

Brazilian Beef Export: Traceability as a Production Chain Management Tool

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Abstract— This study aimed at searching the Brazilian beef production chain actors perception about SISBOV and the consequences that traceability system has brought to the Brazilian beef producers exporting to the EU. For that purpose it was used the Collective Subject Discourse qualitative methodology, tool that allows making it known the collective opinion about a specific subject. The survey was based upon a sample of thirty-four persons, both genders, most of them with a high level of education, belonging to five different categories of actors related to the cattle production in Brazil: farmers, slaughterhouses, certifying companies, class associations and governmental regulatory organizations. Results have shown that SISBOV is perceived as a feasible traceability system for wealthier farmers dealing with exports, considering the critical costs for certifying the farms without revenue guarantee, due to the slaughterhouses monopoly power. As an advantage, SISBOV is perceived as a better way of managing the farms, promoting the cattle sanitary quality. Nevertheless, it must be pointed out that the traceability exigencies from several countries put together tariffary barriers that contradict the free trade approach, also taking into account the lower disease prevalence in extensive cattle growing as it is observed in Brazil.

Index Terms— Beef, Exports, Management, Traceability

INTRODUCTION

Problems related to food safety, associated to animal health, such as the avian influenza and the “mad cow disease” (Bovine Spongiform Encephalopathy – BSE), were highlighted throughout the 1990’s and ended up by influencing not only the consumers perception about the quality of livestock based food, but also the international trade policies of many countries. The European Union (EU) for instance, established several exigencies to be met by the products imported by that region, due to the international episodes involving traded contaminated beef¹.

From that perspective and in order to export to countries demanding traceability in the beef production chain, it was developed and instituted in Brazil, in 2002, the Brazilian

System for Cattle and Buffalo Identification and Origin Certification: SISBOV^{2,3}.

According to the last review it is now named Cattle and Buffalo Identification and Certification System, with the same previous initials⁴.

Adhesion to SISBOV is mandatory to beef exporters to countries demanding traceability and it is voluntary to producers dealing with other markets, including the domestic one¹. The adhesion implies investments in a group of controls and information technology in the cattle raising link of the beef production chain, increasing that activity management complexity, besides the costs as far as the producers are concerned. On the other hand, the system operation needs nationwide coordination and control, considering the livestock production size, its heterogeneity and geograpical distribution, taking into account the continental dimensions of the country⁵.

SISBOV structure may generate data and documents required by the EU rules and other markets that demand traceability in the beef production chain⁶. However, that system did not prevent the Brazilian beef exports embargo by the EU in 2005⁷, neither the decline in the exports of that product during the second half of the first decade of 2000⁸. Furthermore, the system did not restrain the arguing about the Brazilian beef quality, neither the announcement of imports suspending by Japan, South Africa and China due to a specific case of an animal contaminated by BSE, in a southern state, in 2010, which was confirmed only by the end of 2012⁹.

The Brazilian cattle raising is developed in a complex institutional environment, aiming at increasing the market share in the international trade, even though the producers adhesion to SISBOV is very low¹⁰. Thus, the objectives of this study were to search the Brazilian beef production chain actors perception about SISBOV and the consequences that traceability system has brought to the Brazilian beef producers exporting to the EU.

A. Traceability in the production chain and the beef safe offer

Concerning the food industry, the traceability concept has always been related to production aspects, aiming at the follow-up and control of all links of the production chains, since the beginning of the production, up to the finished product offer^{11,12}.

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The traceability concept has been defined and discussed in several approaches. The *International Organization for Standardization* – ISO defines traceability as “the ability to follow-up any food item through all steps of its production, processing, transportation and distribution”¹³. Another definition, more specific as far as the involved items, is the one which is adopted by the EU, mentioning that “traceability is the ability to follow-up any food product, feed, animal for food production or substances that will be used for consumption, through all steps of production, processing and distribution”, according to Regulation (CE) 178/2002¹⁴.

Traceability systems are tools used in order to get improvements in the levels of safety, quality control, fraud situation detection, complying with consumers demands, alignment with international market standards and also in the management of complex logistic chains^{15,16}. They are structured to allow the products origin identification, as well as the raw materials used in their production¹⁷.

As far as the food industry is concerned, three main objectives for the use of traceability systems come up: to improve the supply chain management, to increase the safety and quality control, and to offer food with qualified attributes¹⁸. Those objectives contribute to increase the company sales and net revenue, besides reducing the costs of distribution systems and returns related expenses.

For the cattle raising sector, traceability systems have been developed to improve the flow through the production chain, which helps to minimize occasional quality and safety related problems, allowing a follow-up of the links, from the farms to the retail market¹⁸.

Food (un) safety issues, observed in Brazil and worldwide during the years 1990, such as BSE, foot and mouth disease, avian influenza, promoted the mandatory establishment of traceability systems in several countries, under the government supervision¹¹. In Brazil, SISBOV, under the Agriculture Ministry (MAPA) responsibility, was instituted in 2002².

It is worth mentioning that in Brazil cattle raising is mainly extensive, involving pasture, and it is concentrated in few large and wealthier farms¹⁹. This kind of raising system reduces the incidence of diseases, such as BSE²⁰, probably the reason which led Brazil to grade 1 of BSE risk (BSE free zone)²¹.

In that context, the cattle raising system productive efficiency is leveraged by the adoption of prophylactic and sanitary procedures, considering the strict relationship between the occasional diseases and the environment where cattle is raised.

Cattle disease control depends on the balance of different production system elements, such as cattle handling, the amount of livestock raised in confinement and extensively, the geographical area where they are raised, among others²².

Traceability in the food industry and in the food production chain may be also seen as part of the competition and differentiation strategies among companies, promoting their reputation, besides guaranteeing the offered products origin. It

may be also related to consumers interests by promoting safe food offer, contributing to protect the population health^{23,24}.

B. SISBOV

Internationally, in the food sector, the establishment of traceability systems appears as a way of integrating processing and production principles and practices¹², through rules and standards which may be used by different markets, promoting traded products quality, production and safety.

In 2002, by Normative Ruling (NR) n.1 of January 9, the Agriculture Ministry instituted the Brazilian System for Cattle and Buffalo Identification and Origin Certification, SISBOV^{2,1}.

Designed to guarantee the Brazilian beef export accreditation to the EU²⁵, SISBOV embraces in its structure a data bank with detailed about the cattle, how it is handled, and its moving within the country².

Due to the extension and scattering of the domestic cattle production, the system counts, for its operation, on the support of a nationwide network of certifying companies which control and guarantee the livestock identification, the farms and slaughterhouses documents, besides the cattle tradings and transfers.

SISBOV comprises all national territory, being voluntary to beef producers for the domestic Market, even though it is mandatory for exporters dealing with countries which require traceability, such as the EU.

An analysis of its structure and adhesion requirements has shown its adjustments to the exigences of that market, contributing to reduce information asymmetries and uncertainties, and making it feasible to obtain finished products differentiation⁶.

C. Cattle traceability: farm management tool

Planning, organizing, managing and controlling are considered basic functions of farm administration²⁶.

Taking that statement into account and as far as livestock traceability is concerned, it must be pointed out the need of intensifying the farms management, as well as the establishment of livestock strict control, in a fast and proper way, through their individual identification²⁷.

Traceability is a managing and controlling tool, which allows follow-up of cattle raising, breeding, pasture, nutritional, sanitary and genetic aspects²⁸.

Those procedures are fundamental for cattle performance assessment, by means of livestock identification and record of events and handling practices, which supports managerial decision-making²⁹. Whenever a cattle traceability system is adopted by a farm where there is no formal control, or the existing controls are carried out in an inefficient or incomplete way, it enables livestock zootechnic and administrative control, promoting improvement in the sanitary control, and furthermore, in the sector productivity^{30,31}.

II. METHODOLOGICAL PROCEDURE

This study is based upon the Collective Subject Discourse (CSD), which consists in a way of representing the collective opinion about a certain subject or phenomenon that takes place in a specific society or culture³².

Thus, in order to get the collective thought, the persons are individually asked to show their opinion, without any psychological or social influence of the group. For that purpose, the CSD methodology deals with the obtained answers by classifying them according to the identification of the subjects, based on the following methodological figures: Key-expression (KE) and Main Idea (MI), which are used in the processing of the statements and further obtention of the CSD³³.

The following groups of economical agents involved in cattle raising for export were intentionally chosen, making up a convenience³⁴ non-probabilistic³⁵ sample, by spontaneous adhesion: owners of cattle raising farms of any size, slaughterhouses affiliated to the Beef Export Companies Brazilian Association (ABIEC), certifying companies involved in certifying cattle raising farms for export, class associations directly related to beef production chain actors, governmental regulatory organizations, such as the Health and Agriculture Ministries, dealing with food inspection and control, including beef and beef based products.

The adopted exclusion criterion for this survey was the elimination of answers not related to the proposed question, as well as respondents who did not belong to the selected categories.

It was used the electronic way to send out invitations to take part in the survey, as well as the instructions to fill out the questionnaire, using the software *QLQT On-Line*, version 1.0.

The nationwide survey was carried out during October and November, 2011. For the objectives of this study the answers to two proposed questions were analysed: one of them about the Brazilian beef production chain actors perception about SISBOV, and the other one concerning the consequences that traceability system has brought to the Brazilian beef producers exporting to the EU.

III. RESULTS

The study has been based upon a sample of thirty four persons (around 8,0% of the total sent invitations, belonging to five different categories of actors related to the cattle production in Brazil. Among the respondents, 85% were men, 47,0% were farmers, and 97,0% had a college degree or higher education, pointing out a high level of education, which is highlighted by their positions, most of them being veterinarians/zootecnicians (41,0%), followed by engineers (24,0%).

One of the proposed questions aimed at identifying the perception of the Brazilian beef production chain actors about SISBOV. The analysis of answers to that question led to the identification of five categories of MI. They are: 1) Correct explanation about SISBOV, 2) Mistaken explanation about

SISBOV, 3) Negative opinion about SISBOV, 4) Positive perception about SISBOV, 5) No knowledge about SISBOV.

Most of the answers (51,3%) indicate a correct explanation about SISBOV, pointing out its institutional aspects, the production chain control, farms certification, livestock traceability, and the alternative ways of adhesion.

Around 8,0% of the answers presented mistaken explanations, considering the origin identification of the beef offered by the slaughterhouses as one of the main objectives of the system, followed by the elimination of failures in the livestock moving and sanitary control, besides the inspection of identification earrings use. Those aspects are not aligned with SISBOV purpose which is the establishment of rules for beef production with origin and quality guarantee, for which the adhesion is mandatory only to export to markets demanding traceability³⁶.

As far as the negative opinions about SISBOV are concerned, 33,0% of the answers point it as an inappropriate system to the Brazilian reality and livestock production, involving high costs, without any additional revenue to producers. The system is also perceived as badly structured, and that due to the fact that it had concept and operation failures in its conceiving, its rules had to be reviewed twice since its beginning.

The positive perception about SISBOV, noticed in only 5,0% of the answers, is based on the importance of the system to lead to a full control of the livestock and the offered beef.

The second proposed question referred to the consequences SISBOV has brought to Brazilian beef producers to export to the EU.

The analysis of the answers enabled the identification of four categories of MI: 1) Good consequences SISBOV has brought to Brazilian beef producers to export, 2) Bad consequences SISBOV has brought to Brazilian beef production to export, 3) Being registered at SISBOV is not enough to supply beef to export, 4) Without any opinion of the consequences SISBOV has brought to Brazilian beef producers to export.

The answers that indicated good consequences brought by SISBOV to the Brazilian beef producers to export stood for 34,0% of the total of answers, and pointed out that SISBOV promotes productivity increase. The respondents also confirm it helps to improve the offered beef quality and safety, making feasible its exports, promoting the producers and the country credibility in the European Market.

However, the negative perception about SISBOV showed up in 57% of the answers. According to the respondents SISBOV turns the production more expensive, it is too bureaucratic and it does not guarantee additional revenue.

It was pointed out in 8,0% of the answers that SISBOV by itself is not enough to make it feasible to export to the EU. The respondents mentioned that the system is no longer the only exigence to export beef to that region. For that, besides implementing the system in their farms, the producers must register them in the TRACES LIST, an additional exigence

imposed by the European Market, since 2008, to import beef from Brazil.

IV. DISCUSSION

Brazilian producers interested in cattle raising to export beef have started, as of 2002, to manage their farms in a different way, due to the establishment of SISBOV².

The system has undergone two reviews, according to the NR n.17 of July 13, 2006³⁷ and NR n.65, of December, 16, 2009⁴, being the first one of them more significant – it determined the establishment of Farm Approved by SISBOV (ERAS), and the certifying companies audit frequency.

SISBOV requires controls, such as the Animal Identification Document (DIA), the livestock moving documentation, besides the documents related to livestock which is sold to slaughterhouses², among others. Another requirement which came up with SISBOV establishment for farms management was the used resource record³⁸, which contributes to improve the administrative processes related to the livestock production management.

Thus, SISBOV may contribute to minimize problems related to data gathering, to help in the livestock follow-up, to enable a procedure ruling for farms certification and traceability, promoting a more efficient management of the cattle raising to export to countries demanding traceability³⁹.

Despite the benefits for the farms management, the survey pointed out that traceability system adhesion leads to an increase in costs, mainly due to the need of adjustments in several administrative procedures and record instruments. On the other hand, traceability allows an increase in productive efficiency, due to a better allocation of available resources³⁷.

It must be noted that with SISBOV establishment in Brazil, traceability has become an incentive for the adoption of a systemic view in the livestock production chain, involving new Technologies for management, mainly information technology³⁹.

On that context, the related technology costs amortization may be obtained through a better product payment, considering the quality expected by the industry, or by obtaining an increase in the productive efficiency, based upon a production technology based management³⁹.

Those aspects were evidenced on the obtained answers, either related to the quality of the beef produced to export to markets demanding traceability, or in the contributions that the traceability system brings to livestock production management.

However, the low level of adhesion of Brazilian producers to SISBOV^{10,6} indicates that some mechanisms considered essential for cattle raising administration, such as the animals inventory, their individual identification, records of entry, depart, birth, and death occurred in the farms, use of medication, feed and diets, among others, are very expensive, discouraging the producers adhesion⁴⁰.

From the interviews carried out for this study, it was evidenced that there are restrictions for the producers to join that system, specially due to significant required investments, and further to that, there is neither guarantee of payment for the needed investments for livestock traceability, nor

financial return, due to the monopoly power of the slaughterhouses.

Furthermore, it must be considered that SISBOV establishment implies costs with employees training, technologic infrastructure, certifying companies payment, among others³⁷. Thus, only the wealthier producers may easily adjust to its rules.

It must be also pointed out that from the inspection and control perspectives, besides following up the Brazilian livestock for export, the animal moving and the producers economical activities, SISBOV promotes the government tracking of those activities, making it difficult for illegal practices, such as clandestine slaughter and tax evading.

The sector updating, carried out mainly due to export purposes, may have positive impacts on the production for the domestic market³⁷. The production excess, which is not exported, tends to be consumed by the local market, with improvement of the offered beef, and furthermore, contributing to the population healthiness^{23,24}.

The high level of complexity in the livestock production chain makes evident an information asymmetry situation among the various participants, especially between producers and slaughterhouses⁴¹. That asymmetry is mitigated in the slaughterhouses perspective and it is emphasized in the producers one, taking into account that the producers are kept dependent of their products buyers, the slaughterhouses.

Considering that approach, the great amount of producers scattered all over Brazil and the reduced number of slaughterhouses¹⁰ may set up an oligopsony situation^{42,43}, which was pointed out by the respondents, especially referring to the monopoly power obtained by the slaughterhouses when trading with the producers.

Despite the high costs involved in the farms adjustments to SISBOV exigences, the producers also point out that establishing a traceability system like SISBOV may contribute to improve the farms management, which leads to a better sanitary safety of the Brazilian cattle raising, improving the national livestock production⁴⁰.

V. CONCLUSION

As it is established in Brazil, even with a limited scope, SISBOV has been perceived as traceability system feasible to wealthier producers, dealing with beef exports to countries demanding traceability, as the European market.

Costs related to the farms certification for beef export have been considered critical by the producers who do not have any guarantee of additional revenue, because of the slaughterhouses market power when establishing the prices.

On the other hand, being potentially a tool to inhibit opportunistic behaviour among the different links of the beef production chain, some actors perceive SISBOV as a better way of managing the farms, promoting the cattle sanitary quality, and strengthening the Brazilian livestock production in the international Market. However, it must be mentioned that traceability exigences from several countries put together non-tariff barrier situations which question the free trade approach.

REFERENCES

- [1] R. E. Mendes, "O impacto financeiro da rastreabilidade em sistemas de produção de bovinos no Estado de Santa Catarina, Brasil", *Ciência Rural*, vol.36, no. 5, pp.1524-8, Sep.-Oct. 2006.
- [2] Ministério da Agricultura, Pecuária e Abastecimento. Gabinete do Ministro, Instrução Normativa n.º 1, de 10 de janeiro de 2002, "Institui o Sistema Brasileiro de Identificação e Certificação de Origem Bovina e Bubalina – SISBOV", *Diário Oficial da União*, sec. 1, pp.6, January 2002.
- [3] J. P. Velho, J. O. J. Barcellos, L. Lengler, S. A. Elias and; T. E. Oliveira, 2009, Feb. "Disposição dos consumidores porto-alegrenses à compra de carne bovina com certificação", *R. Bras. Zootec.*, online, vol. 38, no. 2. Available: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516-35982009000200025&lng=pt&nrm=iso.
- [4] Ministério da Agricultura, Pecuária e Abastecimento. Gabinete do Ministro. Instrução Normativa n.º 65 de 16 de dezembro de 2009, "Altera a denominação do Serviço de Rastreabilidade da Cadeia Produtiva de Bovinos e Bubalinos - SISBOV, que passa a chamar-se Sistema de Identificação e Certificação de Bovinos e Bubalinos – SISBOV", *Diário Oficial da União*, sec. 1, p.19, December, 2009.
- [5] M. A. Lopes and G. Santos, "Principais dificuldades encontradas pelas certificadoras para rastrear bovinos", *Revista Ciência e Agrotecnologia*, vol. 31, no. 5, pp.1552-1557, Sep.-Oct. 2007.
- [6] N. R. Furquim and D.C. Cyrillo, "Uma análise do Sistema de Identificação e Certificação de Bovinos e Bubalinos (SISBOV) em relação às exigências internacionais de rastreabilidade", *Rev Economia Administração*, vol.11, no.4, pp.482-505, Dec. 2012.
- [7] Agronoticias, 2005, "Febre aftosa: 41 países já anunciaram suspensão da compra de carne brasileira", website. Available: <http://www.agroportal.pt/x/agronoticias/2005/10/21h.htm>.
- [8] Associação Brasileira das Indústrias exportadoras de carne (ABIEC), 2011, "Exportações de carne bovina do Brasil", website. Available: <http://www.abiec.com.br/download/EXP%20JAN%20-%20DEZ%2010.pdf>.
- [9] Cenáriomt.com.br., 2012, "Mal da vaca louca pode demorar até dois anos para aparecer", Seção Agronegócio. Available: <http://www.cenariomt.com.br/noticia.asp?cod=256249&codDep=6>.
- [10] Ministério do Planejamento, Orçamento e Gestão. Instituto Brasileiro de Geografia e Estatística – IBGE, 2006, "Censo Agropecuário 2006". Available em: http://www.ibge.gov.br/home/estatistica/economia/agropecuaria/censoagro/brasil_2006/defaulttab_brasil.shtm.
- [11] G. S. Bennet, "Identity preservation & traceability: the state of the art - from a grain perspective (status of agricultural quality systems / traceability / certification systems)". PhD thesis, Iowa State University, Ames, Iowa, 2008.
- [12] B. Brown, "Maize to milk: An analysis of the traceability systems of bulk commodities". MSc Dissertation, Iowa State University, Ames, Iowa, 2009.
- [13] International Organization for Standardization (ISO), ISO 22005: 2007 – "Traceability in the feed and food chain - General principles and basic requirements for system design and implementation", 2007.
- [14] Regulation (EC) no. 178/2002 of the European Parliament and of the Council of 28 January 2002, 2002. Available: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:031:0001:0024:EN:PDF>.
- [15] E. H. S. Resende and M. A. Lopes. Boletim Agropecuário, "Identificação, certificação e rastreabilidade na cadeia da carne bovina e bubalina no Brasil", vol. 58, 2004.
- [16] M. A. Resende Filho, "Essays on economics of cattle and beef traceability". PhD thesis, University of Minnesota, 2006.
- [17] S. Dessureault, "An assessment of the business value of traceability in the Canadian dairy processing industry". MSc Dissertation, The University of Guelph, Ontario, Canada, 2006.
- [18] E. Golan, B. Krissof, F. Kuchler, L. Calvin, K. Nelson and G. Price, "Traceability in the U.S. Food Supply: Economic Theory and Industry Studies". U.S. Department of Agriculture, *Economic Research Service AER 830*, March, 2004.
- [19] A. O. Barcellos, A. K. B. Ramos, L. Vilela and G. B. Martha Jr., "Sustentabilidade da produção animal baseada em pastagens consorciadas e no emprego de leguminosas exclusivas, na forma de banco de proteína, nos trópicos brasileiros", *R. Bras. Zootec.*, vol.37, pp.51-67, 2008.
- [20] A. E. F. Marra, 2010, "Doença da vaca louca ou encefalopatia espongiforme bovina". Available: <http://rehagro.com.br/plus/modulos/noticias/ler.php?cdnoticia=1964>.
- [21] Scientific Steering Committee, 2002, "Geographical Risk of Bovine Spongiform Encephalopathy (GBR)". Available: http://ec.europa.eu/food/fs/sc/ssc/out243_en.pdf.
- [22] Empresa Brasileira de Pesquisas Agropecuárias (Embrapa), "Criação de bovinos de corte no Estado do Pará", *Sistemas de Produção*, vol. 3, 2006. Available: http://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/BovinoCorte/BovinoCortePara/paginas/manejo_san.html.
- [23] M. A. Resende Filho, "Essays on economics of cattle and beef traceability", PhD Thesis, University of Minnesota, 2006.
- [24] S. Pouliot, "Traceability and food safety: liability, reputation and willingness to pay", PhD Thesis, University of California, Davis, 2008.
- [25] F. M. SARTO, "Análise dos impactos econômicos e sociais na implementação da rastreabilidade na pecuária bovina nacional", Graduation Dissertation, Universidade de São Paulo, Escola Superior de Agricultura "Luiz de Queiroz", Piracicaba, 2002.
- [26] A. C. E. Neto, "Gestão de sistemas de produção de bovinos de corte: índices zootécnicos e econômicos como critérios para tomada de decisão", in *Simpósio de Produção de Gado de Corte*, vol.5, Anais..., 2006. Available: http://www.simcorte.com/index/Palestras/5_simcorte/simcorte2.PDF.
- [27] F. M. MARTINS and M.A. LOPES, "Rastreabilidade bovina no Brasil", in *Boletim Agropecuário da Universidade de Lavras*, Lavras: Editora da UFLA, 2003, 72pp. Available: www.editora.ufla.br/site/adm/upload/boletim/bol_55.pdf.
- [28] A. R. Scalco, T.R. Queiroz, J. G. Camargo and F. Machado, " Cenário da gestão da qualidade na cadeia produtiva da carne bovina: Estudo de casos", in *Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural*, vol. 46, 2008. Available: <http://ageconsearch.umn.edu/bitstream/110015/2/411.pdf>.
- [29] E. R. Valle (Org.), "Boas práticas agropecuárias: bovinos de corte", *Manual de orientações*, Campo Grande: Embrapa Gado de Corte, 2011. 69 pp. Available: http://bpa.cnpqg.embrapa.br/material/MANUAL_de%20BPA_NACIONAL.pdf.
- [30] D. D. Fernandes, "O impacto da implantação da rastreabilidade bovina na pecuária de corte do Pantanal de Mato Grosso do Sul: limites e oportunidades", in: Simposio sobre recursos naturais e sócio-econômicos do Pantanal, vol.4, *Anais...* Corumbá: Embrapa, 2004. Available: http://www.cpap.embrapa.br/agencia/simpan/sumario/artigos/aspectos/pad/socio/321SC_Fernandes_2_OKVisto.pdf.
- [31] G. A. C. Sánchez, "Sistema de rastreabilidade na gestão de empresas de bovinos de corte na região de Aracania do Chile", MSc Dissertation, Escola de Administração, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2010.
- [32] F. Lefèvre and A. M. C. Lefèvre, *Pesquisa de representação social: um enfoque qualitativo – a metodologia do Discurso do Sujeito Coletivo*, Brasília: Liber Livro Editora; 2010.
- [33] L. Bickman and D. J. Rog, *Handbook of applied social research methods*, Thousand Oaks: Sage, 1997.
- [34] A. Fink, *How to sample in surveys*. Thousand Oaks: Sage, 1995.
- [35] Ministério da Agricultura, Pecuária e Abastecimento. *Cartilha do novo serviço de rastreabilidade na cadeia produtiva de bovinos e bubalinos – SISBOV*, Brasília: SDC/ABIEC/CNA/ACERTA, 2006.
- [36] Ministério da Agricultura, Pecuária e Abastecimento, 2006, "Instrução Normativa n.º 17 de 13 de julho de 2006", Available: http://www.camara.gov.br/proposicoesWeb/prop_mostrarintegra?jsessio=nid=774E9A99F81467059BCB91E88C525711.node1?codteor=539309&filename=LegislacaoCitada+-PDC+477/2008.
- [37] H. Cócero and J. C. S. Jesus, "Impactos da implantação da rastreabilidade bovina em empresas rurais informatizadas: estudos de caso", *Revista de Gestão da Tecnologia e Sistemas de Informação*, vol.4, no.3, pp.353-74, 2007.
- [38] V. M. B. Lima, C. T. Bornstein and H. L. Cukierman, O programa brasileiro de rastreabilidade da produção de bovinos – revisão e análise crítica. *Estudos Sociedade e Agricultura*, vol.14, no.1, pp. 49-87, 2006.
- [39] J. G. C. Machado and J. F. D. Nantes, "A rastreabilidade na cadeia da carne bovina", *I Congresso luso-brasileiro de tecnologias de informação*

e comunicação na agro-pecuária, Santarém, Portugal, 2004. Available: http://www.agriculturadigital.org/agritic_2004/congresso/Seg_e_Qual_Alim_Rastreab/A_Rastreabilidade_na_Cadeia_Carne_Bovina.pdf.

- [40] R. O. Gomes, "Rastreabilidade bovina direcionada para o gerenciamento da propriedade rural: controle nutricional e sanitário", Graduation Dissertation, Faculdade de Veterinária. Universidade Federal do Rio Grande do Sul, 57 pp., Porto Alegre, 2012.
- [41] F. S. P. Urso, "A cadeia de carne bovina no Brasil: uma análise de poder de mercado e teoria da informação", PhD Thesis, Fundação Getúlio Vargas, São Paulo, 2007.
- [42] R. S. Martins, D. Rebechi, C. A. Prati and H. Conte, "Decisões estratégicas na logística do agronegócio: compensação de custos transporte-armazenagem para a soja no estado do Paraná", *Revista de Administração Contemporânea*, vol. 9, no. 1, 2005. Available: http://www.scielo.br/scielo.php?pid=S1415-6552005000100004&script=sci_arttext.
- [43] L. Golani and R. Moita, "O oligopsonio dos frigoríficos: uma análise empírica de poder de mercado", *Inspere Working Paper, WPE: 228/2010*, 2010. Available: http://www.insper.edu.br/sites/default/files/2010_wpe228_0.pdf.



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