production chain in which the process could be interrupted. The results obtained for selected countries are presented with results of this study at the end of the paper. The Liddell and Bailey's model, with small fittings, it was applied in the present research.

MATERIALS AND METHODS

Data gathering

Three main data sources were used: a questionnaire, documents and personal correspondences. The main data source was a structured questionnaire composed by thirty-seven questions. This instrument was previously tested by submitting it to three agro-industries and analyzing the results obtained from agro-industries responses.

The study population was composed by the twenty-six agro-industries, all of them met affiliated the Brazilian Association of the Producer and Exporter Industry of Pork Meat - ABIPECS (ABIPECS, 2007). The option by agro-industries as a research population was based on empiric knowledge of the coordination role accomplished by those agro-industries along the pork meat chain, derived from intense vertical integration governance structure present in the Brazilian pork sector.

All twenty-six agro-industries were contacted by telephone and, later on, they received the questionnaire sent by electronic mail. The questionnaires were addressed to the operational and/or export directors of those companies. The period of data gathering extended from April - September of 2007. Among the twenty-six agro-industries, just ten of them (38.5%) returned their questionnaire satisfactorily answered. However, those agro-industries together exported more than 72% of the Brazilian pork meat and they have slaughtered more than 77% of the all pigs slaughtered in Brazil in 2007 (ABIPECS, 2007).

Classification model to availability and implementation of TTA programs

To receive 1 (one) point for traceability in a particular level of the marketing chain (Table 1), it is necessary that that level has the following components:

1. A documenting agency, public or private, responsible for researching and developing the practices and procedures for traceability at that level of the marketing chain;
2. An agency that monitors compliance for traceability at that level of the marketing chain. The documenting agency may or may not be the same entity;
3. Verification of traceability by a third-party either through direct inspection, audit, or other means;
4. Labeling of final products to provide traceability to that particular level of the marketing chain.

In case of one or more requirements are not assisted, any point will not be attributed. As five levels compose the traceability (complete, farmer, processor, distributor, national), the maximum score to be obtained will be five points (Table 1).

The requirements to receive one point for transparency at each level of the marketing chain is:

1. A documenting agency that develops written practices and procedures for transparency at that level of the marketing chain;
2. Public access to the written and accepted practices and procedures for producing the product at that level of the marketing chain. A method must also be in place for incorporating public input

Table 1. TTA definitions and classifications utilized for BEPMC.

Complete traceable	Farmer traceable	Processor traceable	Distribute or traceable	National origin traceable
Definition: the ability to track the identification of a pork product backwards to the initial input of production, that is, genetic line and feed ingredients	Definition: identification of an individual product back to the farmer but not to the initial production ingredients	Definition: identification of an individual product back to the processor but not to the farmer	Definition: identification of an individual product back to the distributor but not to the processor	Definition: identification of an individual product back to the nation of origin but not the distributor
Farmer transparency	Processor transparency	Distributor transparency	National transparency	Not applicable
Definition: the availability of information on the entire production process is available from farmer to the consumer	Definition: the availability of information on the entire production process is available from processor to the consumer	Definition: the availability of information on the entire production process is available from distributor to the consumer	Definition: the national standards are publicly available. Decisions regarding national standards are open for both industry and public input	Not applicable
Farm assurance	Processor assurance	Distributor assurance	Not applicable	Not applicable
Definition: the process of creating safety and quality standards at the farm-level, which involve regular internal and external verification through testing or auditing	Definition: the process of testing and auditing specific requirements at the abattoirs and processor level to ensure safety and quality standards are met	Definition: the process of testing and auditing live animal and product transportation techniques to ensure specific standards of safety and quality are met	Not applicable	Not applicable

Source: Adapted from Liddell and Bailey (2001, p. 289).

into the development of these procedures;
3. That at least 50% of market participant at that level of the marketing chain participate in the same or closely associated program;
4. That there is a disclosure about chemicals used to produce the product at that level of the marketing chain.

The levels that assist to these requirements in its totality, will receive one point. The non-attendance to any one of these needs will result in a score equal to zero point. Being the transparency of the productive and commercialization processes composed by four levels (farmer, processor, distributor and national), the maximum score possible to be obtained for the transparency will be of four points (Table 1).

The requirements to receive almost one point for food safety assurance at each level of the productive chain are:

1. A documenting system that develops the practices and procedures that assure food safety at that level of the marketing chain be provided;
2. An agency designated to monitor compliance with the rules and procedures designated in the documenting system;
3. That third-party verifications be made for compliance.

The requirements to receive almost one point for extrinsic quality assurance at each level of the marketing chain are:

1. That the documented standards for extrinsic quality assurance be required at that particular level of the marketing chain;
2. An agency, public or private, is assigned to monitor compliance with these standards;
3. That third-party verification is made for compliance.

The levels that assist appropriately to all the requirements will receive one point. The original method conceived and used by Liddell and Bailey (2001), the marketing chain was composed by four levels (farmer, processor, distributor and retailers). Our analysis will be limited just to three levels (farmer, processor and distributor), once was considered that the requirements of the product requested by the distributors are the same ones claimed by the retailers and consumers. The maximum score possible to be obtained for assurance of food safety is equal for three points. The same score can be obtained for the assurance of the extrinsic quality. The highest score for assurance of food safety, intrinsic and extrinsic, is six points.

The general score of the BEPMC will be obtained being added the subtotals of the TTA Programs. That is, the maximum score possible will be formed by the sum of five points for traceability, four for transparency, 3 (three) for assurance of the food safety and three of the assurance of the extrinsic quality, totaling fifteen points. Based on that classification model two different analyses were carried out. First, the availability of TTA Programs for and into BEPMC was analyzed, namely, the existent availability were evaluated so that the requirements proposed in the classification methodology are assisted. Second, it was looked to measure the effective level of implementation of TTA Programs by BEPMC. The effective level of implementation of TTA Programs by BEPMC was only obtained by analyzing the data extracted from research questionnaire. That is, was just considered the effective use of TTA Programs by the BEPMC actors.

Table 2. Weighting Index utilized for each processor company.

Agro-industries	Pigs slaughters in 2007	Weighting index
Agro-industry 1	247.690	1.9
Agro-industry 2	1.794.056	14.0
Agro-industry 3	99.379	0.8
Agro-industry 4	685.883	5.4
Agro-industry 5	3.941.069	30.9
Agro-industry 6	312.000	2.4
Agro-industry 7	356.526	2.8
Agro-industry 8	2.372.005	18.6
Agro-industry 9	214.500	1.7
Agro-industry 10	2.751.634	21.5
Total	12.774.742	100.0

[a]Data obtained from Abipecs (2007).

The score obtained by each level of the marketing chain, for each appraised item, was multiplied by the weighting index presented on the Table 2, which is based on the relative participation of each agro-industry in the total of pigs slaughtered by all agro-industries in 2002.

The results of these multiplications fill the columns AI1, AI2, AI3,..., AI_n on the Table 4, where: AI1 is the “Agro-Industry 1” which did part of the research sample, AI2 is the “Agro-Industry 2”, and so forth. The sum of the products obtained in these columns represents an index (column "Index" Table 4), which means the proportion of pigs slaughters by BEPMC which production processes are based on some TTA Program. The column "Score" (Table 4), was filled being attributed “1” (one) point or "0" (zero) point to each level of BEPMC, having the following arbitrary approach: when Index value ≥ 0.5, was attributed “1” (one) point; when Index value < 0.5, was attributed “0” (zero) point. That is, when 50.0% or more of the pigs slaughters, met under processes based on some TTA Program, was considered as that level having really implemented such a program.

To identify the competitiveness level of BEPMC in the international context a comparative analysis among the data obtained by Liddell and Bailey and the results obtained in this study was done. The values were incorporate in the Table 5 allowing the comparison among the scores obtained by each selected country. The scores related to the implementation levels of TTA Programs obtained by each selected country are discussed and we settling down an ordinal classification among the countries.

RESULTS

Availability of TTA program for BEPMC

The results presented in this section are related to the availability of programs that drive to the traceability of the products, to the transparency of the processes and the assurance of food safety and quality. The results are presented in the Table 3.

In agreement with the established approaches, the traceability level reached by BEPMC allow that the final product be traced back to the farmer level. The complete traceability was not attributed due to the absence of an agency which develops norms that allow tracing the genetic lines, the input used in the animal feeding and other processes and input previous at the farmer level. Thus, BEPMC obtained 4 points amongst 5 possible points. The Brazilian agency for traceability normalization is the Brazilian Association of Technical Norms - ABNT, through its Technical Committees of Normalization (ABNT, 2003a; Matias, 2003). This process has narrow entail with the ISO Norms/Series 9000.

Traceability

Results shown in the Table 3 suggest that there aren’t public agencies that monitor the actions related to the compliance of norms and referring patterns to the traceability. That fact meets linked to the processes of certification of processors plants (agro-industries), which are executed normally by private agencies specialized in set certification processes and audits, in the slaughterhouses and processing plants. The certificates emitted by those agencies are internationally recognized.

The norms, procedures and traceability processes verification by a third-party are accomplished by means of auditing. Although there is a partial participation of public agencies in that process, as is the case of the Federal Inspection Service – SIF. SIF was not considered by not being the main working focus on such a kind of service. Thus, was observed that other organisms accomplish the process: audit agencies contracted by customers, government departments of importers countries, or by technical board of customers' importers of pork meat.

Transparency

Referring to the transparency of the production process through the availability of norms, procedures and

Table 3. BEPMC score for availability of TTA programs.

Item	Documenting agency	Monitoring agency	Type of verification	Label availability	Score
Traceability					
Complete	None	None	None	No	0
Farmer	ABNT-CB 56/ISO	Certifying agencies (CA)	Audit	Yes	1
Processor	ABNT-CB 56/ISO	Certifying agencies (CA)	Audit	Yes	1
Distributor	ABNT-CB 56/Isso	Certifying agencies (CA)	Audit	Yes	1
National	ABNT-CB 56/Isso	Certifying agencies (CA)	Audit	Yes	1
Subtotal					4
Item	**Documenting agency**	**Location for public access**	**% participation**	**Chemical disclosure**	**Score**
Transparency					
Farmer	MAPA/SDA/DDA	MAPA/DAS/DDA/Internet	> 50	Yes	0
Processor	MAPA/SDA/DIPOA/ANVISA	MAPA/DAS/DIPOA/ ANVISA/Internet	> 50	Yes	1
Distributor	MS/ANVISA	MS/ANVISA/Internet	> 50	Yes	1
National	MAPA/MS	MAPA/MS/Internet		Yes	1
Subtotal					3
Item	**Documented system**	**Monitoring agency**	**Type of verification**	**Status**	**Score**
Safety assurance					
Farmer	ABNT/ISO/PAS	None	None	Starting to use	0
Processor	ABNT/ISO/PAS	CA/DIPOA/ANVISA	Inspections	In process	1
Distributor	ABNT/ISO/PAS	CA/MS/ANVISA	Inspections	In process	1
Subtotal					2
Item	**Documented standards**	**Monitoring agency**	**Type of verification**	**Status**	**Score**
Quality assurance					
Farmer	PAS	None	None	Spot actions	0
Processor	ABNT-CB 38/ISO/PAS	CA/DIPOA/ANVISA	Audit inspections	In process	1
Distributor	ABNT-CB 38/ISO/PAS	CA/DIPOA/ANVISA	Audit inspections	In process	1
Sub-total					2
Total score					11

production process at farmer level, such information is just superficial and it doesn't allow the clear identification of the adopted practices by consumers. Moreover, due to definition lack of an inclusion method of the public's participation in the elaboration of practices and procedures "zero" point was attributed to this level.

The available transparency on the production process is coordinate by public agencies, centralized by the Ministry of the Agriculture - MAPA, and by the Ministry of the Health - MS, and accomplished by its secretaries and departments. At farmer level the practices and procedures are defined in the National Program of Pig Sanity - PNSS (MAPA, 2003). The Inspection Department of Products of Animal Origin - DIPOA, acts more intensely in the slaughterhouses plant and its processes. To DIPOA competes to guarantee that the product of animal origin is healthy, safe and reliable for the consumer (DIPOA, 2003).

The procedures at distributor level are defined and monitored by the National Agency of Sanitary Vigilance - ANVISA. Are attributions of ANVISA: to monitor transport of food products, storage in warehouses or harbor terminals, and shipment. The ANVISA is developing some programs seeking the assurance of the quality and food safety, included: HACCP - Hazard Analysis Critical Control Point; BPF - Good Manufacture Practices; and, PPHO - Standard Procedures of Operational Hygiene (ANVISA, 2003a). This agency has created a department that allows the access and the public's participation, named '*Ouvidoria*'[1] (ANVISA, 2003b; 2003c).

[1] It is a department maintained by The National Sanitary Vigilance Agency (ANVISA) which role is to hear the public about some doubts or claim about food safety and quality.

Safety food assurance

The developed actions seeking to establish a production process that assures a safety food along the chain, took to the obtaining of 2 points among 3 possible points (Table 3). The implementation and control of practices adopted still meet in an initial phase of implementation at the farmer level, while for the processors and distributor the process comes more advanced. For this reason, one point was attributed to each level, processor and distributor and, “zero” point to the farmer level.

Concerning with the system development that defines practices and procedures of food safety is relatively recent in Brazil. In 1998 was initiating a joint effort of some entities in launching the HACCP Program, which sought to diffuse its implementation and of its pre-requirements (Good Practices - BP and Standard Procedures of Operational Hygiene - PPHO) in the industries (Valois, 2002). Actually this project is an integral part of the Safe Food Program - PAS, and had its enlarged inclusion, so much in areas of performance as of partnerships and participant institutions (PAS, 2003).

Some processor plants possesses own systems of quality assurance. Such systems meet inserted in the management norms of NBR-ISO 9000 Series. To assist the requirements of these norms in referring to the process control and quality assurance, the agro-industries usually run over the practices of HACCP and its requirements: Good Production Practices - BPF and Standard Procedure of Operational Hygiene - PPHO. After the effective implementation of these set of norms and programs the agro-industries are audited by third-party Certifying Agencies (CA).

Quality assurance

The actions developed by BEPMC for assurance of extrinsic aspects of the quality allowed the attribution of 2 (two) points among 3 (three) possible points (Table 3). Are included in the denomination "Quality Assurance", procedures and described norms and practical actions monitored in the sense of preserving the environment, to guarantee the animal welfare during all production stages, to monitor the use of hormones in the production processes, as well as the use of Genetically Modified Organisms (GMO's).

In the BEPMC case was observed that the actions seeking to assist the analysis approaches proposed for this research are not managed by only one agencies, which could concentrates the actions. Different agencies, but in an isolated way, have been treated de questions related to the environmental preservation (SEMA, 2003; FATMA, 2003).

At the farmer level, the Safe Food Program - PAS, meets in an initial implementation stage. The PAS is based on the HACCP practices that would approach a series of relative cares to the animal welfare and other risk points, as the use of hormones along the production process. As such norms and procedures have not been identified in a clear way the absence of monitoring agency is a consequence. For these reasons, the score attributed at the farmer level was "0" (zero) point.

Even at processor and distributor levels, the environmental questions are treated in separate from the others. The norms and environmental procedures have been based on NBR-ISO Norms Series 14000. The ABNT maintains Technical Committee of Normalization - ABNT/CB 38 - Environmental Management (ABNT, 2003a; ABNT, 2003b).

TTA programs implementation

The data on the Table 3 suggest that BEPMC reached a score of 11 points among 15 possible points in relation to availability of TTA Programs. However, important is to analyze, besides the availability, whether or not the TTA Programs come being implemented in the practice and measure the implementation level.

This research present some advances when compared to Liddell and Bailey’s (2001) study, because it allows to go besides the investigation of the availability of TTA Programs and measuring the use that the marketing chain is doing to obtain improvements in the production processes and to signal larger food safety to consumers.

Regarding the methodological approach and the results derived from the analysis and interpretation of data gathered from agro-industries, the score obtained by BEPMC to the effective implementation of TTA Programs was five points among fifteen possible points (Table 4). According to results, we can assume that the implementation of TTA programs is still in an initial phase in the processors (agro-industries) plants and, by extension, to the other levels, mainly at farmer one. Exceptions to this observation are the programs of food safety assurance, which meet quite spread and implemented by the agro-industries, but they still lack of a deeper implementation for the other levels along the production chain.

The score attributed to the availability of TTA Programs being compared (Table 3) with the score obtained by the effective implementation of such programs (Table 4), is proven that deficiencies in the implementation exists, and are equivalent to a gap of six points. That is, if BEPMC had implemented all the available TTA Programs mentioned in the Table 3, would reach the eleven points.

BEPMC compared with the marketing chain of some selected countries

In this section a comparative analysis is presented. The comparative analysis just takes into account the scores obtained by the United Kingdom, Denmark, Canada, United States, Japan, Australia/New Zealand and Brazil’s

Table 4. BEPMC Score based in effective implementation of TTA Programs.

Item												
Traceability	**AI 1**	**AI 2**	**AI 3**	**AI 4**	**AI 5**	**AI 6**	**AI 7**	**AI 8**	**AI 9**	**AI 10**	**Index**	**Sc.**
Complete traceable	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0
Farmer traceable	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0
Processor traceable	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.33	0
Distributor traceable	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.33	0
National Origin traceable	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.33	0
Subtotal												0
Item												
Transparency	**AI 1**	**AI 2**	**AI 3**	**AI 4**	**AI 5**	**AI 6**	**AI 7**	**AI 8**	**AI 9**	**AI 10**	**Index**	**Sc.**
Farmer transparency	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Processor transparency	0.02	0.14	0.01	0.05	0.31	0.02	0.03	0.19	0.02	0.22	1.00	1
Distributor transparency	0.02	0.14	0.01	0.05	0.31	0.02	0.03	0.19	0.02	0.22	1.00	1
National transparency	0.02	0.14	0.01	0.05	0.31	0.02	0.03	0.19	0.02	0.22	1.00	1
Subtotal												3
Item												
Safety assurance	**AI 1**	**AI 2**	**AI 3**	**AI 4**	**AI 5**	**AI 6**	**AI 7**	**AI 8**	**AI 9**	**AI 10**	**Index**	**Sc.**
Farmer assurance	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0
Processor assurance	0.02	0.14	0.01	0.05	0.31	0.02	0.03	0.19	0.02	0.22	1.00	1
Distributor assurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Subtotal												1
Item												
Quality assurance	**AI 1**	**AI 2**	**AI 3**	**AI 4**	**AI 5**	**AI 6**	**AI 7**	**AI 8**	**AI 9**	**AI 10**	**Index**	**Sc.**
Farmer assurance	0.00	0.14	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0
Processor assurance	0.00	0.14	0.01	0.05	0.31	0.00	0.00	0.19	0.00	0.22	0.91	1
Distributor assurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0,00	0
Sub-total												1
Total score												5

pork meat chain. Therefore, analyses won't be deepened on the implementation of TTA Programs, but will just be established a classification with relationship at the levels of availability.

The scores presented in this study to others countries than not Brazil, were extracted from the Liddell and Bailey's (2001) study. However, due to the fact of the availability and implementations of TTA Programs have not been analyzed in retailers' level in BEPMC, the relative points were suppressed out from this chain level also to the others countries. The total scores for those countries can be seen in the original Liddell and Bailey's (2001) article.

Being used such scores was possible to proceed a comparative analysis between the Brazilian pork meat chain position and the pork meat chain of others countries (Table 5). The countries better ranked were Denmark with 14 points obtained among 15 possible points, and United Kingdom with 13 points. In intermediary positions meet Australia/New Zealand and Brazil, with 11 points obtained among the 15 possible points. Japan obtained the fifth largest score with 9 points. With the smallest scores are United States and Canada with 8 points obtained among the 15 possible points.

In synthesis, Brazil is an intermediary position between the analyzed countries regarding the availability of TTA Programs. The countries with larger availability than Brazil are Denmark, United Kingdom and Australia/New Zealand. In inferior positions to Brazil are Japan, Canada and United States. We can classify the position occupied by Brazil as reasonable, but the effective implementation of the TTA Programs, as stated previously, shows that there is a lot to be done so that this level is reached

Table 5. Scores obtained by selected countries comparing the availability of TTA programs.

Item	United Kingdom	Denmark	Canada	EUA	Japan	A/Nz[1]	Brazil[2]
Traceability							
Complete traceable	0	0	0	0	0	0	0
Farmer traceable	1	1	0	0	0	1	1
Processor traceable	1	1	0	0	1	1	1
Distributor traceable	1	1	1	1	1	1	1
National origin traceable	1	1	1	1	1	1	1
Sub-total	4	4	2	2	3	4	4
Transparency							
Farmer transparency	1	1	0	0	0	0	0
Processor transparency	1	1	1	1	1	1	1
Distributor transparency	1	1	1	1	1	1	1
National transparency	0	1	1	0	0	1	1
Subtotal	3	4	3	2	2	3	3
Assurance – food safety							
Farmer assurance	1	1	0	0	0	0	0
Processor assurance	1	1	1	1	1	1	1
Distributor assurance	1	1	1	1	1	1	1
Sub-total	3	3	2	2	2	2	2
Assurance – quality							
Farmer assurance	1	1	0	0	0	0	0
Processor assurance	1	1	1	1	1	1	1
Distributor assurance	1	1	0	1	1	1	1
Sub-total	3	3	1	2	2	2	2
Total score	13	14	8	8	9	11	11

[1]A/NZ = Australia and New Zealand; [2]Research Data.
Source: research data fro Brazil and results obtained by Liddell and Bailey (2001, p. 298) for others countries.

indeed.

Conclusion

Based on the obtained results, can be observed that the Liddell and Bailey' model could also be applied to the Brazilian Exporter Pork Meat Chain with satisfactory results in terms of measuring the TTA System implementation along the production chain. It was also possible to move forward in terms of the applied model, bringing a contribution in the sense of facilitating the measuring of the effective level of implementation of the TTA Programs along the marketing chain.

Besides the objectives proposed for this research, was observed that BEPMC disposes of TTA Programs that allow occupy an intermediary position in relation to other important "players" in the world market of pork meat. However, some weaknesses were detected and, in this way, some actions can be suggested: to develop actions addressed in the sense of strengthening the presence of TTA Programs at farmer level; to strengthen programs, as PAS, that seek to integrate all actors of the marketing chain; to turn clear and available to the public the procedures, norms and practices adopted in production processes and to integrate both the public and private agencies in the sense of activating the implementation of the traceability, transparency and assurance practices.

As can be seen, the effective implementation of the TTA Programs is not uniform along the BEPMC stages. While some actors at certain levels of the marketing chain meet in advanced phases of use of those programs, incorporating them to all the practices along the production process, other actors meet distant from that integrated vision of implementation. This observation proposes the need of actions that seek to activate this process. Fits to highlight the needing for improve the performance of private companies in the coordination of action activities integrated in this process through certification processes, to example than it is observed in other countries as in United Kingdom, for instance, where ABM possesses a strong performance (ABM, 2003).

The comparative analysis of the competitiveness of BEPMC based on the focus of the availability of TTA Programs indicates that Brazil meets in an intermediary position. However, actions that seek to implement the available programs of food safety are essential for a larger insert of BEPMC in the world market. As can be noticed, exists a wide field of possibility and alternatives to be worked in a reduced space of time and that is vital for the marketing chains that intend to play an important role as a big player in the international pork meat market.

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