What Can We Learn from Best Practices Regarding Food Chain Transparency?

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Abstract

This paper reports on food chain transparency. The research specifically aims to investigate best practices. Therefore, inductive research was conducted, starting with the identification of best practices. Further, underlying patterns were investigated to derive hypotheses and to develop a theoretical framework. These were confronted with literature findings which resulted in the validation of the hypotheses and the theoretical framework. Overall it can be concluded that several types of food chain transparency exist, whereas the different types represent a hierarchy of transparency domains, and that the basis mainly applies to information quality. In addition, it is shown that performance indicators measure directly or indirectly the success of transparency.

Keywords: *Inductive research, best practices, transparency, food chain*

1 Introduction

Since its introduction in the 1990s, transparency has become one of the most popular concepts within chain management in general (e.g. Hofstede 2003) and within food chain management in particular (e.g. Theuvsen 2004). Additionally it has gained much interest due to the number of crises and the increasing customer demand in the food sector (Deimel, Frentrup et al. 2008). When it comes to transparency, researchers as well as practitioners often raise the question of whether the more transparency the better. To answer this question, one needs to analyze existing experiences and best practices regarding food chain transparency. However, most scientific papers discuss the theoretical aspects of transparency without presenting empirical evidence. Furthermore, with respect to numerous collaborative failures, it is unlikely that food chain transparency is adequately addressed in practice either. In the meantime, without a complete understanding of the existing experiences and best practices regarding food chain transparency, the benefits of more transparency will be disputable. As a consequence, validity of the derived implications for food chain management will be brought into challenge. Therefore, the objective of this paper is to investigate best practices regarding food chain transparency and to develop a theoretical framework for advancing research on this topic.

The paper is structured as follows: Section 2 presents the research methodology. In section 3, the identified best practices are shortly described, the results of the investigation of these best practices are discussed and hypotheses are formulated. Afterwards, a theoretical

framework is developed and the hypotheses, together with this theoretical framework, are validated. Finally, a conclusion is formulated in section 4.

2 Research methodology

The proposed research has been carried out within the frame of the EU-project Transparent_Food (Quality and integrity in food: a challenge for chain communication and transparency research). For the purpose of investigating best practices regarding food chain transparency, inductive research founded on a multiple-case approach has been conducted. Inductive research, also called the "bottom-up" approach, moves from specific observations to a broader generalization for theory-building (Kovács and Spens 2005). A summary of the five stage process of the inductive research used in this study is presented in Figure 2.

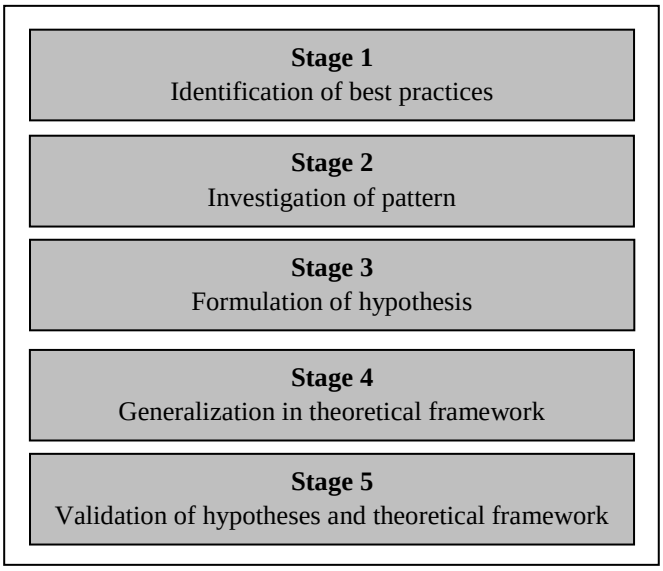

Figure 2. Five stages of inductive research, founded on a multiple-case approach

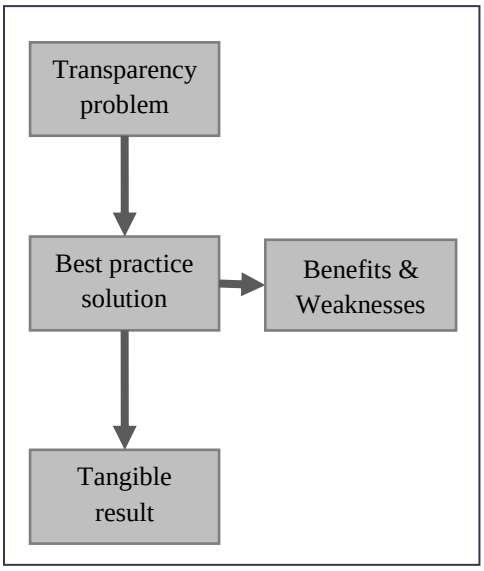

Figure 1. Template for identification of best practices

In the first stage, best practices were gathered worldwide based on a template (Figure 1) with the help of both researchers and practitioners and compiled into an inventory. Therefore, first, a template was developed to describe the best practices regarding food chain transparency. This template has four main sections: (1) the formulation of the transparency problem, (2) the description of the transparency solution (the best practice) to solve this problem, (3) the presentation of the tangible result achieved and (4) the discussion of the potential benefits and/or weaknesses of the best practice. Second, a database of experts concerning food chain transparency was established. Experts are defined as scientists and practitioners with relevant knowledge exceeding general knowledge on the field based on their track records (e.g. scientific publication, project participation). Third, these experts were approached via mail and asked to send their contribution to the best practice inventory based on the template. Fourth, reminders were send to the experts that didn't respond. Further, during the 4th International European Forum on System Dynamics and Innovation in Food Networks (8-12 February 2010, Igls), a best practice discussion session was organized. Moreover, in the frame of the Transparent_Food project, a stakeholder event took place on 6 May 2010. During both even contact was made with additional experts. In this way, a total of 50 best practices were collected between December 2009 and June 2010.

Best practices are defined according to two criteria: (1) solutions which go beyond the usual practice, (2) solutions that can be applied for further development of existing systems or development of new systems with superior performance. These criteria were developed by the researchers of the Transparent_Food project (Work Package 6) based on their knowledge and expertise purely for the purpose of harmonized selection of best practices. According to this definition, an inventory of best practices regarding food chain transparency was established.

For theory-building, it is important to study patterns in the identified cases. Hence, in stage 2, underlying patterns being present in the inventory have been investigated. First, the best practices were divided into different categories, namely transparency domains. Second, the common basis of the best practices was identified. Third, performance indicators for transparency mentioned in the best practice inventory were classified.

As a result of this investigation, hypotheses emerged in stage 3. In stage 4, these hypotheses have been generalized in a theoretical framework. Finally, in stage 5, existing theories were used to corroborate the validity of the hypotheses and the theoretical framework.

3 Results

In this section, we start with giving a general overview of the identified best practices regarding food chain transparency. Next, we discuss the patters being present in the inventory and formulate hypotheses. Afterwards, we develop a theoretical framework. Finally, we confront our findings with the literature and as a result validate the hypotheses and the theoretical framework.

3.1 Identification of best practices

Overall, 15 best practices, which are implemented in a broad geographical scale (e.g. fair-trade, food miles, detection of antibiotics in milk etc.), were collected. Further, five identified best practices are used all over Europe such as Farmsubsidy.org which makes data related to payments and recipients of farm subsidies publically available. Additionally, 27 best practices from different Europe countries were gathered (5 from Germany, 3 from the Netherlands, 3 from Hungary, 3 from UK, 3 from Sweden, 2 from France, 2 from Portugal, 2 from Belgium, 1 from Austria, 1 from Italy, 1 from Greece and 1 from Denmark). Also three best practices from the USA were identified (e.g. Carbon Tax). As a result, 50 best practices were compiled into the inventory.

Most of these best practices (22) relate to agriculture, food production and processing in general. Two of these best practices focus on the organic food sector and two on the frozen food sector. Further, best practices regarding animal production (16) as well as vegetable production (7) and milk production (2) were reported. Also two best practices about restaurants and one about wines were included in the inventory.

3.2 Investigation of pattern and formulation of hypotheses

3.2.1 Transparency domains

The investigation of the best practice inventory indicates that food chain transparency can relate to different domains, namely safety, quality, origin and sustainability. Each domain can be further divided into different sub-domains. Such categorization (i.e. classification of best practices based on discriminating elements) is recognized as the first step in the investigation of patterns.

Within the domain of *food safety*, a distinction can be made between compositional, technological and organizational aspects. Compositional aspects relate to transparency of chemical hazards (e.g. heavy metals, pesticides, nitrites), biological hazards (e.g. microbiological pathogens, toxins, allergens) and analytical considerations (e.g. official accreditation by ISO standards). Technological aspects focus more on the manufacturing of food products: transparency of the primary production (e.g. GM vs. GM free), processing (e.g. traditional vs. emerging technologies), packaging (e.g. intelligent packaging), transport and distribution (e.g. temperature control), handling (e.g. intended use) and abuse (e.g. sabotage). Organizational aspects include legal (e.g. HACCP) and voluntary (e.g. BRC) management systems for food safety. Also monitoring schemes, such as official food surveillance, are categorized into this sub-domain.

The domain of *food quality* can be divided into eight sub-domains: (1) composition, (2) health and nutrition claims, (3) sensory properties, (4) raw material production, (5) storage conditions, (6) processing methods, (7) packaging and distribution and (8) authenticity. In contrast to the compositional aspects of food safety, the sub-domain composition of food quality refers to transparency of enriched products, reduced ingredients and microbiological quality.

The third domain, *food origin*, does not have sub-domains. It relates to transparency of place, region and country. Consequently PDO (Protected Designation of Origin) and PGI (Protected Geographical indication) can also be categorized into this domain.

The domain of *food sustainability* comprises three sub-domains representing environmental, social and economic issues. Environmental issues can be for example organic production processes, integrated farm management and carbon footprint labeling. Social issues, on the contrary, relate to transparency regarding animal welfare, labor and working conditions, fair trade, social and community capital, and vegetarian production processes. Economic issues focus on price transparency, cost transparency, profit transparency etc.

Similarly to the Maslow's hierarchy of needs, a hierarchy of transparency domains (Figure 3) can be constructed with the most fundamental levels of transparency at the bottom. Typically, fulfilling the most fundamental transparency needs is necessary, before the superior levels can be reached. The hierarchy of transparency domains shows the shift of the general policy of the food sector from basic production (food that is safe to eat) to more quality, origin, sustainability focused production (McInerney 2002, Lang 1999).

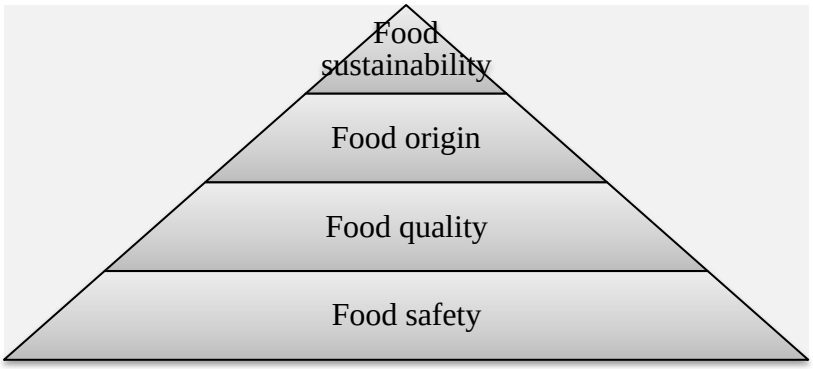

Figure 3. Hierarchy of transparency domains

Food safety is considered to be the most fundamental level of transparency because food chain members and consumers are increasingly concerned about food incidents (Beulens, Broens et al. 2005). In other words, if food is not safe to eat and consequently causes illness, transparency for the superior levels is redundant. After food safety transparency is fulfilled, food quality (e.g. sensory attributes) can be assured which forms the second level. If consumers and food chain members have reached transparency in food safety and quality, knowledge about food origin gains interest. Food origin can be seen as an enlargement of food quality, where not only the composition of food is transparent but also the origin of all the ingredients. Finally, the most superior level of transparency is food sustainability, whereas a distinction can be made between environmental (e.g. food miles), social (e.g. fair trade) and economic issues (e.g. price transparency).

As a result of this investigation, the first hypothesis states:

> Several distinct types of food chain transparency exist, whereas the different types represent a hierarchy of transparency domains (Hypothesis 1).

3.2.2 Information quality

Our results reveal that information sharing is the key element of transparency. Consequently, sufficient information quality is a prerequisite of food chain transparency. This information quality mostly includes aspects of accuracy, relevance, timeliness, reliability, completeness, usefulness, credibility, trustworthiness and being up-to-date.

Accuracy and relevance: The experts generally agreed that sharing accurate and relevant information is a key to success of transparency projects. For example they reported about practices, where “a subset of data is exported and sent automatically to main business partners, informing them in real time with *accurate* and *relevant* data”.

Timeliness: The experts were convinced that timely information is crucial in case of a crisis situation: “the identification and registration systems proved already a few times that they provide *quickly* the relevant information”.

Reliability: Experts realized the importance of safeguarding the reliability of the communicated information: “*reliability* of the company communication”, “detailed and *reliable* information covering the full chain is provided to the end users and final buyers, who can provide this information to the consumers by request”.

Completeness: The need for complete information became apparent from the reports of the experts. As such, communicating complete information turned out to be one of the main information quality characteristics: “records and documentation are *complete*”, “access to *detailed* information”.

Usefulness: The major challenge in transparency projects is to provide useful information and to perk redundant data. So, food chain members are challenged to communicate useful information: “potentially *useful* information being available”.

Credibility: The experts indicated that sharing credible information is one of the key elements of transparency: “channel *credible* information toward the consumer” “the communicated information needs to be clear and *credible*”.

Trustworthiness: Trust is crucial for food chain members to survive in the fast-moving international environment in which they operate. The experts were convinced that trust is even more important in transparency projects. Therefore, trustworthy information is part of the transparency solution: “the label should be from a *trusted* voice (e.g. third party certification)”.

Being up-to-date: Working with up-to-date information has been recognized as being essential for transparency. This was reflected in the best practices as: “the scheme allows for *up-to-date* information”.

Therefore, the following hypothesis can be formulated:

The basis of food chain transparency applies to information quality (Hypothesis 2).

3.2.3 Transparency performance

Another pattern, that can be identified from the best practice inventory, is the evaluation of transparency performance of food chains based on performance indicators such as the avoidance of abuse (“*avoid falsifying* and *prevent* the *cheating* of consumers”), the increase of market share (“contribute to *higher market shares*”, “*assures market access and recognition*”), the possibility to act quickly in crisis situations (“*be able to act quickly* in case of an epidemic or crisis” “*quick access* to data”) and the improvement of competitiveness (“*develop competitive strategies*”, *improved competitiveness* of producers”). These performance indicators can directly or indirectly evaluate the success of a transparency practice. Direct performance indicators evaluate the extent to which the main goal of the transparency practice is achieved, while indirect performance indicators evaluate the extent to which other goals of the transparency practice are achieved. The main goal of “animal ear tags”, for example, is to “act quickly during an epidemic or crisis”. As a result, this is a direct performance indicator while “the increase of trust in the origin of animal products for the domestic market” is another goal (sub-goal) of this best practice and thus an indirect performance indicator.

As a result, we posit the following hypothesis:

Performance indicators evaluate directly or indirectly the success of a transparency case (Hypothesis 3).

3.3 Generalization in theoretical framework

Based on the hypotheses discussed in section 3.2, a theoretical framework for food chain transparency was constructed (Figure 4). Since transparency domains, information quality and performance indicators are considered as the key patterns in the best practices regarding food chain transparency, these elements constitute the theoretical framework.

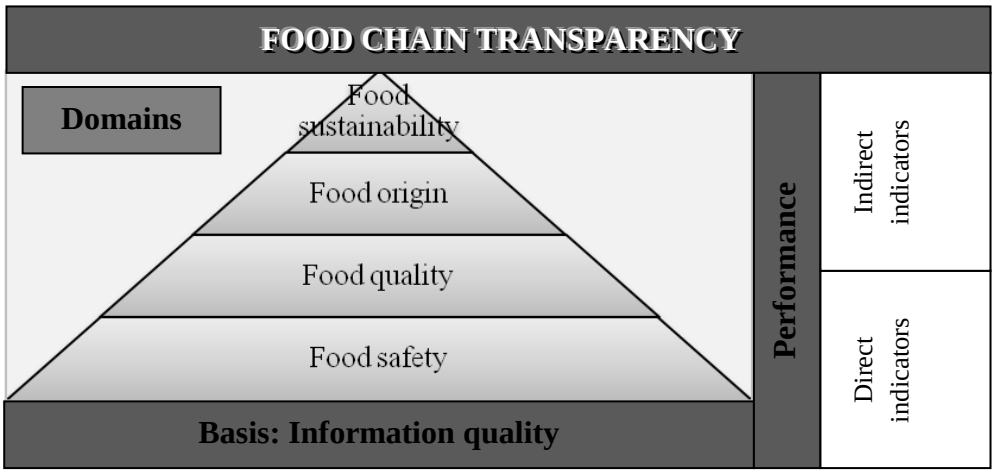

Figure 4. Theoretical framework for food chain transparency

First, the figure depicts the hierarchy of the four transparency domains: safety, quality, origin and sustainability. The domain of food safety comprises three sub-domains representing compositional, technological and organizational issues. The second domain, food quality, can be divided into eight sub-domains: (1) composition, (2) health and nutrition claims, (3) sensory properties, (4) raw material production, (5) storage conditions, (6) processing methods, (7) packaging and distribution and (8) authenticity. The domain of food origin does not have sub-domains. Within the domain of food sustainability, a distinction can be made between environmental, social and economic aspects.

The figure also illustrates the basis of food chain transparency, namely information quality. Because information sharing is the key element of transparency, sufficient information quality is of major importance. Information quality mostly includes aspects of accuracy, relevance, timeliness, reliability, completeness, usefulness, credibility, trustworthiness and being up-to-date.

Furthermore performance indicators, which measure directly or indirectly the success of a transparency case, are part of the theoretical frame. The avoidance of abuse, the increase of market share, the possibility to act quickly in crisis situations and the improvement of competitiveness are examples of performance indicators.

In the next section, we will validate this theoretical framework and corresponding hypotheses based on the literature.

3.4 Validation of hypotheses and theoretical framework

3.4.1 Transparency domains

A comprehensive review of the literature shows that some authors formulate a general definition of transparency, while others make a distinction between different types of transparency. For example Sporleder and Goldsmith (2002) suggested that the concept of transparency "refers to the extent of coverage from upstream to downstream industries within the supply chain and how apparent information is to downstream industries". Likewise, Hofstede (2003) presented the following definition: "Transparency of a netchain is the extent to which all the netchain's stakeholders have a shared understanding of, and access to, the product-related information that they request, without loss, noise, delay and distortion." Moreover, he defined three types of transparency: history, operations and strategy transparency. Hultman and Axelsson (2007) described cost, supply, organizational and technological transparency. Additional work by Granados, Gupta et al. (2008) deals with price transparency.

The classification (domains and sub-domains of food chain transparency) used in our work corresponds the best with the distinction made by Wognum, Bremmers et al. (2011). They state that consumers wish to be informed about food safety, origin and sustainability whereas sustainability comprises environmental, social and economic issues. This suggests the use of the domains food safety, origin and sustainability. However, in our theoretical framework also the domain of food quality is included since several best practices were identified that focus more on quality aspects (e.g. health and nutrition claims, sensory properties) instead of safety aspects (e.g. chemical and biological hazards, criminal recycling). Furthermore, our best practice inventory provides a more detailed classification of the domains into sub-domains. Consequently, these findings support Hypothesis 1: Several distinct types of food chain transparency exist, whereas the different types represent a hierarchy of transparency domains.

3.4.2 Information quality

Literature confirms that information sharing is the key element of transparency. Lamming (1993), for example, introduced cost transparency as "the sharing of costing information between customer and supplier, including data which would traditionally be kept secret by each party, for use in negotiations". Similarly, Hofstede (2003) refers to information exchange and sharing as main parts of operations and strategy transparency. Furthermore Hultman and Axelsson (2007) demonstrated that in all research fields of transparency "the key characteristic seems to be the ability to 'see through' something and to share information that is not usually shared." Consequently, adequate information quality is the prerequisite of food chain transparency. Monckza, Petersen et al. (1998) stated that "information quality includes such aspects as the accuracy, timeliness, adequacy and credibility of information exchanged". DeLone and McLean (1992) identified nine studies (see, e.g. Bailey and Pearson 1983) which include empirical measures of information quality. The most occurring measures in these studies were accuracy, timeliness, reliability, completeness, usefulness and relevance. Likewise, Yu-min and Yi-shun (2009) summarized the major instruments for measuring information quality (see, e.g. Rainer and Watson 1995). They identified accuracy, precision, currency, timeliness, reliability, completeness, conciseness, format, usefulness, relevance, understandability and relevance as the most

proposed information quality attributes. These aspects are in line with the outcome of the best practice inventory. They allow us to confirm Hypothesis 2: The basis of food chain transparency applies mainly to information quality.

3.4.3 Transparency performance

According to Van der Vorst, van Beurden et al. (2003), the chain performance on traceability is characterized by the number of links in the supply chain that can be traced back- and forward, the tracing unit that defines the level at which the traced object is uniquely identified (e.g. a farmer, a delivery, a cow), the time needed for tracing the products and the reliability of the tracing. Here it should be noticed that traceability is only part of transparency: "Traceability is defined as the ability to track the inputs back to their source at different levels of the marketing chain, while transparency refers to the public availability of information on production practices" (Liddell and Bailey 2001).

Besides these performance indicators of traceability, performance indicators of transparency are also apparent in scientific literature, such as the speed and cost of product recall or withdrawal (Van der Vorst 2004), the improvement of work efficiency, the extent and speed of sharing information (Van der Spiegel, Luning et al. 2004), data correctness and completeness (Van der Vorst 2004) and the access to new markets.

This indicates that there is nor an agreed definition of transparency performance of food chains, neither an agreed list of performance indicators to be used. Still, performance can generally be defined as the extent to which goals are achieved (Kaplan 1983). Consequently, evaluation of transparency performance of food chains requires the measurement of the achievement of the goals of the transparency practice. As such, transparency performance of food chains can be understood as the degree of accomplishment of goals of the transparency practice (Simatupang, Wright et al. 2004; Provan, Fish et al. 2007; Provan and Kenis 2007). In this context, the existence of clearly defined goals for the transparency practices is regarded as the first and most important step in evaluating the transparency performance of food chains (i.e. clear statements of what the installed transparency system meant to achieve). This should be followed by the measurement of the extent to which these goals are achieved. However, as indicated by Ferguson (2000), a distinction can be made between the main goal (primary goal) and sub-goals (secondary goals). For example, if the primary goal is transparency of quality information, the secondary goals could be stimulating improvement in quality performance, encouraging customers and consumers to reward quality or helping consumers make informed choices (Ault 2008).

Most of the studied indicators are in line with the ones found in the best practice inventory. Further, these will directly or indirectly evaluate performance, depending on the main goal and sub-goals of the transparency project. Therefore, Hypothesis 3 can be approved: Performance indicators evaluate directly or indirectly the success of a transparency case.

3.4.4 Validation of theoretical framework

Since the three hypotheses are approved, we can conclude that the proposed theoretical framework (Figure 4) is valid. So, the inductive research design resulted in a theoretical framework for food chain transparency. In conclusion, transparency domains, information

quality and performance indicators are the main elements. This theoretical framework can be used to better understand the complexity of transparency, to better evaluate transparency and as a starting point for future research.

4 Conclusion

This paper investigated best practices regarding food chain transparency. The study was built on a five stage inductive research design with a multiple-case approach. In the first stage, 50 best practices were identified based on a template with the help of both researchers and practitioners and complied into an inventory. This best practice inventory enabled the investigation of underlying patterns in the second stage. In stage three, these patterns were translated into hypotheses. Further, in stage four, we generalized the hypotheses in a theoretical framework. Finally existing theories were used to corroborate the validity of the hypotheses and the theoretical framework.

This study identified four transparency domains (food safety, quality, origin and sustainability) which represent a hierarchy of transparency domains. Moreover, the basis of transparency was identified, namely information quality. Additionally, we showed that the success of a transparency project can be measured with direct or indirect performance indicators.

Further, some limitations of the paper are worth mentioning. First, the paper is limited in its scope with regard to the research setting because the number of countries and sectors involved in the study was limited due to time and budgetary constraints. Given the non-random sampling procedure (for the best practice identification with the help of non-randomly selected experts) and the low sample size (50 best practices), the best practice inventory cannot be considered fully representative. Hence, the results are mainly indicative and should not be generalized. Second, the selection of best practices was based on “soft” criteria which were developed by the researchers of the Transparent_Food project. Therefore, future research should overcome the above mentioned limitations and focus on validating the results with the help of quantitative research.

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