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System Dynamics in Food Quality Certifications: Development of an Audit Integrity System

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ABSTRACT

Due to the complex structure of certification schemes the risk of flaws and scandals is generally high. It has further increased by several developments during the last years. With regard to their potential effects, it is questionable whether the certification approaches are actually able to detect deficiencies within the system and thus prevent crises which may lead to its breakdown. Hence, the ability of a standard to meet its objectives of food quality and safety needs to be enforced. In this contribution we launch the implementation of a controlling tool which automatically monitors audit quality based on information of the respective data bases. By analysing possible negative influences, opportunistic behaviour can thus be detected.

Keywords: certification, quality assurance systems, risk oriented auditing approach

1 Introduction

Over the past few years, certification schemes in the agribusiness sector have gained huge importance as an instrument of quality assurance in the supply chain (Jahn et al., 2005; Fulponi, 2006). Especially in the EU several standards have been established, which range widely in their focus, target groups and goals. While most of these systems have a rather low coverage in the food sector (e. g. Label Rouge or Geprüfte Qualität Bayern), certification schemes such as QS, BRC, IFS or GlobalGap already cover substantial parts and are widely known within the business (European Communities, 2006a). However, the reputation and status these systems have built up during the past few years, depend on the confidence in meeting the promises of assuring quality and food safety. If the standard is unable to come up to the expectations of consumers and business partners, its value decreases and trust is going to fade (Fulponi, 2006; Albersmeier et al., 2009). In consequence, the withdrawal of considerable parts of the supply chain from the system could bring down the entire system. Aside from this effect, a certification scheme is always exposed to the interests of censorious stakeholders (e. g., consumer associations and other NGOs) who generally have good connections to media and politics. In this case, even the rumour or accusation of flaws and scandals poses enormous problems for the reputation of the standard.

Due to the complex structure of certification schemes the risk of flaws and scandals is generally high, but has also been increased by several developments during the last few years. The rapid expansion, for instance, has greatly enhanced the number of participants within the systems (e. g., more than 110,000 companies in the German QS-system). Most systems are expanding their performances (more production levels in the food chain, different products, more countries etc.); some systems, like the QS-system, even aim to control the entire supply chain – from the animal feed industry to retailing. Furthermore, the interest of external stakeholders in food issues has increased and has been amplified by the mass media.

With regard to the potential effects of these developments, the question is whether the respected certification approaches are actually able to detect deficiencies within the systems and thus prevent scandals and crises which may lead to the breakdown of standards. Most of the certification schemes nowadays are at the point where they have to stay abreast of these changes and build mechanisms to prevent harm to their systems. Thus, the importance of this development should enforce the implementation of a controlling tool which monitors the audit quality, which in this contribution is defined as the quality or ability of a standard to meet its requirements in order to ensure a high quality and safety of food products manufactured under the respective scheme. By analysing possible negative influences on the system, opportunistic behaviour can be detected.

A controlling tool to ensure audit integrity is presented below. In theoretical aspects the development of this instrument draws on a risk approach, whereas the practical application is based on the central data banks of the respective quality assurance systems. These in turn have the potential to be the basis of an effective external quality control, revealing weaknesses, changes and irregularities among the system elements.

2 Quality certification in the agribusiness sector

During the 1990s, the European agribusiness sector was hit by several crises and scandals (Tuncer, 2001). As a result, consumer confidence in the ability of traditional governmental regulators in the agribusiness sector to deal with safety and quality issues has declined (Pennings et al., 2002; Poppe, Kjaernes, 2003; Albersmeier, Spiller, 2009). Beside the lack of trust in public institutions, the food industry is even more mistrusted. Albersmeier and Spiller (2009) revealed that especially the meat industry is lacking in positive reputation. However, mistrust and insecurity do not only negatively affect the businesses, but also their products. Alienated consumers, which reduce or stop their (meat) consumption, are a consequence (Dirks, 2007).

This consumer reaction is especially true for food products, since consumers behave very sensitively towards scandals and crises related to esculent. A major reason for this is that food products contain many quality attributes which are process-based (for example organic, GMO-free, animal welfare etc.) and cannot be verified by the buyer even after consumption and use (Antle, 2001). Certification systems were introduced in order to reduce the information asymmetry evoked by such credence attributes (Auril, Schilizzi, 2002). In response, many European countries, and especially the private sector, have launched specific initiatives to implement standards with requirements that are in part higher than the respective state regulations. In recent years, a multitude of various quality assurance schemes have been established (Jahn et al., 2005; European Communities, 2006a; Sodano, 2006). These can be classified according to the following criteria (Theuvsen, Spiller 2007):

- target group: consumer-oriented labels (e. g., organic farming, fair trade); business-to-business schemes (e. g., International Food Standard, GlobalGap, BRC Global Standard);
- focus: product characteristics (e. g., Protected Designation of Origin, Protected Geographical Indication); process characteristics (e. g., environment-friendly, welfare standards);
- goal: guarantee of legal minimum requirements in a mass market (e. g., IKB in the Netherlands, QS in Germany); product differentiation (e. g., organic farming schemes);
- content: safety (e. g., IKB); quality (for instance PDO schemes); production standards (e. g., organic farming standards);
- standard owner: state-run systems (such as organic farming in Denmark), international standardization organizations (e. g., ISO 9000 and 22000), stakeholder approaches (e. g., Fairtrade), producer schemes (e. g., farmers` associations in the case of the British Assured Farm Standard), private inspection bodies (e. g., Vitacert by the German Technical Monitoring Institution/TÜV); retailer driven schemes (e. g., BRC Global Standard and International Food Standard);
- areas of application: local (e. g., Geprüfte Qualität Bayern in Germany); national (e. g., Danske Slagterier in Denmark); international (e. g., ISO 22000);
- number of stages involved along the food supply chain: single-stage (e. g., GlobalGap is applied in farming); multistage (e. g., the QS-system covers the whole supply chain).

Especially the certification schemes which aim to guarantee legal minimum requirements attained a high market share in the respective industry (European Communities, 2006a). The QS-system, for instance, records about 38,000 audits per year which were predominantly conducted in the agricultural sector (106,000 certificates in the last four years). QS is mainly active in the meat industry, covering about 90 % of all German pigs and poultry for slaughter (QS, 2009). The animal feed industry and all important German slaughterhouses are also covered. Additionally, almost 23,730 retail stores (316 from abroad) are

integrated in the QS-system. In 2004 QS expanded their product categories to fruits and vegetables including the levels of production, wholesale and retailing. Besides QS, GlobalGap also has a strong international angle: about 94,000 producers have been certified in crops, livestock, aquaculture and compound feed in more than 80 countries (GlobalGap, 2009). The product range is nowadays extremely broad and in addition to green coffee, it also includes flowers and ornaments as well as meat and fish. GlobalGap is only applied on the production level. In contrast, the International Food Standard (IFS) covers the companies at the top of the supply chain. The IFS certificate is used in the business relationship between processor and retailer. Currently, more than 4,935 food producers all over the world are certified according to the IFS (IFS, 2006). Since 2006 the IFS has offered a logistic standard which closes the gap between production level and the trading companies in the food chain.

While certification schemes differentiate on the basis of different variables, the institutional structure is comparable for almost all privately organised standards. Various institutions participate in the certification process, as shown in Figure 1.

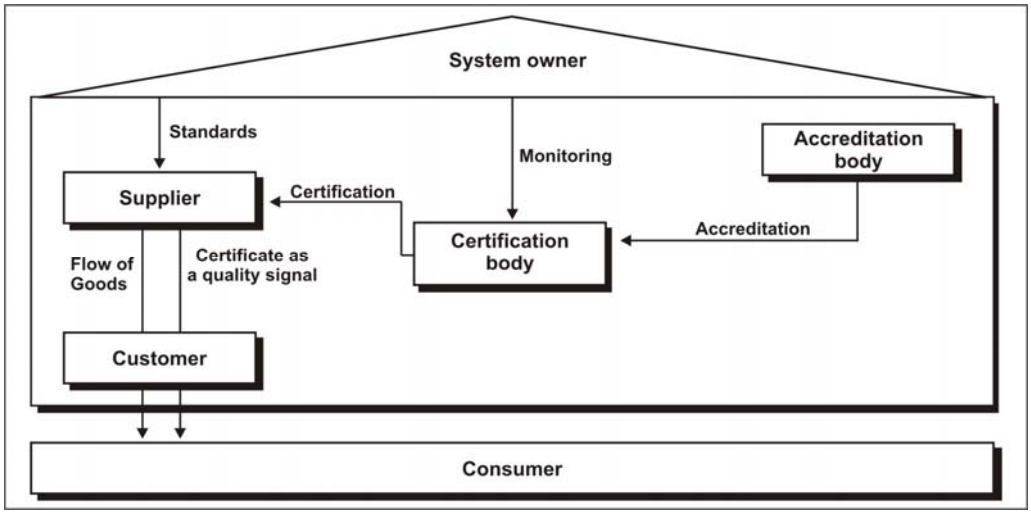

Figure 1.
Basic structure of certification (Source: Jahn et al., 2005)

The starting point is the link between the producer and the customer (consumer or institutional buyer). The supplier provides a certificate serving as a quality signal for the customer or within the supply chain, which is issued by a neutral certifier (third party audit) (Luning et al., 2002). The audit is based on requirements laid down by the respective standard initiator. Certifiers, in turn, have to prove their ability to carry out inspections according to these rules through an accreditation. This accreditation is usually given by the ISO 65/EN 45011 standard, which includes general requirements for assessment and accreditation of certification bodies (Jahn et al., 2005).

All in all, the whole system is only working if consumers trust the effectiveness of the auditing scheme. This supposition provokes a doubled trust difficulty: Since consumers lacked trust in the producer, certification standards were implemented to guarantee product quality and safety. However, consumers also need to trust the certification standards and their auditing processes that means that they have to be able to effectively control the producer (Albersmeier et al., 2009). Thus, the credence attribute is shifted from the actual food product to the certification system. The process of trust building is alleviated, since consumers only need to trust a few institutions, which are the standard owners and not thousands of producers.

3 System Dynamics in quality certifications

Due to the characteristics described above, certification is sensitive to flaws and opportunistic behaviour which highly endanger the performance of the system. To fulfil the promises of a valid and reliable control, the standard therefore heavily relies on the functioning and the genuine behaviour of the participating institutions. It only works when the system elements interdigitate successfully. For this purpose, the relationships and the interactions within the system exert significant influence and restrict the way in which auditing processes are carried out in quality assurance systems.

3.1 Application of System Dynamics on certification schemes

With the growing complexity of the respective standards (more production steps, different products, credence attributes, external stakeholders, different countries) a system oriented view ("Systems thinking"[1]) of certification schemes becomes one important theoretical approach to analyse system integrity (Sterman, 1994; Ossimitz, 1995). This concept allows a fundamental comprehension of the dynamics within a quality assurance standard. By analysing the interactions and the effects during changes risk factors can be exposed that positively or negatively affect the reputation of certification systems.

The theory of System Dynamics is especially applied in socio-economic studies and provides a central concept for an improved perception (Kapmeier, 1999) and an advanced understanding of how objects in a complex system interact (Sterman, 2001). Here, systems are generally defined by the structure, characteristics and interplay among their elements (sub-systems). These are connected and form a unified whole by interrelationship. A change in one variable reinforces (positive) or balances (negative) other variables, and influences the whole system over time (Ossimitz, 1997). The starting point of System Dynamics is always an investigation of adverse system behaviour (Forrester, 1994). Thus, negative feedback loops can only be managed if the causer/catalyst for this situation is ascertained (Forrester, 1991). The comprehension of the structure in considered social or physical systems is the key to achieving the objective of systems improvement (Forrester, 1994). Moreover, the concept applies a simulation model to gain a better understanding of the system behaviour.

However, the System Dynamics approach in this contribution is applied metaphorically. Emphasis is not laid on the development of a detailed simulation model, but on the application of the idea of Systems Thinking to certification schemes in the agribusiness sector. Systems Thinking generally belongs in the conceptualizing phase of System Dynamics, in which the basic audit integrity system (see section 5) is described (Forrester, 1994).

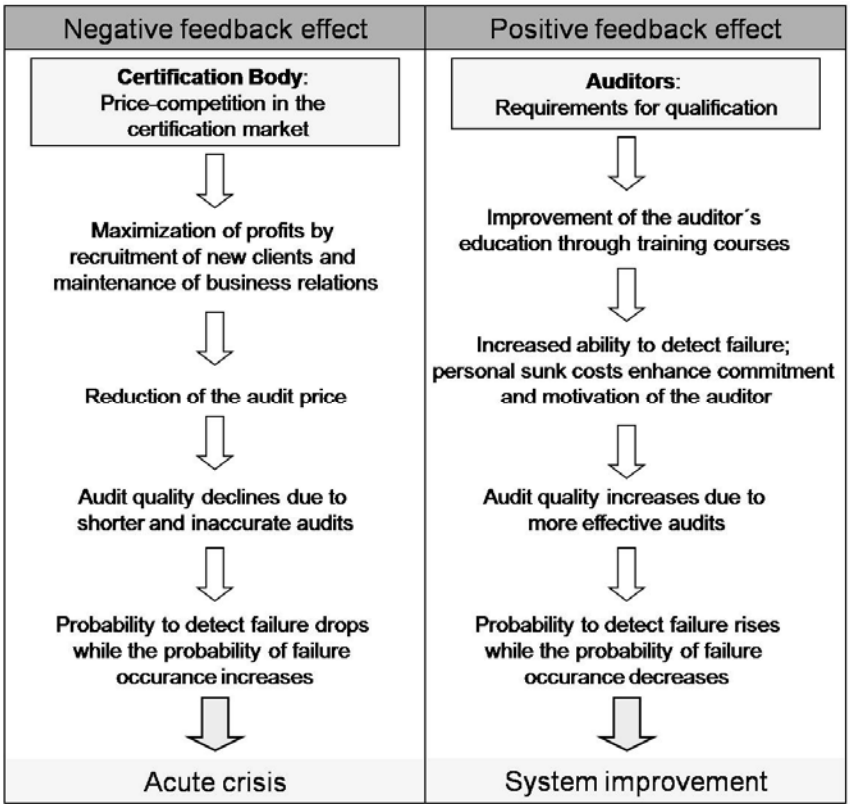

Figure 2.
Examples of positive and negative feedback loops

[1] Richmond (1994: 139) defines systems thinking as "the art and science of making reliable inferences about behaviour by developing an increasingly deep understanding of underlying structure".

Well-intentioned attempts to solve problems or improve situations frequently create unanticipated side effects (Sterman, 2001). Seen from our perspective, quality assurance schemes are generally endangered by two reactions which cause adverse system behaviour: While the development of creeping effects is characterised by a time delay between taking a decision and its effects on the state of the systems (see Figure), exponential effects underlie a rapid and spontaneous behaviour. They occur selectively and are based on down trading processes (in general negative creeping effects) which, accumulated, catalyse the development of exponential overshoot effects. The latter is especially burdened by the unstable constitution of certification schemes—strong dependency on gatekeepers within the food supply chain and high exposure to critical stakeholders.

Slow, creeping processes were initiated somewhere in a certification scheme by a single event and affect the systems by degrees. Single events, for instance, can be a change in the requirements of auditors' qualification or an increasing competition among the certification bodies (see Figure). As harmless as this single decision might seem to be at the beginning, due to interactions and feedback loops it can lead to distorted and unexpected consequences, but also redound to positive reinforcement. Negative feedback effects for instance may evolve from a high concentration of certification bodies on the market for auditing. Consequently, an intense competition for clients—which includes the recruitment of new clients as well as efforts for the maintenance of already existing business relations—arises, which brings down the prices. Due to their size, especially large certification bodies can generate cost advantages which inure to the benefit of the so-called low-balling. Low balling describes the effect that in order to gain new customers auditing companies offer auditing services with prices lower than the actual expenses for the control (Quick 1996). This leads to sunk costs in the first phase. Consequently, profits need to be obtained from customers in the next auditing periods (DeAngelo, 1981). This mechanism is especially amplified by the formal contractual relationship between client and certifier, which is developed in such a manner that customers pay the auditor for the certification of their business. Thus, precondition for arising returns is the linkage to the respective mandate. On the one hand this evokes dependencies of certification bodies on their clients and on the other hand the whole control process needs to be rationalized (e.g., shorter and inaccurate audits) (Graham, 1985; Nagel, 1998). Costs have to be reduced and the customer relation perpetuated. In the end, these circumstances lead to a lower probability to detect failure and fraud while at the same time also the possibility of failure occurrence increases within the companies. In the long run certification bodies which examine carefully and thus, produce higher costs will gradually disappear from the market while cheap and cursory auditing companies will prevail (adverse selection). This can easily lead to a collapse of the system like the current financial crisis demonstrates.

However, also positive feedback loops are possible. For example, deficits of the auditor expertise are a huge threat to the certification standard. Hence, to require a higher inspector qualification is one way to improve the whole system. Various standard owners already offer different training courses to improve auditor education. Through this, the individual ability to detect failures and fraud should be increased and thus, personal sunk costs enhance the commitment and motivation of the auditor. All in all, audit quality rises due to more effective inspections.

3.2 The importance of System Dynamics in certification schemes

Based on System Dynamics, this study provides a new perspective on certification schemes by pointing out interactions and feedbacks which may cause an acute crisis and in consequence, lead to a loss of reputation and credibility. These factors have as yet barely been researched, although they should—especially against the background of the rapid systems growth—be perceived as a matter of importance for the standard owners since they greatly influence the performance of certification schemes.

An analysis of the factors influencing the performance of certification systems thus represents the initial point for the application of System Dynamics. From experience, we know that quality assurance systems are generally susceptible to opportunistic behaviour. In 2000, about 10 % of organic corn sold in Germany came from "conventional" agriculture despite the existing control scheme (Jahn et al., 2005). Other examples of imperfect monitoring standards can be found in Anania and Nisticó (2003), GfRS (2003), and McCluskey (2000).

While the auditor checks that the companies have conformed to the standard requirements, the certifier himself has to comply with the requirements of proper certification (Bush et al., 2005). Studies of the IFS and QS-system exposed discrepancies in the audit result of different certification bodies and auditors (Albersmeier et al., 2009). The identified differences and irregularities generally document varying assessment standards between different certification bodies and auditors. However, several interpretations of these flaws are possible. On the one hand, differences in the auditors´ abilities and varying auditing intensities could be the reason for variations. On the other hand, economic dependencies might cause an auditor to issue "courtesy certificates".

Precise investigation to uncover the reasons for deficient audit results generally draws on knowledge of the structural framework of certification. This information provides a basis for an effective intervention in the improvement process of audit quality. Only if the auditing company is unbiased and succeeds in detecting opportunistic behaviour, i. e. rule breaking along the value chain, will certification schemes be credible. While the relationships between single system elements were identified in the context of the certification process (see Figure 3.), the interactions and feedbacks among the sub-systems are shown in Figure . Based on the System Dynamics approach (Forrester 1961; 1991; 1994), the model in Figure 3 is a first attempt to clarify the interrelations within the certification scheme. These observations describe in an exemplary way interactions among the system elements, which may lead to negative feedback loops. All of the demonstrated interactions can cause negative feedback loops within the system. In the following these are exemplified on the basis of interaction one to five.

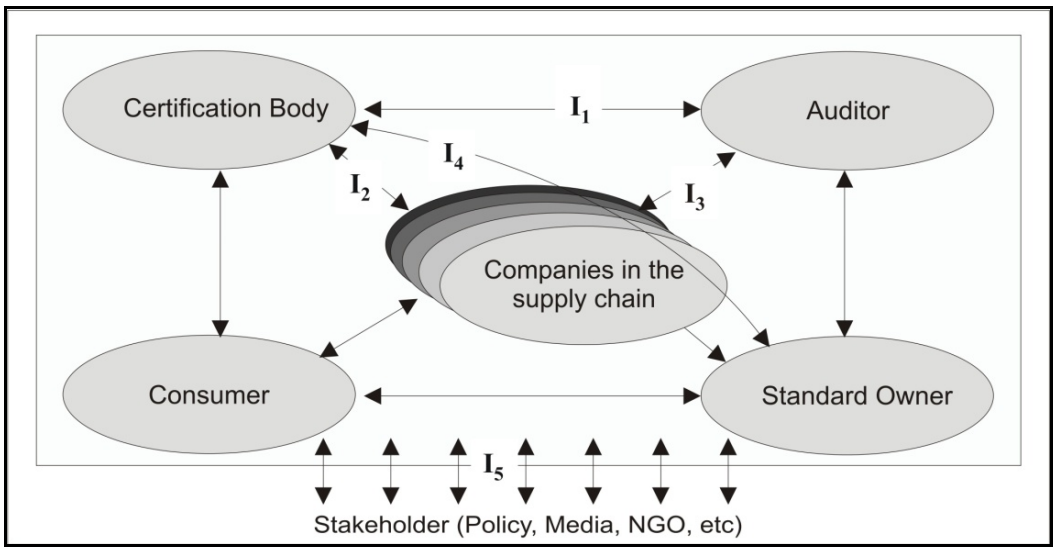

Figure 3.
Quality assurance systems as a System Dynamics model

Interaction 1 (I_1): Certification bodies play an essential role through the selection of their auditors: at first by the recruiting of respective staff and also by the choice of auditors for the certification of relevant businesses (Albersmeier et al., 2009). Thus, they can indirectly influence the audit level within a system by either employing cheap and poorly skilled or highly qualified inspectors. Since auditors depend on their employment, certification bodies can strategically exploit their auditors. Thus, price and costs as well as possible strategic concepts concerning audit quality can be achieved.

Interaction 2 (I_2): In general, a company is free to choose between several certification bodies. The pronounced stress of competition and the low prices for audits that certifiers report in personal conversations can lead some auditors to deliberately audit inattentively in order to minimise their costs and, at the same time, increase the chances of re-contracting and recommendation (low balling) (DeAngelo, 1981). This situation can arise because of the interest of the audited companies in being sure of passing the audit and, thereby, reaching the customers. They will avoid very strict auditors and exert pressure on the certification body. Especially if individual clients have powerful positions, this dependence can achieve great importance. This situation generally increases the risk for side contracts between the audited company and the certification body (auditor).

Interaction 3 (I_3): By the same token, the auditor may provide a “mere rubber stamp to existing practices” in order to win or keep clients (Bush et al., 2005). Beyond financial or personal dependencies, the auditor’s expertise and qualification, as well as subjective influences such as motivation and integrity, endanger the validity of an audit (Albersmeier et al., 2009). However, since the certifier directly influences the quality of the audit, one single fraudulent auditor can damage the entire certification process (Bush et al., 2005) and eventually cause the collapse of the overall system.

Interaction 4 (I_4): Similar to the auditor, the certification body needs to be accredited by the standard owner. By requirements and monitoring processes the standard owner could control the certification bodies and their performance. However, deficiencies of the structural design can increase the competitive situation beyond the certification bodies. In the case of the QS-system, the so-called “Buendler”

(slaughterhouse companies or co-operative marketing associations), for instance, can choose the auditor for connected businesses—in many cases several hundred farmers. The certification body thus becomes dependent on the "Buendler". Similar structures and problems can also be found in other certification standards such as GlobalGap (Group Certification–Option 2).

Interaction 5 (I_5): Modern agriculture is lacking public trust and confidence (Pennings et al., 2002; Poppe, Kjaernes, 2003; Albersmeier, Spiller 2009). These problems are especially due to the meat sector, where several scandals have occurred during the past few years. Nowadays, consumer awareness is extremely sensitised towards possible product failure (European Communities, 2006b). This development is increased and utilised by strategic campaigns of NGO like Greenpeace or PETA, which have a huge influence on public opinion. NGO point at weaknesses and flaws within certification systems: PETA, for instance, campaigns against the German QS-system which permits the current practices of piglet castration. The Clean Clothes Campaign analysed in their report of 2005 practices of auditors during the execution of social audits in developing countries. The authors describe the certification as a cat-and-mouse game between naïve and badly trained auditors and unscrupulous managers, in which the auditors currently lack the means for effective monitoring (Clean Clothes Campaign, 2005). Literature dealing with public relations—particularly with regard to crisis communication—indicates that in cases of a critical incident it is almost impossible for the affected company to comment on the matter via the media (Schmitt, Hauser 1994; Ashcroft, 1997). These observations generally lead to the question of whether the owner of a quality assurance scheme is actually able to steer the system or whether the initiator is just reacting to the system's behaviour.

However, criticism of consumers' organizations and NGO in general points at flaws within the system and hence, marks the starting point for interaction, which in consequence can cause positive or negative feedback loops. By either responding to consumer demands or not, industry and standard owners can steer the direction of these effects. A positive example which highlights the potential of a collaboration between companies and NGO is the Marine Stewardship Council (MSC)—a leading certification and eco-labelling program for sustainable seafood developed by Unilever and the WWF (World Wildlife Fund). Such a cooperation is able to profit from the credibility of the consumer organisation or NGO.

All in all, these examples for creeping direct and indirect effects among institutions within the system demonstrate that integrity and trust are endangered, not only by external stakeholders, but also by the concurrence of internal elements.

The economic incidence of the application of the System Dynamics approach depends on instruments applied in order to detect negative processes within the scheme. The Audit Integrity System presented below generally generates low costs and bureaucracy expenditures since relevant data is already collected and entered in the database of the respective standard. However, negative effects which arise by reason of consumers or other stakeholders can be monitored by intensifying Public Relation and respective instruments such as Issues Management.

4 Risk assessment and controlling in certification schemes

While the integrity of certification systems in the agricultural and food industry have rarely been scrutinised until now (Jahn et al., 2005, Albersmeier et al., 2009), a similar inspection process in financial auditing has already undergone an intensive analysis. In theoretical aspects the following contribution therefore adopts the risk-oriented approach from financial auditing to analyse the interactions of factors influencing a certification system. This concept concentrated on a dynamic constitution of the auditing process—effectivity and efficiency effects are achieved by focusing on risk priorities.

Since the 1970s and increasingly after the recent scandals such as Enron or Parmalat, which evoked a deep loss of confidence in the quality of financial auditing (Nussbaum, 2002; Thomas, 2002; Vinten, 2003), auditing theory has developed approaches that are geared to the risk potential of the audited company (Cushing, Loebbecke 1983; AICPA, 1984; Graham, 1985; Adams, 1989; Alderman, Tabor, 1989; Konrath, 1989).

The purpose of the risk concept is the alignment of audits with the risk situation and risk potential of the individual client (Alderman, Tabor 1989; Konrath, 1989). The central focus is on the so-called audit risk. This risk constitutes a false estimation of the annual accounts; in this case the audit certificate is unwittingly not restricted or rejected, even though the accounts contain significant flaws (Leffson, Bönkhoff, 1981; v. Wysocki, 1992; Quick, 1996). The risk is composed of several subcomponents. Firstly, the risk of error occurring specifies the probability that errors fundamentally occur in the sample. Secondly, the detection risk concretises the risk that the flaws occurring in the company are not detected by the auditor (Graham, 1985). This risk originates from the choice of improper procedures and from

personal deficiencies of the auditor (Brumfield et al., 1983). If this approach is applied to the certification systems in the agribusiness sector, differences and peculiarities of the quality assurance systems have to be accommodated in a modified model (Albersmeier et al., 2009).

Thereby, the risk-oriented concept cannot only be assigned to the single audit, but also to the whole multistage certification control system—the companies´ self-check, the auditing process by neutral auditors and even the standard owner can conduct an auditor and certification body check. Hence, accountability for the functioning and optimizing of the whole system is possible. In the following such a control tool is presented.

5 Development of an Audit Integrity System

The basis of the "Audit Integrity System" consists of the risk-oriented audit approach. In comparison to financial auditing and even to governmental food safety control, the discussion about a risk-oriented audit in privately run certification schemes seems to have been neglected astonishingly. However, especially the characteristic of a consistent, private standard ownership basically creates the possibility of an Audit Integrity System. A suitable foundation for such a system is the audit data base which is already established in the respective certification schemes such as QS or IFS. These data bases contain important facts about the certified companies (name and register office, location etc.), the audit results (judgement and status) and, furthermore, extensive data of single audits. On the basis of this information, detailed statistic analyses of single control issues are possible. These are presented in Figure 4, which is based on the elements shown in Figure .

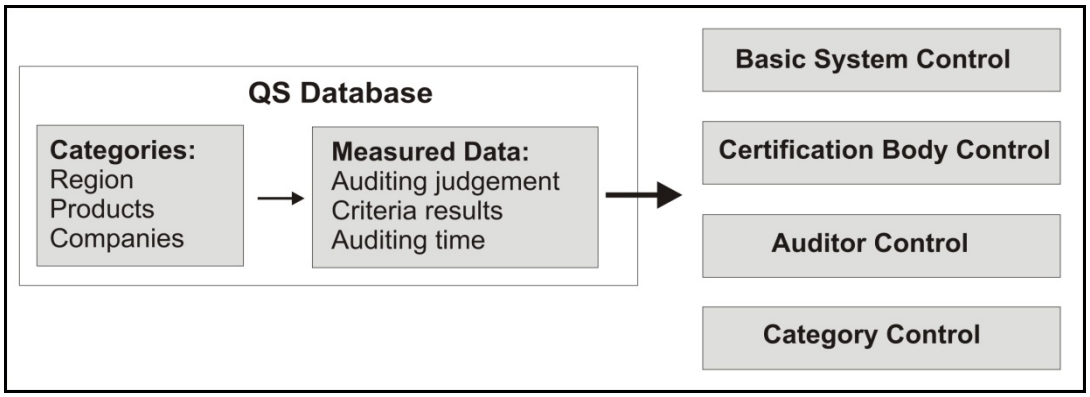

Figure 4.
The Audit Integrity System

General information is incorporated in the Basic System Control, which gives an overview on key data like the number of audits. However, to establish the certification body and auditor control systems, more information about these institutions need to be integrated in the existing data bases. So far, the lack of consistent monitoring of certification bodies and auditors results in a lack of data. The more specifications are given about each control sector, the more categories can be measured. Based on these data a valid risk analysis can be conducted. A well-defined central data base is, thus, the starting point for the Audit Integrity System.

Compared to accounting, quantification and an objective assessment of sub-risks defined by the risk-oriented approach become possible. However, by virtue of the auditor's great influence, universal objectivity can never be claimed for the audit result (Buchner, 1997). Analytical models, which enable the auditor to deduce probabilities from available information, do not exist in financial auditing (Nagel, 1997). The data bases of certification schemes in the agribusiness sector represent "Data Warehouses" exhibiting the potential to gain this information. Necessary facts for the single control branches of the "Audit Integrity Systems" can be achieved. The aim of this information system is to receive automated information on the status quo of the total certification system as well as on the certification bodies and auditors. Based on this knowledge, a dynamic improvement of the system's quality (reliability and validity) is possible. Weaknesses and irregularities can be detected by special parameters and key performance indicators which have to be determined by the standard setter. That means that the scheme

owner has to define which variations from the mean are supposed to be normal and up to when respective values can be considered as outliers, indicating potential risks.

The advantage of such a system is the connection between statistical methods and a detailed profile of the analysed institution. Thus, opportunists can be identified and reasons for deviations individually researched for each system element. Support for the causal research is an automated online portal which is linked with detailed information of the certification bodies, auditor (audit amount, scope etc.) and company. The results of single control branches, for instance, could be visualised by automatically generated figures and tables and recalled online from the standard owner. Hence, this automated online system report could provide information about the situation within the certification system (e. g. number of passed and failed audits, applied audits per product categories or level) and furthermore on crucial variations in the audit quality of special certification bodies and auditors. These variations can be evaluated by comparing single audit results with the whole sample or respective sub-samples. In this way, outliers with respect to their audit results can be identified. However, it is finally the standard owner's job to analyse individual cases and to verify whether reasons for variations can be given in a personal interview, or whether sanctions have to be applied. Each systems partner profits from such a control tool. Companies can, for instance, obtain comparable data for a benchmark of their quality management; and, certification bodies can monitor their auditors.

The application of the Audit Integrity System in practice offers the possibility to achieve detailed and up to date information about the quality assurance system. Thus, the validity and reliability of audit control can continuously be optimised. Based on these results, measures like adaptation of control intervals and depths, application of unannounced sampling audits and the differentiated priorities of inspection contents, can be taken. Since so far none of the current quality assurance systems has used a systematic, data-based control system, the critical factor for future development seems to be the implementation of an audit integrity tool. For practical application, such an automated instrument is necessary in order to verify the interactions and to enable a system-oriented perspective on the certification scheme.

6 Conclusion

Within the framework of this contribution the relevance of a systemic perspective on certification schemes was highlighted. Especially against the background of an advanced expansion of certification systems, the interactions among the system elements need to be mapped and crucial factors have to be revealed in order to achieve an optimized control procedure. Only then can system flaws be detected and remedied and performance improved. On the basis of the audit risk approach this is––in the first instance––particularly related to a better audit quality of certification systems in the agribusiness sector. Efficiency and effectiveness of the certification process can clearly be improved by the application of this model. However, the advantages of this concept can also be transferred to the company level (risk-orientated self check) and the "control of the control" (risk-oriented standard owner). Hence, improvement of the whole system is possible by monitoring each element directly involved in the certification process. Furthermore, consumer confidence and the acceptance of other stakeholders in the guaranteed quality and safety of food will also be strengthened in the long run.

In two case studies, the Audit Integrity System was presented to the German QS-system and the IFS, who generally demonstrated their willingness to improve the scheme. The system owners are interested in enhancing the audit quality and avoiding possible structural deficits. The first objective, which has been developed after a presentation of this concept to the QS GmbH, is an improved systematic data warehouse which will be implemented to allow automatically conducted quality control routines.

Currently, the Audit Integrity System, which monitors the performance of the whole system, is nevertheless neither implemented in the QS-system nor in the IFS. In the QS-system, for example, only first elements, such as spot checks and witness-audits, are applied. So far, the standard owners have predominately concentrated on a single control by the auditor and certification bodies. The main argument against such new control tools is the higher cost incurred by the respective certification system. This may lead to internal trade-offs and barriers to implementation. However, the principal objective of the above-mentioned approach is to minimise the costs of a well-defined audit quality in certification systems and to ensure the survival of the entire certification scheme. Nevertheless, compared to the consequences negative interactions could cause, any kind of expenditures seem to be worth it. All in all, it can be stated, that the sensitivity and perception of potential flaws, or rather, a Systems Thinking is not established in the minds of the standard owners.

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