Measuring consumer perceptions over beef good practices and sustainable production process

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Abstract

Purpose – Information on scales for measuring dimensions related to consumer concerns over production processes is scarce in the literature. The purpose of this study was to develop a more comprehensive scale for measuring concern over the production process (CPP).

Design/methodology/approach – The authors derive the concept based on the results of a bibliographic review, existing certification criteria, an interview with five experts and two consumer focus groups. The authors interviewed 725 frequent beef meat consumers to test the scale.

Findings – Statistical tests and purification yielded a final scale with 18 items and six latent variables: animal welfare, traceability, social responsibility, environmental responsibility, legality and sanitation in slaughterhouses. The authors confirmed the nomological validity of the instrument using product involvement as an antecedent construct and attitude related to sustainable consumption as a consequent of CPP.

Research limitations/implications – The research results may lack generalisability. New research avenues are suggested for testing the scale in other cultural contexts and with different groups of consumers and food types.

Practical implications – This study provides insights for cattle ranchers, the industry and the retail sector in formulating communication strategies and product/brand positioning in response to consumer concerns about the production process.

Originality/value – There is no study at present that fully addresses the use of a scale to measure dimensions of production processes. The creation of the CPP scale is a relevant academic contribution that aids in assessing the influence of the environmental dimension in conjunction with other essential constructs.

Keywords Scale development, Beef, Consumer behaviour, Certification, Production process, Brazil

Paper type Research paper

1. Introduction

Rising incomes in Brazil have allowed more consumers to buy meat more frequently. Total red meat consumption in Brazil was 7,652 tonnes in 2016 and is expected to reach 8,045 tonnes in 2020 and 8,853 tonnes in 2028 (USDA, 2020). Consumers have satisfied their basic food needs and have now begun to consider the importance of additional factors. The main factors that influenced consumption of eco-innovative food in this sample were the attitude towards eco-innovative food, attitudes towards food production, intention of buying eco-innovative food and frequency of purchase (Bossle *et al.*, 2015). Consumers are now moving towards sophisticated products that

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meet their needs and expectations. Brazilian meat intake corresponds to 151.8 g/day, more than fruits (86.1 g/day), vegetables (24.6 g/day) and legumes (40.7 g/day) (Avila *et al.*, 2016).

Both the market and academia now understand that the concept of seals, as well as certifications of origin, food safety and unique product characteristics (e.g. pesticide-free) are increasingly valued by consumers. Economic benefits to certified farmers may include greater on-farm efficiency, new or more secure market access, or price premiums (Alves-Pinto *et al.*, 2015). Nonetheless, studies show that consumer knowledge in these areas is below desired levels (Boccaletti and Nardella, 2000; Oliveira and Spers, 2018).

When buying food, consumers come across myriad products that are differentiated by unique attributes. Traditionally, *price* and *brand* have been perceived as the most obvious attributes (Sharp, 2010). However, the past few decades have witnessed the emergence of products with food attributes and claims, including signs of quality (such as the protected designation of origin) and information on organic origin. More recently, newer claims have been used to add value to a product; these include *fair trade*, *low carbon footprint (CF)*, *natural*, *biodynamic*, *animal welfare* and indicators for *sustainable consumption* (Grunert *et al.*, 2004; Sirieix *et al.*, 2013). Additionally, sustainable consumption can be the result of a decision-making process that considers not only the individual needs of consumers (taste, price and convenience) but also attitudes towards social responsibility (environment and fair trade), sustainable labels and sustainable food production (Stranieri and Banterle, 2015; Vermeir and Verbeke, 2008; Hartikainen *et al.*, 2014).

In this study, we chose beef as our product for examination because of its relevance to sustainability in the Brazilian food sector. Brazil is also one of the largest global producers of beef. In 2016, cattle production generated 7% of Brazil's gross domestic product (US$130bn), with almost 80% of the beef produced being consumed by the local market (ABIEC, 2018). Cattle breeding is one of the main factors in the expansion of the national agricultural frontier; it is also the main source of deforestation and greenhouse gas emissions (GHG) in the sector, accounting for 69% of total agricultural sector emissions (SEEG, 2018). Deforestation and forest fire rates have increased in Brazil recently, and traceability and environmental issues have become relevant elements of the production process addressed amongst major stakeholders in the beef supply chain. The beef sector must thus focus on consumer behaviours to improve sustainability and develop strategies that will lead to compliance with legislation relevant to these demands.

In the sustainable production of food, initiatives have been carried out to encourage farmers to adopt *good agricultural practices*. Drigo (2013) states that producers are not interested in adhering to production standards and a certification system that will conform to good practices without clear economic benefits – that is, without a premium price for the *quality* that will be certified. On one hand, producers demanded a differentiated price as an incentive in the production of animals within good socio-environmental practices. On the other hand, slaughterhouses and retailers launched campaigns to make the security of the meat's origin more tangible. However, we are faced with a sobering reality – neither party is willing to pay more for *sustainable beef*. In this case, quality is the means for obtaining this premium remuneration. Drigo (2013) noted that, consequently, ranchers are combining beef quality with environmental efforts in order to break into niche markets.

This paper contributes to the literature of quality cues that have been discussed in the study by Northen (2000). His research indicates that farm assurance schemes are shown to affect credence attributes in meat; hence extrinsic cues must be used to signal these standards. Northen concluded that the credibility of scheme standards and inspections for validating those standards is of crucial importance for the extrinsic assurance scheme cue (certificate/label) to be effective in predicting these credence attributes. In this present study, we expect to provide contributions by developing an instrument (scale) that could address quality cues related to sustainability in the Beef production process.

There is currently no study that fully addresses a scale for measuring consumer perceptions over dimensions of production processes – a limitation that echoes the findings of earlier studies (Oliveira and Spers, 2018; Barcellos, 2007). Our scale considers effective sustainability actions in the food sector. It will allow scholars to analyse the consumer perceptions of the beef production process (animal welfare, traceability and socio-environmental responsibility), as well as, after measuring perceptions of these dimensions, relate them, in other experimental or modelling studies, to constructs of interest, such as willingness to pay and beef quality, including food safety attributes, and to consumer attitudes towards sustainable consumption.

The originality of this paper is addressed through: (1) Enhancing scales already validated in the literature covering general aspects of food production; (2) providing an opportunity to apply this scale in future food choice studies and (3) contributing to public policies and private communication strategies related to better perception/measuring the food (meat) production process.

Measuring a phenomenon properly is a fundamental step in the process of building scientific knowledge, whether due to the possibility of identifying and describing the data, or because of the possibility of relating the phenomenon to other variables of interest.

Measurement has received more and more attention in different research areas, such as business (i.e. Barbopoulos and Johansson, 2017), marketing (i.e. Morales *et al.*, 2017), psychology (i.e. Gearhardt *et al.*, 2016), tourism (i.e. Fatma *et al.*, 2016) and food (i.e. Lahne *et al.*, 2017). This paper does not employ a deductive approach that is concerned with developing and testing hypotheses. Unlike hard sciences, which deal with directly observable variables, behavioural sciences need to develop scales that will measure constructs from statements about the dimensions that make up the phenomenon.

Our scale measures concerns, or more specifically, consumer perceptions regarding tangible aspects of the beef production process, which address both aspects specified in agricultural agency regulations and specific consumer behaviour constructs. Some variables of the construct *concerns over production process* are addressed in the literature albeit incompletely. Norms and certifications are not always considered by the consumer. The contribution of this study is to obtain a perspective that complements the technical perspective with the consumer's perception. Our challenge is to test and offer a scale that has adequate levels of reliability, that is, it has the ability to reproduce a result consistently over time, considering the subject and object analysed, and validity, which is the guarantee that the scale measures the phenomenon it is intended to measure. Thus, the *concern over the production process* (CPP) scale is a relevant academic contribution that helps researchers to measure consumer perceptions of the meat production process with appropriate precision and, subsequently, using that measure, to establish causal relationships with other constructs of interest.

The CPP scale can be used in proposing new conceptual models of behaviour by meat consumers, as well as assisting in experiments in which the attributes addressed by the scale are being investigated. This study thus provides insights for cattle ranchers, the industry and the retail sector in the formulation of communication strategies and product/brand positioning in response to consumer concerns about the production process. For instance, a specific beef brand could include and communicate attributes related to production process (animal welfare, Carbon Neutral Beef, full traceability guaranteeing food safety, etc). Given that our scale is capable of adequately capturing the consumer's perception of relevant attributes of the beef production process, it measures the tangibility of these benefits as well as the appreciation of them by the end consumer, which can lead to a premium remuneration for ranchers, industry and retailers. Thus, producers would be more stimulated to adopt good social and environmental practices and be compensated for that.

We followed the approach in Mackenzie *et al.* (2011) for measuring and validating constructs in order to develop the CPP scale. For further details, see Figure 1.

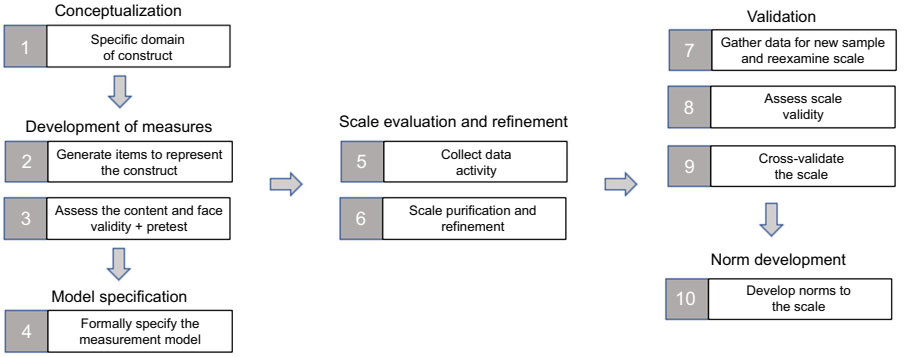


Figure 1.
Scale development and validation

Source(s): Adapted from Mackenzie *et al*. (2011)

2. Literature review

Our literature review is divided into two main sources. We first present successful initiatives involving good practices and certification in the Brazilian beef sector. Next, we address issues related to sustainable production processes and existing certification criteria for cattle raising. We conclude by analysing studies related to sustainable production processes including animal welfare, traceability, legality, food safety and sanitary conditions, and social and environmental responsibility. Those studies are related to elements of the production process that have also been considered in food certification systems (i.e. UTZ, 2017).

2.1 Good practices and certification criteria

The following are initiatives of good practices and socio-environmental certification criteria for Brazilian livestock (Good Agricultural Practices – Beef Cattle [BPA], Brazilian Roundtable on Sustainable Livestock [GTPS] and Rainforest Alliance), which were the basis for our CPP scale.

BPA, from the Brazilian Agricultural Research Corporation (Embrapa) and partners, was created over a decade ago, and the exercise of developing and promoting the implementation of good practices in the beef supply chain introduced new concepts to rancher routines. BPA seeks to adapt the *farming and ranching sectors* to technologies and production practices for efficiency and sustainability, which are all critical to the agricultural sector. This Good Agricultural Practices system is widely accepted in the Brazilian beef supply chain, especially amongst the major players. It has since become a reference for quality and good socio-environmental certifications systems in this sector.

Initiatives in tracing beef for export, especially in the European Union, have helped to meet the food safety expectations of international consumers. To ensure food quality and safety, consumer groups, non-governmental organizations and supermarket chains in the national and international meat trade have demanded that their suppliers implement quality control processes with certification of products offered based on market requirements and standards. BPA thus mandates the implementation of good practices in the field, as well as in the industry and the overall beef production supply chain. Another market requirement is the sustainability of production systems – that is, adherence to environmental laws is economically viable *and* guarantees animal welfare.

The main control activities under BPA are farm management, farm social function, human resource management, environmental management, rural facilities, pre-slaughter management, animal welfare, pasture management, food supplements, animal

identification and traceability, and sanitary control and reproductive management. BPA has evaluation criteria for each of these areas. The descriptions of these criteria were used to create the proposed scale.

The Rainforest Alliance certification system (Sustainable Agriculture Network, 2010) is one of the most widely recognised certification systems in the sustainable agriculture sector. Support strategies help in improving farming practices and management systems, as well as in increasing farmers' knowledge. At the same time, these aspects aid in conserving biodiversity, natural resources, productivity and resilience of farms, as well as in improving the livelihoods of producers and workers.

The Rainforest Alliance standard promotes the three pillars of climate-intelligent agriculture: sustainably increase productivity and farming practices; adapt and develop resilience to climate change; and reduce or eliminate greenhouse gas emissions where possible (Rainforest Alliance, 2017). Some of the important issues covered in this certification system include animal welfare and management; food; sanitation, traceability, sustainable pasture management and phytosanitary treatments; waste and pollutant management; environment; employee training; employee health and safety; and employee well-being and social aspects.

Another institution that works with socio-environmental practices in Brazilian livestock is the Brazilian Roundtable on Sustainable Livestock (GTPS). In 2018 this organization established an Indicator Guide for Sustainable Livestock production (GIPS). The objective of GIPS is to provide guidance on the meaning of sustainable livestock. It encourages all stakeholders in the beef supply chain to improve their practices for sustainability through self-assessment tools for continuous improvement, with different performance stages, applicable to all members of the Brazilian beef supply chain and published in an auditable format. The activities covered by the GIPS include five principles: management and support for the production sector, communities, workers, environment and supply chain (GTPS, 2008).

2.2 Sustainable production process

Next, there are issues related to sustainable production processes that analyse studies related to animal welfare, legality, traceability, food safety and sanitary conditions, and social and environmental responsibility. Products reflecting sustainability processes and supply chain practices are distinguished by their credibility attributes; these are characteristics that each entity in the supply chain cannot readily discern when examining or consuming a product (Golan *et al.*, 2004). Credibility attributes are both physical and process related. A process attribute refers to characteristics in the production or supply chain, such as country of origin, fair trade and labour ethics (Golan *et al.*, 2004). To impact the market, the processes of creating products with credibility attributes must be guaranteed throughout the supply chain and communicated to the consumer. Northen (2000) demonstrated that there are several categories of physical product attributes, in addition to process attributes. By splitting attributes into those categories, it was shown that process attributes (e.g. animal welfare, organic production, traceability) and several types of product attributes (e.g. some food safety and nutrition attributes) should be defined as "credence" in nature. Some studies referring to relevant areas of the food production process will be discussed below and serve as the basis for CPP scale.

2.2.1 Animal welfare. Grunert *et al.* (2004) argued that consumer concerns about food production have increased in recent years in most European countries, especially in three areas: organic production, animal welfare and interest in products manufactured "naturally" (i.e. without the use of advanced technology). The quality attributes related to the production process have credence characteristics, since the consumer will hardly be able or willing to evaluate the stated conditions in the production of a certain meat. Characteristics of the

process can "influence the formation of quality expectations more as an indicator of overall quality than as a singular attribute" (Grunert *et al.*, 2004, p. 271).

In her cross-cultural research, Barcellos (2007) raised the issue of consumer concern for animal welfare and protection of the environment. The results show little concern for animal welfare amongst Brazilians and Australians. The concern for environment preservation tended to be a priority for Brazilians and Australians (2nd) and the Dutch (1st). Barcellos (2007) included a question to survey consumer concern regarding the use of slave labour. The possibility of using slave labour on beef cattle farms in Brazil was a concern for 73.8% of those interviewed in Brazil.

Chini (2015) investigated consumer values in animal production, as well as expert opinions on how beef produced in pasture areas could be a differential. The signal attribute – animal welfare – was extensively discussed in this work, especially because it is an attribute related to the meat production process. In this case, pasture-raised animals represented animal welfare.

Another study that addresses animal welfare was carried out by Souza *et al.* (2013) to properly understand the reactions of consumers to animal mistreatment in the industrial processes of meat production. The study shows that a seal guaranteeing the absence of maltreatment in the meat production process could be accepted by the consumer market if the public were correctly informed about differences in animal welfare standards. Because meat is a commodity, some countries have labelling schemes. The *main* criteria certified in these schemes include traceability, a guarantee of origin, employee management, food safety and hygiene, and animal welfare.

2.2.2 Traceability. Scholars have discussed the level of knowledge that consumers have of the food production process within the boundaries of different constructs. Hanf and Kühl (2005) argued that quality, in consumer understanding, is a construct with multiple attributes, and they considered orientation throughout the process as one of the main dimensions of the quality control system. That is, the production system must be explicit: "from farm to fork". The authors noted that "providing traceability information and having a transparent production chain becomes a competitive necessity" (Hanf and Kühl, 2005, p. 179).

Amongst means for identifying traceability, scholars have used the term "traceable to the farm" (Caracciolo *et al.*, 2010; Cicia and Colantuoni, 2010; Loureiro and Umberger, 2007; Lusk *et al.*, 2003). Wu *et al.* (2017) tested traceability by including product traceability information at three levels: (1) no traceability information (*NOTRACE*), (2) traceability to slaughter/processing (*LOTRACE*) and (3) traceability to the farm (*HITRACE*).

A meta-analysis of consumer behaviour regarding meat traceability conducted by Cicia and Colantuoni (2010) summarizes the extensive consumer willingness to pay (WTP) literature on this attribute. This work demonstrated that consumers across countries consider attributes related to traced meat to be a higher priority. According to these researchers, food safety, field traceability and animal welfare are the attributes most requested by consumers. They consider this information important enough for the industry to establish premium prices for products with different levels of traceability. Caracciolo *et al.* (2010) suggested that an important attribute is "traceability to the farm." In this case, the premium price would be between 11 and 16.4%, so the consumer would be informed about the production steps of the meat from "farm to table."

Stranieri and Banterle (2015) carried out a study to understand consumer attitudes towards the origin of the meat by considering information present in the product label. Their results indicate that most consumers showed high interest in different information on labelled meat. The variables of traceability, certification, freshness and shelf-life were important in the model studied by these authors.

The importance of traceability was analysed by Wu *et al.* (2017). They interviewed Chinese consumers for their preferences towards traceable pork. The results showed that

consumers had the highest WTP for traceability certification. Despite heterogeneity amongst the consumer groups, all exhibited some positive WTP for the local product attribute in traceable pork. Therefore, it is beneficial to include source labelling during the launching of traceable food markets in China.

Kraisintu and Zhang (2011) identified the benefits of traceability in each sustainability dimension. In the *economic dimension*, the factors that lead to economic sustainability were cost savings and increased profits; in the *social dimension*, traceability provided social sustainability, along with reducing, preventing and controlling harmful foods and, in the *environmental dimension*, traceability contributed to environmental sustainability, protecting environmental resources and preventing pollution. Traceability alone does not reduce the asymmetry of information on the credence attribute, but it is a necessary condition for controlling unobserved attributes, such as animal welfare and environment-friendly production (Cicia and Colantuoni, 2010).

The Brazilian Federal Inspection System (SIF) stamp is normally present on the packaging and on the meat itself, meaning that it comes from animals that were slaughtered at meatpacking plants authorized by the Federal Inspection Service (SIF).

Barcellos (2007), showed that the presence of the SIF stamp on meat was associated with product safety, while certification seals were more associated with meat quality. In view of the above, in the current study, the safety and confidence in meat origin is considered an important element of the production process, because it takes into account the traceability of the product and the confidence in relation to safety aspects of food production.

2.2.3 Food safety. Research indicates that consumer food choices have been more influenced by concerns about the impact of the food system on human health, namely, *food safety*. The perception of safe food appears to be a strong requirement in product choice. *Traceability* across all stages of the meat production chain then makes the quality of the product more *tangible*.

Consumer preferences and WTP for certification associated with credence attributes in relation to the preference for traceability and beef origin are also recurring issues in the literature (Umberger *et al.*, 2003; Verbeke and Ward, 2003; Lusk *et al.*, 2003). In fact, the spread of *mad cow disease* has led to increased debate on certification of origin, traceability and food safety inspection in consumer perceptions of food safety and quality. For example, Loureiro and Umberger (2007) studied American consumers and evaluated the attributes of the country of origin certificate, traceability and meat tenderness. The results prove that attributes related to "inspected food safety" have the highest average premium compared with the other three evaluated attributes. The authors state that "[. . .] traceability is necessary to verify credence attributes such as origin, so it is expected that the traceability of an animal will be valued by the consumer and would help maintain high reputation of American meat [. . .]" (Loureiro and Umberger, 2007, p. 510).

2.2.4 Legality. Most food certification systems consider legality as a baseline for having a sustainable product. Throughout the Standard for Rainforest Alliance system the underlined terms carry a specific definition for applicable law, as they "Include local, county, province, state or national law and that law which has been integrated into or legally deemed to be superior to national law by a state's signing of an international treaty" (RAS, 2017). These definitions are binding elements for criteria. Principle 4 of the RAS system has the following objectives and outcomes: Farms protect workers' rights, as defined by ILO core conventions. Farms do not use forced labour or engage in labour discrimination. The health and well-being of all workers (and young workers in particular) are protected, and minors below 15 years of age are not hired as farm workers.

Another well-known certification system, UTZ, involves several aspects of legality towards worker conditions. Respect for the rights of workers regarding freedom of

association, hours of work, wages and respectful treatment, and the non-use of forced or child labour are part of the UTZ certification criteria (UTZ, 2017).

Regarding legality for worker conditions Brazilian law has strong regulations that are used as a reference in most certification systems. The NR 31 covers Safety and Health at work in Agriculture, Livestock, Forestry and Aquaculture. This Regulatory Standard aims to establish the precepts to be observed in the organization and in the work environment, in order to make the planning and development of agriculture, livestock, forestry, forestry and aquaculture activities compatible with safety and health and the environment (Brazil, 2018).

A study conducted by Guimarães *et al.* highlights a set of different search, experience and credence attributes, which make measurement even more complex. Subjective and difficult-to-measure attributes may open the door to failures in food quality evaluation. Thus, the authors conclude that sustainability of a high-quality food chain demands appropriate measurement mechanisms and criteria, according to international protocols (Guimarães *et al.*, 2020). The greater the difficulty in measuring the attributes, the less transparent it becomes for the consumer. By proposing an instrument to measure the attributes related to the meat production process, we are providing elements for the consumer to assess the dimension of the legality of the production process.

Further in regard to legality, transparency in the food supply chain was indicated by Trienekens *et al.* (2012) as essential for guaranteeing food quality and provenance to all users of food and food products. The authors mention that intensified information exchange and integrated information systems involving all actors in the chain are needed to achieve transparency with respect to a multitude of food properties. Elements considered to be enablers of transparency are governance law mechanisms, quality and safety standards and information exchange. In this study legality appears as one of the relevant dimensions to be considered in constructing the CPP scale.

2.2.5 Social responsibility. Regarding consumer interest in social aspects, especially employee work conditions, Stöckigt *et al.* (2018) examined sustainability in online shopping deliveries and grocery shopping. Their results show that, in scenarios where certain information is accessible, sustainability-related attributes such as environmental impact and working conditions show higher-importance values in the decision-making process than most other attributes. In other words, consumers seem to base their decisions on sustainability-related attributes (when information is provided) as much as on price. This conclusion is in line with Rashid and Byun (2018), who concluded that a *Fairtrade* label on a product leads to a significant increase in attitude, purchase intention and brand trust compared with products without a tag informing about fair and environment-friendly conditions during production.

However, consumer environmental and ethical values towards production and their actual choices of products with such claims are mutually inconsistent. Ghvanidze *et al.* (2017) decided to examine this relationship; the choice of the product attributes – nutritional information, health benefits, ecological impact of production (produced with minimum chemical emissions) and social responsibility of producers (good working conditions for employees) – was based on an extensive literature review and the results of a pilot study. The results showed that product attributes emphasising the ecological impact of production and social responsibility of food producers are specifically valued by consumers with high levels of environmental consciousness and by those concerned about how goods are produced.

2.2.6 Environmental responsibility. Studies have also demonstrated the importance of concern for environmental responsibility in the production process. Organic and locally grown products have positive environmental impacts when they are associated with the reduction of GHG emissions required for production. Magistris and Gracia (2016) conducted a choice experiment on Spanish consumers to test their preferences for sustainable food products by examining products with reduced GHG emissions, namely, organic and locally

produced almonds. They showed that consumers were willing to pay a price premium for locally (less distant) and organically grown almonds but were not interested in paying a higher price for almonds that travelled long distances.

In the study by Carlsson *et al.* (2010) on common citizens' WTP for reducing CO_2 emissions, Americans generally seem to believe less in anthropogenic climate change compared with their Chinese and Swedish counterparts. They also found clear differences in the WTP between China, Sweden and the United States, rejecting the hypothesis of equality in WTP (for a given level of CO_2 reduction) between them. Sweden had the largest WTP, while China had the lowest. Thus, while the Swedes and Chinese have similar attitudes towards climate change, they differ considerably in their WTP for this attribute.

Echeverria *et al.* (2014) were the first to provide an analysis of the WTP in food labelling for CF in developing countries. Contrary to general belief, Chilean consumers responded well to the global warming issue. Although they were unfamiliar with CF, they wanted to receive more information on it and preferred foods with low GHG emissions. Furthermore, Chilean consumers showed a positive attitude towards CF, with a WTP that was 29% above the average price for milk and 10% for bread.

We next consider the consumer's degree of knowledge of the food production process, within the measurement of different constructs. In the study by Oliveira (2012), this construct is closely related to the perception of food safety. Thus, the author intended to access the degree of consumer knowledge on issues such as animal welfare, traceability and socio-environmental responsibility. In our work, we use these dimensions for evaluating and measuring the concern over production processes.

Summarising, the elements addressed by practical initiatives validated with literature review findings gave rise to six relevant aspects for the *concern of production process* scale: animal welfare, traceability, legality, social and environmental responsibility and food safety in meatpackers.

3. Material and methods

We adopted an exploratory sequential mixed method (Creswell, 2014), where the results of one phase of a study stage will serve as a substrate for the others. We used a mixed methods approach because of the incapacity of a single data source (e.g. only quantitative) to provide a complete solution to our problem. The application of qualitative and quantitative approaches together provides a more consistent solution to the problem than the use of a single approach. The Mackenzie *et al.* (2011) construct measurement and validation procedures were used to develop CPP scale (For further details, see Figure 1).

3.1 Specific domain of construct (Step 1)

We delimited the concept of the construct by using the results of the bibliographic review (Grunert *et al.*, 2004, 2011; Barcellos, 2007; Cicia and Colantuoni, 2010; Chini, 2015; Wu *et al.*, 2017; Caputo *et al.*, 2018; Oliveira and Spers, 2018), five in-depth interviews with five experts, and two focus groups with consumers and consultations with BPA (EMBRAPA, 2011), the Sustainable Livestock Indicators Guide of the GTPS (2008) and the Rainforest Alliance (Sustainable Agriculture Network, 2010).

3.2 Item generation (Step 2)

In this step, 36 items were generated from the bibliographical reviews conducted in *Step 1*. We then evaluated the adequacy of the items, and possible redundancies and problems of conceptual equivalence. At the end of this evaluation, we discarded 12 items, and divided the remaining 24 items into the six dimensions of the scale (see Table 1).

Second order variable	First variable	Items	References
Concerns over the production process	Animal welfare	4	Caputo *et al.* (2018), Chini (2015), Grunert *et al.* (2004)
	Traceability	4	Barcellos (2007), Cicia and Colantuoni (2010), Oliveira and Spers (2018), Wu *et al.* (2017)
	Legality	4	BPA norms; RAS; Imaflora
	Social responsibility	4	BPA norms; RAS; Imaflora; Ghvanidze *et al.* (2017), Stöckigta *et al.* (2018)
	Environmental responsibility	4	BPA norms; RAS; Carlsson *et al.* (2010), Echeverría *et al.* (2014), Magistris and Garcia (2016)
	Food safety concerns in meatpacking	4	BPA norms; RAS, Imaflora

Note(s): BPA: Good Agricultural Practices – Beef Cattle; RAS

Table 1. Concerns over production process scale source

3.3 Face and content validity (Step 3)

We prepared a pre-test on SurveyMonkey and sent the link to 40 beef consumers and five marketing professionals before applying the instrument. The respondents were instructed to read the questionnaire carefully and report any problems with spelling, meanings of statements and use of the measurement scale. The *marketing specialists* also validated the content, pointing out possible problems with the clarity of the statements and the theoretical adequacy of the items. To perform the judgement, we used two scales on a 7-point Likert scale; these included "very bad," "very good," "completely inappropriate," and "completely appropriate." Items with an average below three are revalued and/or redone.

After this procedure, the researchers discussed the respondents' doubts under the supervision of an adjudicator – a senior lecturer and senior agribusiness consultant, who was responsible for judging the relevance of the proposed changes. The final wording of the items is shown in Table 2 (in Table 2, column 1 please see the items referring to the CPP scale. The table also describes PIV items – Product Involvement – and SCA items – Sustainable Consumption Attitude, used for the nomological validation of the CPP scale in Sections 4.2 and 4.3). This is a common procedure in studies that test the scale and seeks to verify whether the predictive capacity of the scale being tested is compatible with the theoretical relationships observed in previous studies.

3.4 Specification of the measurement model (Step 4)

After 12 inappropriate and redundant items had been excluded during the initial item generation stage (Section 3.2), CPP was measured based on 24 issues, divided into traceability (*TRA*), animal welfare (*AWE*), social responsibility (*SOR*), food safety concerns in meatpacking (*FSC*), environmental responsibility (*ENR*) and legality (*LEG*). It is a second-order reflective multidimensional construct, measured from six first-order reflective dimensions with multiple indicators. We measured the observable variables on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree".

3.5 Data collection (Step 5)

We emailed the questionnaire link on SurveyMonkey to Brazilian consumers registered in a research company database. We created filters to exclude consumers who rarely or never purchased meat, as well as those who did not eat meat. Of the 795 who accessed the questionnaire, 725 filled it out completely. Most consumers were women – 53%, 54% with monthly income between $1000.00 and $2000.00 (1$ equivalent to 5 reais), 72% with

Second-order variables	First-order variables	Item code	Item	*M**	SD*	*M***	SD**
Product involvement (PIV)	Pleasure value (PLE)	PIV01	Meat is important to me	5.686	1.583	5.823	1.520
		PIV02	Meat is absolutely necessary for me	5.141	1.811	5.239	1.799
		PIV03	I enjoy a meal with meat more than a meal without meat	5.584	1.772	5.660	1.720
		PIV04	I appreciate meat very much	5.804	1.557	5.828	1.577
	Symbolic value (SIV)	PIV05	You can tell a lot about a person based on his/her choice of meat	3.986	1.967	3.830	2.062
		PIV06	My choice of meat conveys about me to other people	3.967	2.026	3.809	2.104
		PIV07	My choice of meat gives other people an image of me	3.892	2.020	3.820	2.088
	Risk importance (RIM)	PIV08	I would find a bad choice of meat terrible	5.144	1.833	5.158	1.976
		PIV09	I do not have a lot to lose when I make a bad choice of meat (reverse)	2.920	1.994	2.994	2.087
		PIV10	I find it very annoying to make a wrong choice of meat	5.080	1.994	5.006	2.087
	Likelihood of risk (RIL)	PIV11	When I buy meat, I know that I make the right choice (reverse)	5.365	1.776	5.303	1.773
		PIV12	I feel lost when having to choose meat	5.435	1.478	5.396	1.540
		PIV13	I never know if I make the right choice of meat	2.565	1.478	2.604	1.540
Concern over the production process (CPP)	Animal welfare (AWE)	CPP01	I am concerned if animals were reared in a natural and free way	3.615	2.020	3.672	1.983
		CPP02	I am concerned if animals received humane and ethical treatment throughout their life	3.413	1.969	3.417	1.928
		CPP03	I am concerned if animals received adequate feeding and sanitation	5.576	1.732	5.668	1.639
		CPP04	I am concerned if slaughter was carried out painlessly and according to animal welfare standards	5.430	1.764	5.314	1.893
	Traceability (TRA)	CPP05	I only choose the beef when it is possible to identify its origin	4.890	1.871	4.906	1.878
		CPP06	I try to choose foods that have guaranteed origin	5.710	1.489	5.668	1.505
		CPP07	I try to choose food that can be traced back to its origin in case of any problems	5.017	1.866	5.011	1.868
		CPP08	Traceable food is safer food	5.680	1.549	5.794	1.488
	Legality (LEG)	CPP09	I am concerned if producers and meatpackers follow labor standards (workers register, safety at work)	5.403	1.720	5.263	1.865
		CPP10	I am concerned if producers and meatpackers use child labour or forced labour	5.558	1.712	5.532	1.805
		CPP11	I am concerned if producers work within legalities	5.702	1.625	5.586	1.719
		CPP12	I am concerned if meatpackers work within legalities	5.776	1.616	5.744	1.639
	Social responsibility (SOR)	CPP13	I am concerned if producers and meatpackers worry about benefits to officials and families (health plan, early childhood education)	5.017	1.860	5.135	1.824
		CPP14	I am concerned if producers and meatpackers promote development of communities	4.934	1.897	4.870	1.922
		CPP15	I am concerned if producers value hiring and training of local labour	4.948	1.865	4.928	1.895
		CPP16	I am concerned if meatpackers value hiring and training of local labour	4.953	1.851	4.920	1.870
	Environmental responsibility (ENR)	CPP17	I am concerned if producers adopt practices that reduce greenhouse gases emission	5.133	1.840	5.047	1.906
		CPP18	I am concerned if beef comes from farms that have not undergone deforestation	5.080	1.833	5.039	1.925
		CPP19	I am concerned if beef comes from farms that conserve water and avoid its waste	5.097	1.808	5.067	1.880
		CPP20	I am concerned if beef comes from meatpackers that conserve water and avoid its waste	5.088	1.812	5.097	1.848
	Food safety concerns in the meatpackers (FSC)	CPP21	I am concerned if beef comes from meatpackers properly inspected by health authorities	5.834	1.586	5.895	1.492
		CPP22	I am concerned if beef comes from meatpackers that have good hygiene practices in relation to slaughter environment and machinery	5.840	1.558	5.727	1.589
		CPP23	I am concerned if beef comes from meatpackers that take care of the hygiene of employees (uniforms) and of instruments used	5.837	1.562	5.681	1.601
		CPP24	I am concerned if beef comes from meatpackers that have waste and effluent control	5.536	1.665	5.406	1.771
Sustainable consumption attitude (SCA)	General green products (GGP)	SCA01	I would be willing to stop buying products from companies guilty of polluting the environment	5.014	1.800	5.086	1.858
		SCA02	I make a special effort to reduce the use of products that use scarce natural resources	5.293	1.666	5.183	1.753
		SCA03	When possible, I always choose products that cause less pollution	5.589	1.541	5.448	1.712
		SCA04	I do not buy a product when I know the possible damage it can cause to the environment	5.372	1.616	5.232	1.728
		SCA05	When I buy products and foods, the concern over the environment interferes with my purchase decision	5.188	1.675	5.144	1.760
	Food products (FOP)	SCA06	I prefer foods that are produced respecting the environment	5.686	1.501	5.644	1.582
		SCA07	I buy organic products because they are healthier	5.161	1.760	5.196	1.748
		SCA08	I am willing to pay a little more for products and foods that do not harm the environment	5.343	1.626	5.385	1.674

Note(s): *M*: mean; SD: standard deviation; * Sample 1; ** Sample 2; Crossed out text was excluded in CFA

Table 2. Descriptive statistics of measures

university education and most aged between 21 and 40 years (70%). The questionnaires were collected in the largest cities in the five Brazilian regions. This is a sample that represents the typical Brazilian middle class meat consumer.

We detected 34 unsystematic missing values, and these were filled with the average of their respective variables. The sample was separated into two groups through a draw. In Section 4.1, we used *Sample 1* to perform an exploratory factorial analysis (EFA) and to check the adjustment of the instrument (*Step 6*). In Section 4.2, we used *Sample 1* to confirm the model fit using confirmatory factorial analysis (CFA), reliability, and convergent and discriminant validity obtained in the first CFA, and to test the nomological validity of CPP scale (*Steps 7–8*). In Section 4.3, *Sample 2* was used for cross-validation of the scale (*Step 9*).

In addition to a specific section dealing with socio-demographic issues, three parts of the quantitative instrument dealt with constructs of the survey, all measured on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree." The first part of the questionnaire addressed the scale we developed.

Next, the second section addressed questions related to product involvement (*PIV*); it consisted of 14 questions divided into the dimensions of risk likelihood (*RIL*), importance attributed to risk (*RIM*), symbolic value (*SIV*) and pleasure value (*PLE*) (Laurent and Kapferer, 1985; Jain and Srinivasan, 1990; Verbeke and Vackier, 2004; Barcellos, 2007).

The third section dealt with attitudes related to sustainable consumption (*SCA*) from the food product (*FOP*) and general green product (*GGP*) constructs and contained eight items (Roberts, 1996; Lages and Vargas Neto, 2002; Bedante, 2004; Silva *et al.*, 2015). Further details about the questionnaire are provided in Table 2.

The second and third sections of the questionnaire include items that will assist in the final validation test of our scale (see Sections 4.2 and 4.3 for more details). The nomological validity test serves to confirm the theoretical relationship between constructs. Thus, in the literature we seek an example of a theoretical antecedent construct (Product Involvement) and a consequent theoretical construct (Sustainable Consumption Attitude) for consumers' concerns over production process. If our scale was well constructed, it must reproduce the cause and effect results obtained in previous studies. As a reference, we use the relationship between constructs found by Burnier *et al.* (2020).

3.6 Scale purification and refinement (Step 6)

Regarding scale purification and refinement, we conducted an EFA in each dimension of the scale to verify the unidimensionality and reliability of the measurements, as well as to check the convergent and discriminant validities.

We confirmed that all second-order constructs are one-dimensional. The reliability of the dimensions was attested by high alpha values (between 0.852 and 0.971); the convergent validity was obtained by high factor loadings (between 0.734 and 0.969) and average variance extracted (AVE) values (between 0.697 and 0.911). Additionally, we found discriminant validity using the criterion presented by Fornell and Larcker (1981).

4. Results

4.1 Gathering data and re-examination of scale properties (Step 7)

To analyse the scales, we used composite reliability (CR) and MaxR(H) to measure the internal consistency of the constructs. To attest discriminant validity, we examined whether the maximum shared variance (MSV) and the average shared squared variance (ASV) were less than the AVE. For convergent validity, we considered AVE values greater than 0.500 (Fornell and Larcker, 1981).

We used Amos 22.0 to perform a CFA by employing covariance-based structural equation modelling. The model fit indices we considered were chi-square per degree of freedom

(χ^2/df < 5.0), goodness-of-fit index (GFI) (>0.90), Tucker–Lewis index (TLI) (>0.95), comparative fit index (CFI) (>0.95) and root mean square error of approximation (RMSEA) (close to 0.06) (Hu and Bentler, 1999). The Harman's single factor test was used to check for the existence of common method variance (Podsakoff and Organ, 1986).

The CFA of the scale did not present good fit indices (χ^2/df = 4.173; GFI = 0.812; TLI = 0.920; CFI = 0.932 and RMSEA = 0.094). Considering the problem of model fit, we opted to exclude six items from the CPP scale using the modification indexes. We performed the exclusion of one item at a time, until the minimum criteria for adjusting the model were achieved. The exclusion criterion item was the highest modification indices from the Amos software. Modification indices indicate how much the chi-square value of a model would drop if the parameter were free instead of constrained, that is, by how much the model fit would improve.

To obtain a good fit, we excluded items CPP3, CPP8, CPP9, CPP14, CPP17 and CPP24. As a result, we reached an adjusted model (χ^2/df = 3.514; GFI = 0.892; TLI = 0.953; CFI = 0.963 and RMSEA = 0.083). We also attested the reliability (CR > 0.700 and MaxR (*H*) > 0.800), convergent validity (AVE> 0.500) and discriminant validity of the scale (MSV < AVE) (Fornell and Larcker, 1981). Thus, the final version of the CPP scale was formed by 18 of the 24 initial items. For further details on reliability and convergent and discriminant validities, see Table 3. To consult correlations amongst constructs and factor loadings, see Figure 2. The same cut-off criteria for the parameters and item exclusion procedure were used in the next sections of this manuscript.

4.2 Assessment of scale validation (Step 8)

In this step, we tested the nomological validity of the final version of the CPP scale using the hypothesized structural model with *PIV* as an antecedent (Burnier *et al.*, 2018). We performed a CFA of the *PIV* scale and the measurement model, considering *CPP* as the response variable and *PIV* as a predictor.

The results show that the *PIV* scale presented a good adjustment index (χ^2/df = 1.262, GFI = 0.977, TLI = 0.994, CFI = 0.996 and RMSEA = 0.027) after excluding items PIV09 (RIL dimension) and PIV11 (*RIM* dimension).

We also attested the reliability (CR between 0.719 and 0.935), convergent validity (AVE between 0.564 and 826) and discriminant validity (MSV between 0.012 and 0.254 < AVE) amongst the dimensions of the construct. These results indicate the possibility of using *PIV* in the structural model to test the nomological validity of the CPP scale.

We confirmed the fit of the measurement model (χ^2/df = 2.482, GFI = 0.853, TLI = 0.942, CFI = 0.948 and RMSEA = 0.064) and estimated the beta coefficient between *PIV* and *CPP*.

	SOR	AWE	ENR	FSC	LEG	TRA
SOR	*0.955*					
AWE	0.647	*0.906*				
ENR	0.817	0.757	*0.953*			
FSC	0.644	0.671	0.726	*0.913*		
LEG	0.734	0.737	0.799	0.781	*0.919*	
TRA	0.610	0.677	0.647	0.681	0.648	*0.825*
CR	0.969	0.932	0.967	0.938	0.942	0.865
AVE	0.912	0.821	0.908	0.834	0.845	0.680
MSV	0.667	0.573	0.667	0.610	0.638	0.464
MaxR(H)	0.979	0.937	0.973	0.945	0.958	0.866

Note(s): The diagonals represent the root of the extracted variance

Table 3. Confirmatory factorial analysis – sample 1

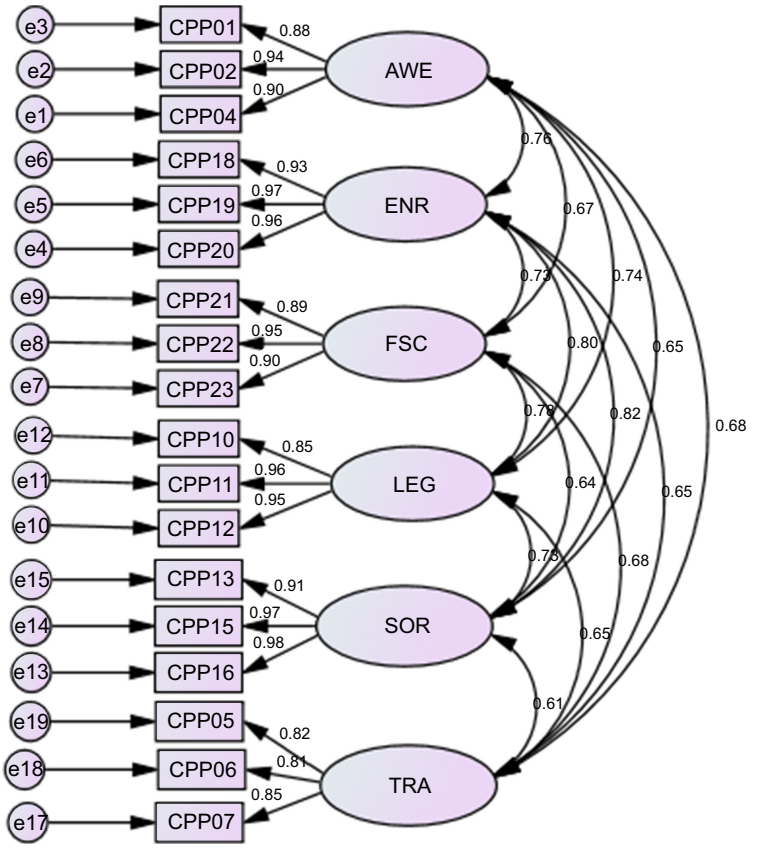


Figure 2.
Confirmatory factor analysis of concerns over product process scale – sample 1

Note(s): Traceability (*TRA*), animal welfare (*AWE*), social responsibility (*SOR*), food safety concerns in meatpacking (*FSC*), environmental responsibility (*ENR*), and legality (*LEG*)

We verified that *PIV* is an antecedent of *CPP* ($\beta = 0.586$; SE = 0.113; critical ratios = 5.179; $p < 0.001$). These results corroborate the findings of Burnier *et al.* (2020) and suggest that our scale has theoretical properties compatible with those reported in the literature for the phenomenon, besides confirming the nomological validity of the CPP scale.

4.3 Cross-validation of the scale (Step 9)

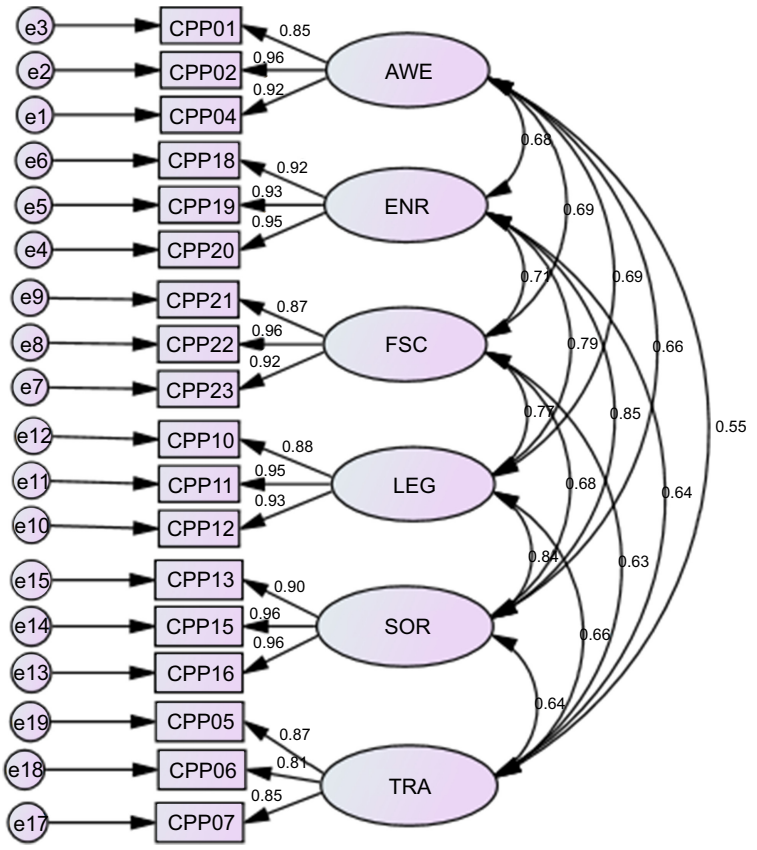
To cross-validate the instrument, we used *Sample 2*. First, we tested the fit of the CPP scale to rule out the existence of any sample bias in the results found in Section 4.2. Then, we performed a CFA on the *SCA* scale and tested the relationship between *CPP* (antecedent) and *SCA* (consequent) using structural equation modelling.

The results shown in Table 4 suggest that, in the CPP scale, the criteria of reliability (CR between 0.879 and 0.959), convergent validity (AVE between 0.709 and 0.886) and discriminant validity (MSV – between 0.440 and 720 < AVE) were satisfied. The results of the CFA show good fit for *CPP* (χ^2/df = 3.672, GFI = 0.882, TLI = 0.948, CFI = 0.959 and RMSEA = 0.086), confirming the scale's suitable properties. For further details about correlations amongst dimensions and factor loadings, see Figure 3.

	SOR	AWE	ENR	FSC	LEG	TRA
SOR	*0.941*					
AWE	0.661	*0.910*				
ENR	0.848	0.677	*0.933*			
FSC	0.679	0.592	0.710	*0.921*		
LEG	0.839	0.687	0.786	0.767	*0.921*	
TRA	0.637	0.548	0.641	0.629	0.664	*0.843*
CR	0.958	0.936	0.953	0.944	0.944	0.880
AVE	0.885	0.829	0.871	0.848	0.849	0.710
MSV	0.719	0.472	0.719	0.588	0.704	0.441
MaxR(H)	0.966	0.952	0.954	0.958	0.951	0.884

Note(s): The diagonals represent the root of the extracted variance

Table 4.
Confirmatory factorial analysis – sample 2



Note(s): Traceability (*TRA*), animal welfare (*AWE*), social responsibility (*SOR*), food safety concerns in meatpacking (*FSC*), environmental responsibility (*ENR*), and legality (*LEG*)

Figure 3.
Confirmatory factor analysis of concerns over product process scale – sample 2

We also found excellent fit indices for *SCA* (χ^2/df = 3.092, GFI = 0.970, TLI = 0.972, CFI = 0.983 and RMSEA = 0.076) and for a structural model that consider *SCA* as a consequent of the *CPP* construct (χ^2/df = 3.169, GFI = 0.845, TLI = 0.935, CFI = 0.943 and RMSEA = 0.078). After confirming the suitable properties of the constructs, we tested the cause and effect relationship between *CPP* and *SCA* to reinforce the discriminant validity obtained in Section 4.2. The results confirmed *CPP* as a predictor of *SCA* (β = 0.969; SE = 0.079; critical ratios = 12.296; $p < 0.001$), corroborating previous nomological validity (Section 4.2) and literature (Burnier *et al.*, 2018).

4.4 Develop norms for the scale (Step 10)

In *Step 10* of the development and validation of the CPP scale, we presented instructions to researchers and practitioners for using our instrument in their research and projects. The CPP scale is multidimensional and was measured on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree." The instrument must be applied directly to beef consumers. We recommend creating appropriate filters in the questionnaire to exclude consumers who rarely or never purchase meat, or never eat meat. It is possible for application patterns to be updated by researchers (Mackenzie *et al.*, 2011), especially in the case of new validation and adaptation research.

4.5 Discussion

Statistical adjustments demonstrate that the scale effectively measures the phenomenon it is supposed to measure, and the results can be reproduced over time, including in different samples of subjects, as shown in Sections 4.1 and 4.3. The good fit model confirms the results of the qualitative stage of this study, developed through interviews, focus groups and item validation with specialists, which provided face and content validity for the measures.

Additionally, the scale is theoretically more comprehensive because it was developed using six latent variables (animal welfare, traceability, social responsibility, legality, environmental responsibility and sanitation in slaughterhouses) and 18 items to measure consumer concerns about the production process. Considering that the dimensionality, validity and reliability requirements have been met, we can state that the results can be generalised, that is, the scale is capable of capturing and reproducing compatible results in different new samples from different strata, to present the perceptions of Brazilian middle class consumers regarding the beef production process.

We confirmed the nomological validity of the instrument using *PIV* as an antecedent construct and *SCA* as a consequent of *CPP*, meaning that we ratify both the ability of our scale to predict a known theoretical construct and related to it in the existing literature, and the phenomenon that is the object of measurement to be predicted by a construct that has a relationship attested beforehand in the extant literature (e.g. Burnier *et al.*, 2020). Thus, it is possible that the scale can be adapted and used as a reference in investigations addressing sustainability in food of animal origin, i.e. pork or poultry. There is space for developing and positioning that products/brands with socio-environmental attributes as part of the benefits offered at the market.

The metrics validated by consumer perceptions about aspects related to food production have implications for certifiers and for companies (industry and retailers) that will differentiate products from the consumer perspective. Grunert (2011) suggests six barriers to choosing sustainable products. One of the barriers would be that "Perception leads only to peripheral processing. Consumers see the label, but do not care to make an effort to understand what it means. It may still affect their choices, though" (Grunert, 2011, p. 209). The proposal to create this scale allows certifiers or eco-labellers to identify attributes (e.g. animal welfare, traceability and environment responsibility), which are perceived by the consumers, or that lead to the main attributes that they process when making their choice.

5. Conclusions

Previous studies have explored only some dimensions of the production process, as observed in Oliveira and Spers (2018) and Barcellos (2007), who found animal welfare, traceability and socio-environmental responsibility to be relevant in determining consumer concerns with the production process. The purpose of this study was to develop a more comprehensive scale to measure concern over the production process. In addition to academic sources, we used criteria from socio-environmental certification standards (Sustainable Agriculture Network, BPA, GIPS/GTPS) to cover items related to good practices that were also evaluated in this study.

Our results provide practical and theoretical implications that benefit sustainable beef consumption research in several ways. We enable a better understanding of sustainable practices in the beef supply chain through identification and measurement of activities developed throughout the production process, which can help managers with formulating communication strategies and product/brand positioning in response to consumer concerns over the production process. These communication strategies should be a means of creating opportunities for more efficient modes of production, because they facilitate consumer understanding regarding responsible actions undertaken in the stages of the production process. Aware of consumer willingness to consume products with socio-environmental production attributes, the world's second-largest beef producing company launched the Carbon Neutral Beef (CNB) initiative in 2020, which responds to a call for productive efficiency, reduction of environmental impact and attention to animal welfare (Villa Alves *et al.*, 2015). With this new CNB concept, several of the elements present in the scale proposed in this study are clearly communicated (animal welfare, traceability, environmental responsibility).

The government must be attentive to the proper functioning of their Food Inspection Service. Concern for socio-environmental aspects and animal welfare should serve as an argument for the Brazilian government in negotiations with other countries in order to facilitate the opening of other international markets. Traceability to the farm should also be a point of attention for public agencies, aiming to ensure credibility of Brazilian product safety as well as to enable the certification of Brazilian meat in relation to the attributes considered relevant, such as animal welfare. A report in international media has shown one of the UK's largest food retailers attempting to cut links to a giant Brazilian meat producer due to its association with Amazon deforestation (Morisson, 2020). Another article shows that a top investment house delisted the world's largest meat producer over its lack of commitment to sustainability issues (The Guardian, 2020). Government, meatpackers and retailers need to assure that the meat comes from a non-deforested area. In those cases, understanding traceability and environmental responsibilities, as well as consumer perceptions are important elements of the production process and part of the CPP scale developed in this study.

A better understanding of activities related to the sustainable beef production process indicated in this study facilitates the tangibility of these benefits as well as the appreciation of them by the end consumer, which can give rise to a premium remuneration to the different links in the chain. Thus, producers would be more motivated to adopt good social and environmental practices and be compensated for it.

Related to supply chain standards the model proposed in this study could be used to measure different types of consumer preferences as a guide for interaction between elements of the scale. For instance, some markets may be more sensitive to animal welfare and others to environmental issues. In this case the standards could be adapted based on the consumer's point of view, considering that for farmers it is difficult to attend to all dimensions. The scale developed may vary depending on consumer concern on different occasions of beef purchase, hedonic or functional (Burnier *et al.*, 2021). Some items of this scale may be evaluated

differently when purchased meat has a functional use, i.e. purchase of the product for daily consumption, when compared to recreational/hedonic use, as in the case of purchase of meat to make a barbecue. We recommend that researchers use the beef purchase occasion as a control variable in surveys or experiments.

Some elements of the production process mentioned in this scale such as animal welfare, environmental responsibility (GHG emission) and traceability should be tested through consumer WTP studies. The trade-off of those attributes can provide relevant information to the industry and retailers. Traceability, an item related to the production process, appears as a relevant attribute in several studies (Cicia and Colantuoni, 2010; Caracciolo *et al.*, 2010). The WTP for traceable meat is greater than the desire to pay for untraceable meat (Verbeke and Ward, 2003; Wu *et al.*, 2017). In interviews with experts, industry representatives indicated that "farm-to-table" traceability was relevant to business operations as a way of making food safety tangible. However, the type of traceability – from farm to table or industry to table – must be tested through consumer WTP to understand how types of traceability are valued compared to non-traceable products. It is possible that consumers are more concerned about origin related to industry (meatpackers) than to farms.

For further research, the proposed scale should be used as a reference for new investigations addressing socio-environmental issues in other segments of the food industry in Brazil and other countries. The same socio-environmental elements researched in this study should be tested in different cultural contexts in order to understand behavioural differences amongst consumers from different countries regarding concerns over production process of beef.

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