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# Approach to use the Engage Exchange Model for information management in crisis communication and animal disease control

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Dedicated to my parents

## ABSTRACT

### Approach to use the Engage Exchange Model for information management in crisis communication and animal disease control

This doctoral thesis is featured as a pseudo-cumulative work. Three independent chapters (2 to 4) are framed by an introductory and a concluding chapter (1 and 5).

The objective of this thesis was to develop a concept proposal for improving information management of animal disease prevention and control, to assess the implementation by experts and to test it on a pilot application.

The methodical-theoretical approach of the Engage Exchange Model was used. Initially the question was studied how the existing information and information structures of the private and public sector can meet the information needs of involved decision makers in case of an animal disease outbreak. Furthermore, 26 expert interviews provided statements on which potential has not been exhausted yet. A strategic alliance was proposed as an organizational concept for improved information management, consisting of farmers, inter-company network coordinators, who representing farmers, competent regional veterinary authorities and superior public institutions with managerial functions in case of an animal disease outbreak. To enable an assessment of the implementation level of a communication concept in a strategic alliance, a process reference model according to the maturity method of ISO 15504 was defined. Based on this model a concrete task list and time roadmap can be established for the integration of an individual organization into the strategic alliance. An exemplary maturity assessment was executed on 12 selected livestock trading organizations being on the path to private network coordinators, with particular regard to engage and exchange additional information with partners of the predefined alliance. Finally, the application of a technical support tool for communication according to the Engage Exchange Model was tested and assessed. The outbreak of Classical Swine Fever in an area near the Dutch German border served as crisis scenario to demonstrate the functionalities of the tool for specific user groups. A subsequent validation by a method combination of anonymous survey, demonstration and discussion panel in the framework of a workshop with 13 experts and potential applicants resulted in concrete statements about necessary developments in the future process of prototyping and possible further application areas of this approach for the field of feed and food control.

The prototype presented and validated in this thesis serves as a support tool for public-private partnership alliances to facilitate an improved crisis communication. It represents a first technical-organizational concept proposal which should be implemented in future joint exercises for crisis management.

## KURZFASSUNG

### Ansatz zur Nutzung des Aufschaltungs-Austausch-Modells für das Informationsmanagement in der Krisenkommunikation und Tierseuchenbekämpfung

Die vorliegende Doktorarbeit ist als pseudo-kumulativen Schrift gestaltet. Drei in sich geschlossene Kapitel (2 bis 4) sind eingerahmt von einem einleitenden und einem zusammenfassenden Teil (1 und 5).

Ziel der Arbeit war es, einen Vorschlag zur Verbesserung des Informationsmanagements in der Tierseuchenprävention und -bewältigung zu konzipieren, die Umsetzung durch Experten bewerten zu lassen und an einem Anwendungsbeispiel pilotmäßig zu erproben.

Verwendung fand der methodisch-theoretischen Ansatz des Aufschaltungs-Austausch-Modells. Dabei wurde zunächst der Frage nachgegangen, in wie fern die existierenden Informationen und Informationsstrukturen der Privatwirtschaft und der Behörden den Informationsbedarf der beteiligten Entscheidungsträger im Tierseuchenfall decken können. Eine qualitative Auswertung von 26 Experteninterviews lieferte darüber hinaus Aussagen, welches Potential noch nicht ausgeschöpft werden konnte. Als organisatorisches Konzept zur Verbesserung des Informationsmanagements wird eine strategische Allianz vorgeschlagen, bestehend aus Tierhalter, die Tierhalter vertretenden privatwirtschaftlichen überbetrieblichen Netzwerkkoordinatoren, zuständigen regionalen Veterinärbehörden und ihnen übergeordnete öffentliche Einrichtungen mit koordinierenden Funktionen im Tierseuchenfall. Um den Grad der Umsetzung eines Kommunikationskonzepts in einer strategischen Allianz zu bewerten, wurde gemäß der Reifegradmethode nach ISO 15504 ein Prozess-Referenz-Modell definiert. Auf Grundlage dieses Modells lässt sich eine konkreter Aufgabenliste und zeitlicher Fahrplan zur Integration der jeweils eigenen Organisation in die strategische Allianz aufstellen. Exemplarisch wurde eine Reifegradbestimmung von 12 ausgewählten Viehvermarktungsorganisationen auf dem Weg zu privaten Netzwerkkoordinatoren durchgeführt, unter besonderer Berücksichtigung der Bereitstellung und des Austauschs von zusätzlichen Daten im Krisenfall mit Partnern der zuvor festgelegten Allianz. In einem letzten Schritt erfolgte die Erprobung und Bewertung der Anwendbarkeit eines technischen Tools zur Unterstützung der Kommunikation im Sinne des Aufschaltungs-Austausch-Modells. Als Krisenszenario diente der Ausbruch der Klassischen Schweinepest in einer Region nahe der deutsch-niederländischen Grenze, um die Funktionalitäten des Tools für unterschiedliche Nutzergruppen zu demonstrieren. Eine anschließende Validierung mit Hilfe einer Methodenkombination aus anonymer Umfrage, Demonstration und Diskussionsrunde im Rahmen eines Workshops mit 13 Experten und potentiellen Anwendern lieferte konkrete Aussagen zu Weiterentwicklungsmöglichkeiten und weitere Anwendungsfelder in der Futter- und Lebensmittelüberwachung.

Der in dieser Arbeit vorgestellte und bewertete Prototyp eines Unterstützungstools für Public-Private Partnership Allianzen zur Erleichterung der Krisenkommunikation stellt einen ersten technisch-organisatorischen Konzeptvorschlag dar, der zukünftig in gemeinsamen Übungen für das Krisenmanagement umgesetzt werden soll.

# Contents

# List of abbreviations

| | |
|---|---|
| AAM | Aufschaltungs-Austausch-Modell (Engage Exchange Model) |
| AIDA | Allianzen für Informations- und Dienstleistungs-Agenturen zur horizontalen Bündelung von Koordinierungsaufgaben im Qualitäts-, Gesundheits- und Risikomanagement der Fleischwirtschaft (Alliances for horizontal coordination of information and service agencies concerning quality, health and risk management tasks within the meat economy) |
| Balvi iP | Bundeseinheitliche Anwendungen für Lebensmittelüberwachung und Veterinärwesen, Informationsverarbeitung (German documentation system for official veterinary surveillance and food and feed control) |
| BMELV | Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (Federal Ministry of Food, Agriculture and Consumer Protection) |
| BRBS | BedrijvenRegistratie- en BeheersSysteem (Dutch system for farm registration and control) |
| CBS | Centraal Bureau voor de Statistiek (Statistics Netherlands) |
| CL | Capability Level |
| $CL^{private}$ | Capability Level of private part model |
| $CL^{public}$ | Capability Level of public part model |
| CSF | Classical Swine Fever |
| DESTATIS | DEUtsches STATIStisches Bundesamt (Federal statistical office Germany) |
| e. G. | eingetragene Genossenschaft (registered cooperative) |
| e.g. | exempli gratia (for example) |
| EC | European Community |
| EEM | Engage Exchange Model |
| et al. | et alii (and further) |
| EU | European Union |
| F | Fully achieved |
| FKZ | Förderkennzeichen (project reference number) |
| FMEA | Failure Mode and Effects Analysis |
| GIS | Geographical Information System |
| GmbH | Gesellschaft mit beschränkter Haftung (limited liability company) |
| h | hour |
| Hi-Tier | Herkunftssicherungs- und Informationssystem für Tiere (German official system for documentation of animal movements) |
| i.e. | id est (that is) |

| | |
|---|---|
| I&RVL | Identificatie en Registratie Varkens Leveringen (Dutch registration system of animal movements in combination with pig transport regulations) |
| ICS | Information and Communication System |
| IDV | Integriertes Datenverarbeitungssystem Verbraucherschutz |
| IKB | Integrale Keten Beheersing (Dutch quality assurance system) |
| ISN | Interessengemeinschaft der Schweinehalter Deutschlands (Community of pig farmers in Germany) |
| ISO | International Organization for Standardization |
| IT | Information Technology |
| L | Largely achieved |
| LS | Lower Saxony |
| mod. from | modified from |
| n | sub-sample size |
| N | sample size (abbreviation depends on the context) |
| N | Not achieved (abbreviation depends on the context) |
| NGO | Non-Governmental Organizations |
| NRW | North Rhine-Westphalia |
| OIE | Office International des Épizooties (World Organisation for Animal Health) |
| P | Partially achieved |
| PA | Process Attribute |
| PAM | Process Assessment Model |
| PDCA | Plan, Do, Check, Act |
| PRM | Process Reference Model |
| QS | Qualität und Sicherheit (German private quality assurance system) |
| QUARISMA | QUality And RIsk Management in meat chains |
| SafeGuard | Sound Animals and healthy Food within the Euregio Guaranteed by a United Approach that facilitates averting danger in Rural Districts |
| SMS | Short Message System |
| TiGA | TierGesundheitsAgentur (German private animal disease agency) |
| TRACES | TRAde Control and Expert System |
| TSBH | TierSeuchenBekämpfungsHandbuch (German manual for animal disease control) |
| TSN | TierseuchenNachrichtenSystem (German official animal disease reporting and management system) |
| UBN | Unieke Bedrijf Nummer (Dutch farm identification number) |
| VVL | Verordening Varkens Leveringen (compulsory Dutch pig transport regulations) |
| VVVO-Nr. | ViehVerkehrsVerOrdnungsNummer (Farm identification number due to the German livestock movement order) |

# 1. General introduction

## 1.1. Research background

In the area of food production and animal husbandry, one will speak of a crisis if serious damage is caused to humans and animals and if enormous economic losses for specific companies or sectors occur (PETERSEN & NÜSSEL, 2013). In this regard, epidemic diseases can be seen as common triggers of crises. Due to global trade, epidemic diseases became a permanent threat. For example, in 1997 the European Union spent 1.3 billion euros on the control of Classical Swine Fever (CSF). In 2001, the foot-and-mouth disease led to costs amounting to one billion euros (BREUER et al., 2008). The direct costs of the CSF outbreak in 2006 in the German federal state of North Rhine-Westphalia covered an amount of 24 million euros spent on compensations and subsidies. The agricultural sector estimates the total financial damage in this case to reach up to 80 million euros because the whole sector was directly (e.g. by culling) or indirectly (e.g. by market restrictions) affected (JAEGER, 2006; SCHULZE ALTHOFF et al., 2007; BOSMANN & SAATKAMP, 2010).

For crisis prevention as well as for crisis control, good information and communication management is important to enable those in charge in the public and in the private sector to make efficient decisions. Therefore, it is necessary to comply with all documentation duties and, in case of crises, an unhindered data flow must exist to make sure that the required information reaches the relevant persons quickly (LEIBLE et al., 2013). Various authors point out that in the field of meat production, information and communication between the private and the public sector should be improved (SCHULZE ALTHOFF, 2006; ELLEBRECHT, 2008; SCHÜTZ, 2009; SLÜTTER et al., 2010; THEUVSEN & ARENS, 2011; WILKE et al., 2013; PETERSEN & NÜSSEL, 2013). According to ARENS & THEUVSEN (2010), private as well as public decision-makers in the field of animal disease control have to cope with new technical and organizational challenges to improve the existing communication opportunities. A reason for this is the increasing linkage of production. Therefore, BREUER and co-authors (2008) additionally highlight the necessary improvements in cross-border prevention and cross-border control of animal diseases. The shaping and development of common information and communication system (ICS) solutions for companywide and cross-border crisis communication can be seen as an existing need to pursue these improvements (PETERSEN, 2012). The objective is to ensure

the supply of decision-relevant information to the actors involved in the public and private field in case of a crisis.

One proposed approach to reach this aim is the Engage Exchange Model (EEM) (SLÜTTER et al., 2012; WILKE et al., 2013). Two different situations of communication flow have to be distinguished in this model: (1) the situation of a privately coordinated information exchange between the individual business partners within the production chain and between official institutions in normal times, i.e. no exceptional situation; (2) in contrast to this, the situation during a crisis which portrays an exceptional situation. When this occurs, previously defined information is engaged, and through the exchange of crisis-relevant information, effective and fast communication between authorities and private network coordinators is ensured (BREUER et al., 2008; KASPER et al., 2008; SLÜTTER et al., 2011; PETERSEN & NÜSSEL, 2013).

To close information gaps and to shorten communication channels, the EEM strategy follows the principle of a continuous improvement process. This principle is based on the so-called cycle of Deming (DEMING, 1986) which is also known as PDCA-cycle due to its methodical order plan (P), do (D), check (C), act (A). This means, in the beginning, a plan of improvement has to be developed. Subsequently, this plan has to be implemented. Finally, the effects and changes have to be checked, and if needed, the required modifications have to be started, which, according to DEMING (1986), initiates the start of a new PDCA cycle.

## 1.2. Research objective

The overall objective of this doctoral thesis is to examine whether the EEM approach can actually be implemented as an organizational and technical application in the field of animal disease prevention and control and whether it can obtain an improved crisis communication. Therefore, specific suggestions for the shaping of engage and exchange situations are developed and tested using the example of a CSF outbreak as a possible crisis scenario.

In these circumstances, the following questions have to be answered:

- Which specific weak points and potentials for improvement can be identified for crisis communication between supply chain and competent authorities?
- In which way does the EEM contribute to an improvement of communication?
- Which method is suitable to plan and check the implementation process of the EEM?

- How can inhibiting and supporting factors be derived for an extensive implementation?
- Building on this, how can continuous improvement be validated?

The expected results should serve as guidelines for those responsible in the private and public sector for crisis prevention and control to set up and develop specific crisis communication as defined by the EEM strategy.

## 1.3. Methodical background

To answer the previously mentioned research questions, this thesis concentrates on development, implementation, checking and assessment of a concrete improvement plan for crisis communication.

This is based on the following understanding: Communication shall, in principle, take place through the transfer of information contents (PICOT et al., 2003). The information communicated serves as a preparation for actions and can be seen as “raw material” to “produce” decisions (ALBACH, 1969). Therefore, the benefit of information is not known until it is used. In addition to this, it always depends on the experiences and expectations of the potential user whether information is demanded (PICOT et al., 2003). This means that this thesis has to analyse information as well as communication in different contexts to be able to pursue a holistic perspective on crisis communication.

Therefore, PICOT and co-authors (2003) as well as PASCH and co-authors (2013) propose the following contexts:

- Human behaviour and mutual trust
- Tasks which have to be fulfilled
- Suitable communication channels
- Suitable processes of information and communication
- Quality of collaboration

In literature, a variety of different methods are published to perform the analysis of information needs. These methods can be subdivided into subjective, objective and mixed procedures. Subjective procedures are used to identify the individual information needs. These inductive techniques conclude from one or a few cases to the general perspective. Deductive techniques elicit the information needs according to tasks and can be characterized as objective

procedures. However, to get a detailed analysis of information needs, various authors suggest mixed procedures (BEIERSDORF, 1995; STRAUCH, 2002; PICOT et al., 2003; KRCMAR, 2010). The advantage of mixed procedures is that they are able to avoid the inadequacies of single methods (STRUCKMEIER, 1997; HOLTEN, 1999).

A structured methodical approach with the help of mixed procedures is provided by the analysis of information needs by STRAUCH (2002) and its extension through the technical implementation and introduction of an inter-organizational ICS by SCHULZE ALTHOFF (2006). This analysis includes the whole process of identification of information needs, information gaps, synchronization of information demand and offer, assessment and homogenization of information gaps as well as prioritization and specification of additional information needs as a basis for further development of support systems for communication processes.

To analyse the different phases modified from STRAUCH (2002) and SCHULZE ALTHOFF (2006), within this thesis quantitative and qualitative methods such as surveys and expert interviews as well as the integration of knowledge via meta-analysis based on scientific publications are used. An overview of all single methods employed is shown in Table 1.

**Table 1: Phases of concept development, research tasks and used methods**

| Phase of concept development | Resulting research task | Used single method |
|---|---|---|
| I. Identification of application environment | – Limitation to the research area | – Meta-analysis |
| II. Analysis of information needs | – Analysis of existing information, systems and actors | – Meta-analysis<br>– Expert interview<br>– Survey<br>– Observation |
| III. Target concept | – Identification and analysis of supporting decision processes<br>– Alignment of information need and offer<br>– Prioritizing of uncovered information needs | – Meta-analysis<br>– Expert interview<br>– Maturity method |
| IV. Implementation | – Application of design concept | – Meta-analysis<br>– Prototyping |
| V. Validation | – Validation of design concept | – Meta-analysis<br>– Survey<br>– Workshop |

## 1.4. Structure of the thesis

The thesis is divided into five chapters (Figure 1). The first chapter offers an overview of the formal and content structure of the thesis. It introduces the research background, the general research issue of this thesis and its over-all aim.

The second chapter, at first, will define the research area on which the EEM as an improvement approach should specifically be implemented. Subsequently, by means of a detailed status-quo analysis of the information, its structures, systems and needs, the weak points and potentials to improve crisis communication are highlighted.

The third chapter will introduce the maturity-level method as a measuring frame to assess and improve processes due to the EEM. This method will inform in general about how crisis actors can get access to the identified potentials of improvement. Therefore, a process reference model will be created which will represent the basis for an assessment of chosen crisis actors carried out subsequently in an exemplary manner.

The partial study results of chapter two and three will lead to the development of an ICS concept for the implementation of the EEM approach. The process and results of a first validation of this organizational and technical concept will be presented in the fourth chapter.

In the final fifth chapter, the partial steps will be presented in summary to use the EEM for information management in crisis communication. Finally, the results will be discussed and an outlook on further research activities in this research area will be given.

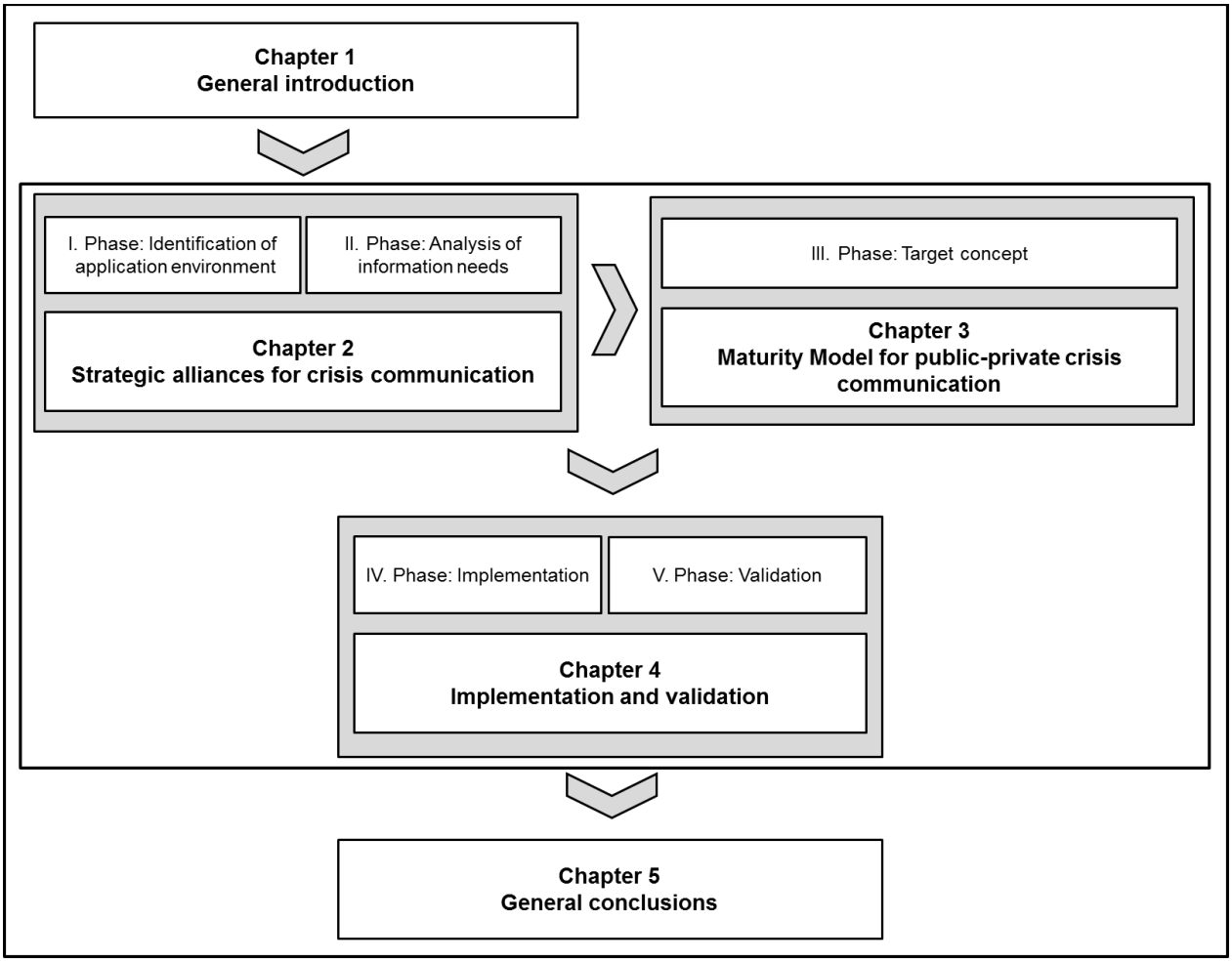


**Figure 1: Structure of the thesis**

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# 2. With a strategic alliance to an improved crisis communication

## Abstract

An adequate information base is important to take efficient decisions in crisis management. This concerns competent authorities when taking measures, directly affects companies in production and indirectly affects service providers when coordinating their services. The more time is needed to collect data for decision-making, the longer the crisis lasts. The consequences of this are avoidable damages for the companies involved and can even include the whole sector for example through market restrictions.

Therefore, the objectives of this study were to uncover existing improvement potentials for crisis communication between competent public authorities and the private sector and to define an implementation concept to take advantage of these potentials in case of a crisis. In this context, Classical Swine Fever (CSF) was used as an example for a crisis trigger in the pig supply chain.

Against the background of the communication strategy of the Engage Exchange Model (EEM), an information analysis was carried out with the help of a combined methodological approach consisting of qualitative and quantitative research methods, expert interviews, observations and surveys.

In summary, both, i.e. competent authorities and the private sector, offer untapped potential to improve information resources and communication channels for animal disease control. Whereas the private sector has a clear demand on quicker information flow, public authorities need to improve data quality. The official use of additional digital information from private information and communication systems (ICSs) is an untapped potential because trust in and knowledge about existing information are little. In order to increase the level of trust in and knowledge about information and to simplify public-private communication, the concept of a strategic alliance between farmers, network coordinators and competent veterinary authorities was established. A strategic combination of public and private ICSs provides additional beneficial effects in crisis communication such as savings in personnel and time, an extension of service offers and a decision support in public and private process management.

## 2.1 Introduction

Against the background of numerous food crises, the collection and storage of process data meanwhile is not only requested by law but also by private initiatives. They pursue complete documentation and traceability in the context of product liability (LUNING et al., 2006; LEIBLE et al., 2013). As a result, the need for information and data has steadily increased along the food supply chains. Accordingly, a series of inter-organizational information and communication systems (ICSs) supported by information technology (IT) have been developed along the pig supply chain (TRIENEKENS & VAN DER VORST, 2006; ELLEBRECHT, 2008).

In case of a crisis, the need for communication between companies, sectors, non-governmental organizations (NGO's), authorities and the public is high. Nowadays, this necessary public-private communication network only occurs ad-hoc in case of a crisis, although, again and again, when following up crises in the food sector, the development and coordination of such an ad-hoc network is determined as a weak point within crisis management (LENDLE, 2011; PETERSEN, 2012). That means that important information is often missing or the information flow is slow, even though this is essential for good decision-making and for effective crisis management. As a result, crises might last longer than necessary which is combined with an increased total damage usually for the whole sector. However, to this day, no common use of public and private IT structures along the chain takes place for crisis communication. On the contrary, in case of crises, competent authorities still collect, evaluate and redirect much information in a personnel and time consuming way, although comparable information has already been collected digitally in IT systems on the private side (ELLEBRECHT, 2008; SLÜTTER, 2010).

This leads to the assumption that information and ICSs of the private sector might be used for crisis management of both, i.e. the private sector and competent authorities, to provide all decision-makers with the relevant information and possibilities for faster communication and finally to shorten the period and negative effects of a crisis. Of course, crisis communication is a difficult process if private-sector companies and competent authorities get into direct contact immediately when a crisis situation occurs (LENDLE, 2011). The existing official and private IT structures, their datasets and last but not least, their position in the information management along the production chain lead to the communication strategy of the Engage Exchange Model (EEM). It suggests a mutual exchange of existing information out of separate ICSs and the engage of additional relevant new information by a common information management approach in case of a crisis.

Crises in the field of meat production have different triggers. The revealing of the rotten-meat scandal or the discovery of elevated levels of dioxin in pork are common examples for this. However, in addition to such scandals caused by actual health risks for the consumer or simply by emerging disgust, the outbreak of an epidemic animal disease can cause a crisis in the meat sector as well. Having a closer look at the German and Dutch pig supply chains, it becomes evident that there is a permanent risk for an outbreak of Classical Swine Fever (CSF) (MEUWISSEN et al., 1999; FRITZEMEYER, 2000; BACKER et al., 2010). CSF is a highly contagious disease of domestic and wild boar. The main infection routes of CSF are direct contact between pigs, but the spread is also possible by alternative routes such as transport vehicles or clothing. The CSF virus is mostly stable and survives for months in faeces, pork and pork products and even years in frozen products (OIE, 2012). In case of an outbreak, this circumstance can lead to comprehensive tracing-back investigations of infections, especially in areas with a high density of domestic or feral pigs (MOENNIG et al., 2003; PATON & GREISER-WILKE, 2003). Through the increasingly global trading of pigs and pork products, the introduction of CSF can never be ruled out completely. The Council Directive 2001/89/EC prescribes a control strategy for stamping-out accompanied by the establishment of defined surveillance and protection zones with specific safety measures in each of these zones such as the prohibition of transports.

Although CSF is not infectious for human beings and does not cause human health risks, it can lead to other serious damages. 1.3 billion euros have been spent on combating the CSF outbreaks between February 1997 and March 1998 (BREUER et al., 2008). During this period, a total of 429 Dutch farms were infected and detected, more than 13.000 farms were involved in one or more control measures. Finally, more than 11 million pigs were destroyed (MEUWISSEN et al., 1999). During the CSF epidemic in 2006 in the German federal state of North Rhine-Westphalia (NRW), the number of infected farms was much lower. Only eight farms were infected but this still led to the culling of more than 110.000 pigs, thereof retrospectively 107.000 pigs with actually negative results on CSF. The epidemic lasted 115 days until its final eradication, and the direct costs of the swine fever outbreak were around 22 million euros. It is estimated that another 20-60 million euros were indirect damage incurred by trading losses. More losses, for example, regarding trade agreements or decreasing consumption, are not included in this calculation (JAEGER, 2006; BOSMAN & SAATKAMP, 2010). In addition to high animal losses and enormous financial losses, damages on the social level are also negative effects. For example, numerous personal dramas have occurred which even included suicides

(MOENNIG, 2008). In conclusion, animal diseases such as CSF can be classified as a permanent risk for triggering a crisis in the German and Dutch pork production sector.

Against this background, the motivation of this study is to examine how to use the EEM for improving communication in crises between public authorities and the private sector. For that reason, the information demand of involved public and private actors in the framework of CSF control is set against the status-quo of information, ICS and IT to derive still untapped potentials for the improvement of crisis communication. Focusing on CSF outbreaks as typical sources of crises in the pig supply chain, the study aims to answer the following questions:

- Which specific weak points and potentials for improvements can be identified in crisis communication between the pig supply chain and competent authorities?
- In which way can the general EEM approach activate these potentials?

## 2.2 Background

### 2.2.1 Chain and information management in pig supply chains

The pig or respectively pork production process is organized by a division of labour. The whole production process from piglet production to processed pork markets is divided into chain links of a so-called pig supply chain. However, the chain is accompanied by other actors within the meat sector such as actors for transport, feed production, consulting, quality assurance and veterinary control. A number of authors such as LAZZARINI and co-authors (2001) or SCHULZE ALTHOFF (2006) talk about netchains of pig production when they include these supporting actors in an overall view of the supply chain.

In 2012, the total stock population of pigs amounted to about 12.1 million in the Netherlands and 28.1 million in Germany. Since 2000, the total pig stock has decreased by about 4.7% in the Netherlands and increased by about 4.4% in Germany (DESTATIS, 2012; CBS, 2012). ARENS and co-authors (2012) took a closer look at the state level in Germany and its activities of pig and pork trading with the Netherlands. It can be observed that North Rhine-Westphalia (NRW) and Lower Saxony (LS) are states with an intensive pig production. In 2010, NRW reared about 23.6% and LS roughly 30.9% of all pigs in Germany. Similar to the situation in the Netherlands, the number of stocks is decreasing while the number of pigs per stock on average is increasing. In addition to this structural shift, an international shift in the division of labour can be observed

as well. While Dutch pig farms more and more focus on piglet production, farmers in NRW and LS instead concentrate on pig fattening. That results in a high demand for piglets in NRW and LS and an increased pressure on Dutch piglet producers to export their piglets. Owing to the close proximity of the border and against the background of an increasing globalization of trade, both German federal states form an important sales market for Dutch piglets. Therefore, in 2010, 17% of all Dutch piglets were sold to LS and even 58% to NRW. BACKUS and co-authors (2012) describe Germany consequently as a premium market for Dutch piglets and assume a strong increase of these exports until 2020.

The slaughter pig market is also highly concentrated. In Germany, the top ten slaughtering companies usually slaughter constantly 75% of all pigs (ISN, 2012). In addition to farms and slaughtering companies, in Germany livestock trading organizations regularly occupy a central position within the pig supply chain instead of one in the wider field of a netchain. They form links between the stages of primary production as well as between the stages of fattening and slaughtering. More than in other countries, in Germany a two-staged trading of pigs through livestock traders dominates (TRAUPE, 2002; SPILLER et al., 2005; BAHLMANN & SPILLER, 2008; VOSS, 2011). GRESHAKE (2011) explains this with a strong personal relationship between farmer and trader. The study of RECKE et al. (2011) predicts that farmers who have opted for this way of marketing will most certainly remain faithful to this way of marketing in future. Bonding between pig farmers and livestock trading organizations is achieved by a large range of extra services such as customer consultancy which create mutual trust and further bonding measures such as bonus systems and good prices (RECKE et al., 2011). Other studies revealed a similar picture. Livestock traders are forced to offer a wide range of services to simply protect their market position in the German pig supply chain (SCHÜTZ, 2009; PETERSEN et al., 2010; SCHLECHT et al., 2010; BRINKMANN et al., 2011).

Legal requirements such as the "stable to table" approach in the EU hygiene package and the extension of product liability to the primary production and its suppliers are a motivation to achieve a cooperation between all actors in pork production. Against that background, BAHLMANN & SPILLER (2009) see the chain-wide German quality assurance system Qualität und Sicherheit (QS) not only as a standard-setting body but also as a coordinator within the netchain. In the Netherlands, the Integrale Ketenbeheersing (IKB) controls the quality within the pig production sector in an equal way. Therefore, both quality assurance systems, IKB and QS, have already cooperated for a couple of years by recognizing the other’s standard and by providing quality-relevant information to each other (QS, 2012). However, such a coordinator ensures only coordination at normative level. At strategic level, BRINKMANN et al. (2011)

identified network coordinators who implement the quality strategy and initiate coordination mechanisms within the chain. In Germany, livestock trading organizations can act as network coordinators because they constantly expand their tasks to additional coordination services in the field of transport, crisis, process and audit management (SCHÜTZ, 2009). Through their services of support and coordination in the performance of legal or private requirements, they take over a mediating role between standard and legislation-setting bodies at normative level and companies of the meat sector at operational level (PETERSEN et al., 2007; SCHÜTZ, 2009). However, it is assumed that especially solutions for coordinating tasks in the field of crisis management are not available in a sufficient number because the willingness to communicate with the normative level is actually in particular high in acute crisis situations (BREUER et al., 2008).

### 2.2.2 Information and communication procedures in CSF crisis management

The legislation of the European Community (EC) consists of numerous articles with requirements for acquisition, documentation and transformation of information which the competent actors in agri-food and food chains have to comply with. Because of these duties already lots of information is stored in IT-supported ICSs. The most important regulations in this research context are presented in Table 2.

**Table 2: Important European regulations regarding information and communication duties in the field of contagious animal diseases (e.g. Classical Swine Fever)**

| Legislation | Intention |
|---|---|
| Regulation (EC) No. 178/2002 | Ensuring traceability of food and feed at all levels of production, processing and trade<br>(according to the approach “from stable to table”) |
| Regulation (EC) No. 852/2004 | Documentation and transformation of information on origin and type of feed, medical and other treatments, diseases and laboratory results which are relevant in the framework of health and food safety<br>(according to the approach of product liability on all stages) |
| Directive 2001/89/EC | Community measures for the control of classical swine fever<br>(according to the approach of stamping-out) |

Based on the Directive 2001/89/EC, within 24 hours after confirmation of an epidemic disease outbreak, an official notification of the outbreak and further detailed epidemiological information have to be forwarded to the European Union (EU) by the affected member state. In case of an outbreak, transport restrictions are the first central measures taken to prevent a further spread of the disease. In addition, investigations must be carried out to get further information about the possibilities of an introduction of the disease (tracing back) and its spread (tracing forward). These investigative tasks can be summarized as epidemiological investigations. To gain information for tracing back und tracing forward, queries of already existing data in official IT systems are combined with individual on-spot visits and direct communication with farmers and other actors involved in the private sector. Determination of a fast, current and detailed basis for further decisions is the overall purpose of these investigations because only with sufficient knowledge about the local situation, the number of animals, farming and contacts, the risk for an introduction and spread can be estimated efficiently. The German Tierseuchenbekämpfungshandbuch (TSBH) and several Dutch Draaiboeken are manuals for each country defining the activities and communication in case of an outbreak depending on the relevant diseases.

Due to the dissimilar structures of both states, the implementation of the European legislation differs regarding content and structure. Whereas the Netherlands pursue a more centralized approach of animal disease control and information management to fulfil the European legislation, Germany follows a federal approach (BREUER et al., 2008) and therefore the tasks for animal disease control are split into district (Kreis), state (Land) and federal level (Bund). In Germany, the responsibilities in case of an outbreak of epidemic diseases rest with the federal level. However, according to the German basic constitutional law, implementation of veterinary legislation and general surveillance is the responsibility of each German state. The official veterinary surveillance and animal disease control is carried out under the responsibility of the competent veterinary authorities at district level. For an overview of the federal structure of veterinary authorities in Germany, see also

Figure 2.


**Figure 2: Federal structure of veterinary supervision in Germany**

Essentially, the official information management of animal disease control in Germany is supported by the following three IT solutions: (i) origin and information security system for animals (HI-Tier), (ii) software system for official veterinary surveillance in the food sector (Balvi iP), (iii) animal disease reporting and management system (TSN), and the European system TRACES (iv) for cross-border animal transports. The collection of additional information or the update of existing information takes place through direct contact with companies in the framework of epidemiological investigation on the spot.

*(i) HI-Tier*

Transport movements of specified animal species are recorded in the central national German database HI-Tier. Pig transports must be reported by the new owner within 7 days after transport according to a defined farm unit, in German called Viehverkehrsverordnungsnummer (VVVO-Nr.). It is possible that service providers such as livestock trading organizations take over these obligatory reports as a service offered to the pig owner. Possible pathways, disease origins and infection causes are identified in detail and verified by an inquiry of animal movements. However, the report of birth, death or slaughter of pigs as well as transport reports issued by the former pig owner is not intended by the system. The absolute number of animals is updated by a counting report at the beginning of each year. In addition, pig owners and livestock traders are

obliged to maintain a current herd register and transport control books as minimum manually written documents. This documentation is monitored by the veterinary authorities through randomly or risk-based on-spot controls. Transports of animals within the member states and from and to third countries are documented in the additional cross-border IT system TRACES presented under (iv).

*(ii) Balvi iP*

This application is used on a nationwide level in Germany but is organized by competent veterinary authorities on district level. The software is designed to support the veterinary offices in managing their activities of consumer and animal protection and to document these results. Therefore, it serves as a register of farms and food production companies as well as a documentation system for results and measures of veterinary inspections required by law.

*(iii) TSN*

TSN is implemented nation-wide and serves as an electronic system for the notification of infectious animal diseases in Germany. A crisis management module and a geographical information system (GIS) for visualizing the disease situation are included in the system as well. Within this module, the responsible veterinary offices can plan all measures and follow up their status-quo of implementation. The function of change or update of datasets in TSN is provided only for veterinary authorities at district level because they are the owners of this information. Neither farmers nor other private sector companies possess an access to TSN.

*(iv) TRACES*

For intra-European registration of animal movements, the database system TRACES was established based on the Decision 2003/623/EC. In this IT system, transports within the EU and from and to third countries are registered, and it enables an exchange of information between the veterinary authorities of different countries.

The Dutch equivalent to the German systems Balvi iP and Hi-Tier is the system of farm registration and management BRBS (bedrijvenregistratie- en beheerssysteem) and the identification and registration system I&RVL Systeem. The identification and registration system (I&R) combines the European duties of the compulsory Dutch transport regulations Verordening

Varkens Leveringen (VVL) in I&RVL Systeem I&R assigns a Unieke Bedrijf Nummer (UBN) as farm unit and epidemiological unit. According to that number, the system saves information like farm veterinarians, animal groups and contact address of the farmer. The reporting of pig movements has to be done within three days after transport in I&R. In contrast to the German systems, a farmer with delayed reporting is obliged to pay a penalty fee. As part of the report duties of the VVL, the farmer has to announce a pig transport before the transport takes place; this transport report is controlled by matching it with the subsequent report of pig movements. Dutch farms are divided into specific categories of pig holdings with explicit transport regulations, depending on their individual production level (e.g. piglet production, pig fattening) and monitoring results (e.g. CSF, salmonella). Only if all requirements are fulfilled, the transport announcement will be approved, and the farmer will be allowed to transport the indicated pigs.

The public communication in case of an epidemic outbreak is usually done through a public notice and additionally through other channels like newspapers, broadcast media and the internet. Farms and other companies which are affected by control measures like restrictions or culling actions, receive official orders by personal delivery to guarantee their validity. During the CSF outbreak in 2006, in NRW alone, the veterinary office of the affected district had to deliver 653 of these official orders by courier to specific farmers. Although this is the most trustworthy way of delivery, it is actually a time-consuming method, especially when the personnel resources are already scarce because of other measures to be taken. The responsible veterinary authority of NRW promised to verify the legal regulations of future electronic notifications of such disease orders (GROENEVELD, 2006).

THEUVSEN & ARENS (2011) who took a closer look at the communication between authorities, came to the conclusion that the communication between veterinary authorities in Germany is seen by themselves as rather good in contrast to cross-border communication which shows organizational hurdles due to the German federal structure and is not least more difficult because of the different languages. On the other side, the status-quo of official communication with stakeholders is seen as rather mediocre. The adequacy of personal communication in combination with lacking mutual trust and the chosen communication media during crises are seen as impact factors and underlying reasons. This applies particularly in relation to stakeholders of the private sector which implicates that the technical design of public-private communication during crises also has to be questioned critically.

### 2.2.3 Research approach

New challenges of cooperation arise between public and private decision-makers in the field of animal disease control as well as through an increasing interlinking of the pig production (BREUER et al., 2008; ARENS & THEUVSEN, 2010). The EEM is a strategy suggested to meet these challenges. This model is based, in principle, on a data exchange between public authorities and the private sector to prevent and control crises. The aim of this model is to provide the best possible information basis for decision-making. Therefore, two different situations of communication flow have to be distinguished in this model: the situation of communication flow in normal times by an information exchange between private actors in the netchain and during crises through its extension to a public-private information management with competent authorities. Thus, previously defined crisis-relevant information is exchanged to ensure a targeted and quick information flow between the involved public and private actors (BREUER et al. 2008, KASPER et al., 2008; SLÜTTER et al., 2011; PETERSEN & NÜSSEL, 2013). The structure of the EEM provides network coordinators with a communication hub in the private and public sector. They bundle many individual users because of their bottleneck position within the supply chain or official structure.

With a view to effective information exchange and communication flow, for both aspects requirements have to be defined specifically for different types of crises. In this context, it has to be recognized that there exists no uniform view on how to analyse the underlying information and communication processes. Both, information and communication can be considered in different contexts. PICOT and co-authors (2003) distinguish between behaviour of information and communication and the relevant task which has to be fulfilled. Therefore, the investigation on information need and the analysis of tasks are complementary to each other. In addition, these authors refer to close interactions between the mutual confidence of individual actors and the intensity level of information and communication which ultimately influence the shaping and transfer of knowledge and the use of information and communication processes and systems. In many cases, the need does not only depend on the information offered but also on the decision-maker’s knowledge about this offer, his or her personal qualities as well as available procedures of information processing (MARR, 1993). It is not unusual that the relevant information is not used, although it is basically available (PICOT et al, 2003). Therefore, an optimum degree of information exists when the offer of information is equal to its demand. Following this logic, the demand for information has to be aligned with the information need. The need for information is generally defined as the type, quantity and quality of information which is required for the

performance of a task (PICOT et al., 2003). When identifying the need for information, it has to be taken into account as well that to fulfil a task the objective information need not always corresponds with the perceived need and thus is not equal to the subjective information need. Owing to this, it must be distinguished between objective need and subjective need of information. The amount of information that will be in demand finally is often just a subset of the original information need. Thus, current information supply only takes place when demand and supply of information coincide (PICOT & REICHWALD, 1991; PICOT & WOLFF, 1995).

The aim of a needs analysis is to collect and assess the user requirements in such a way that an approximation with the optimum of information supply is achieved (HÖHN, 2000). In this context, several authors emphasize that possibilities for a change and extension of the inter-organizational collaboration in communication can arise through new IT (PICOT et al., 2003; PASCH et al., 2013). But it is also stressed that if the willingness for collaboration or cooperation is still lacking or is not coordinated well, this will also hinder communication (VAN DORP, 2004). In summary, when analysing information needs, the following aspects have to be taken into account:

- Complexity and variety of the information needs of individual users
- Limited skills of people to specify their actual information needs
- Difficulties of communication
- Possible unwillingness to cooperate

In animal disease control, decision is a central element of further planning of measures in the production process and the choice of control measures. Information needs have to be gathered, documented and kept up-to-date for different groups of users and often on the purpose of decisions which are only structured to a limited extent. Plenty of potentially usable and recordable information can be derived but an overload of information has to be avoided. This is the task of information management. The objective is to make the best possible use of information as a resource and include the areas of information economy, ICS, process organization and IT. PICOT and co-authors (2003) identified weak points of information management that may lead to deviations from the information optimum:

- Deviation between the subjective and the objective need for information
- Faults in communication between actors
- Faults in information transmission
- Inefficient use of information by sub-optimal institutional settings

According to the strategy of the EEM, information management in crises has to be fulfilled by public-private collaboration.

In general, collaboration can be characterized as a purpose-oriented, long-term cooperation between at least two autonomous business partners which is often fixed by contract. Cooperations have a symbiotic character because they are based on a voluntary pooling of individual business resources aimed at mutual benefits. Often they are combined with a strategic component, the so-called strategic alliances. Partners of a strategic alliance pursue a set of aims or meet critical needs while remaining independent organizations. They provide their strategic alliance with own resources such as products, technological capability, capital equipment, knowledge or expertise. Therefore, the alliance aims for a synergy where each partner hopes to achieve greater benefits than would be possible by individual efforts (PICOT et al., 2003; LAUDON et al., 2010). With knowledge integration, communication, coordination and information logistics, PASCH and co-authors (2013) define four quality criteria of a successful collaboration. These quality criteria highlight that information management plays a very important role in collaboration, and in consequence the weak points of information management as defined by PICOT ad co-authors (2003) and as mentioned above can be transferred into quality problems of collaborations.

## 2.3 Methodology

The analysis of information needs of the public and private sector during animal disease control followed after the first two phases of the methodical procedure suggested by STRAUCH (2002) and SCHULZE ALTHOFF (2006).

That means that at the beginning of the study, a decision was taken in the initial phase to define a specific crisis trigger on which the subsequent information analysis should be based. The decision for CSF as a crisis trigger enabled an in-depth insight into information and communication issues in the field of CSF control instead of a general look on crisis control which would just have been scratching the surface of communication problems in crises (STRAUCH, 2002). In this context, the analysis is carried out with existing information, information needs of involved actors and the organization and IT support of their ICS in the focus of CSF control.

Many authors suggest a combination of methods for the analysis of information needs because of the wide range of perspectives and influences as well as the various tasks within information

management. By combining several inductive and deductive methods, gaps in data collection and interpretation can be overcome (BEIERSDORF, 1995; KRCMAR, 2010; PICOT et al., 2003; STRAUCH, 2002; STRUCKMEIER, 1997; HOLTEN, 1999). Owing to this, the methodical approach of this study includes several single methodical steps as presented in Figure 3.

At the beginning, the interview guidelines and the questionnaire for the survey was derived from meta-analysis. Then, the use of the methods, expert interviews, surveys and observations delivered core information which supported by meta-analysis led to the development of an organizational concept proposal for the implementation of the EEM.

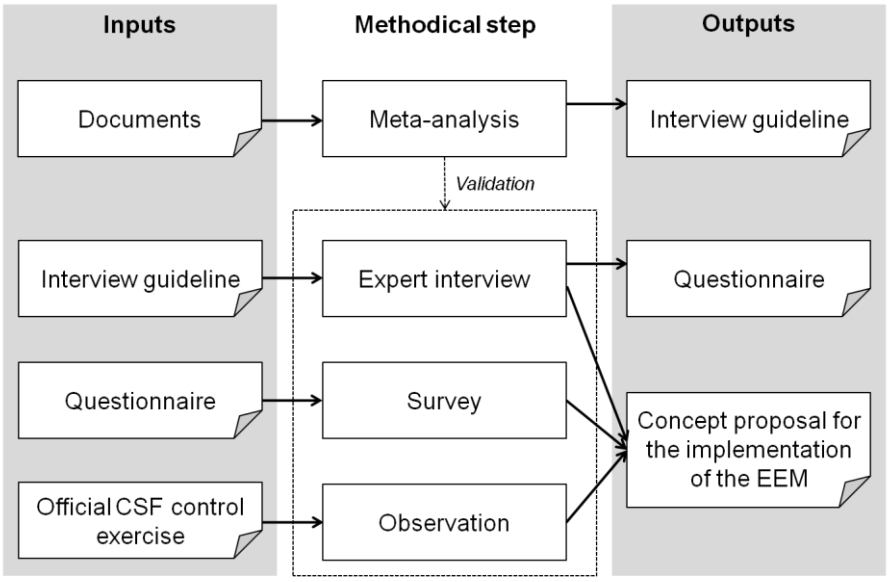


**Figure 3:** **Methodical structure for the development of a concept for the implementation of the Engage Exchange Model (EEM) on the example of Classical Swine Fever (CSF)**

### 2.3.1 Design of meta-analysis

Meta-analysis was used for the preparation of the interview guidelines for expert interviews with several types of experts and to create a questionnaire for a survey. Additionally, the evaluation of interview, survey and observation results was supported by literature from the meta-analysis.

The analysis included documents according to the subject area of chain communication and animal disease control in Germany and the Netherlands. The search was not limited to scientific

documents but also included so-called grey literature which means written material such as reports, working papers, lectures or presentation sheets usually not published commercially. Therefore, some of the documents included were not generally accessible and had to be requested personally. Manuals and legislative documents were limited to the latest and current versions. All other documents were not to be published earlier than 2000 except for documents dealing with the CSF epidemics in 1997 and 1998 in the Netherlands. The reasons for this limitation are later key developments such as broadly used Internet and IT supports in official and private ICS. Examples for this are HI-Tier, TSN or private inter-organizational IT solutions. It was assumed that these key developments influence the meaningfulness of document contents for the current situation of animal disease control and chain communication.

In total, the meta-analysis included 140 documents, thereof 53 scientific documents and 87 miscellaneous documents. The scientific documents consisted of publications in journals and proceedings. All other documents consisted of grey literature as defined above which in total included five manuals, 24 legislative documents, 26 discussion papers and 32 documents of official exercises on animal disease control. A structural overview of all documents involved in the meta-analysis is given in Figure 4.

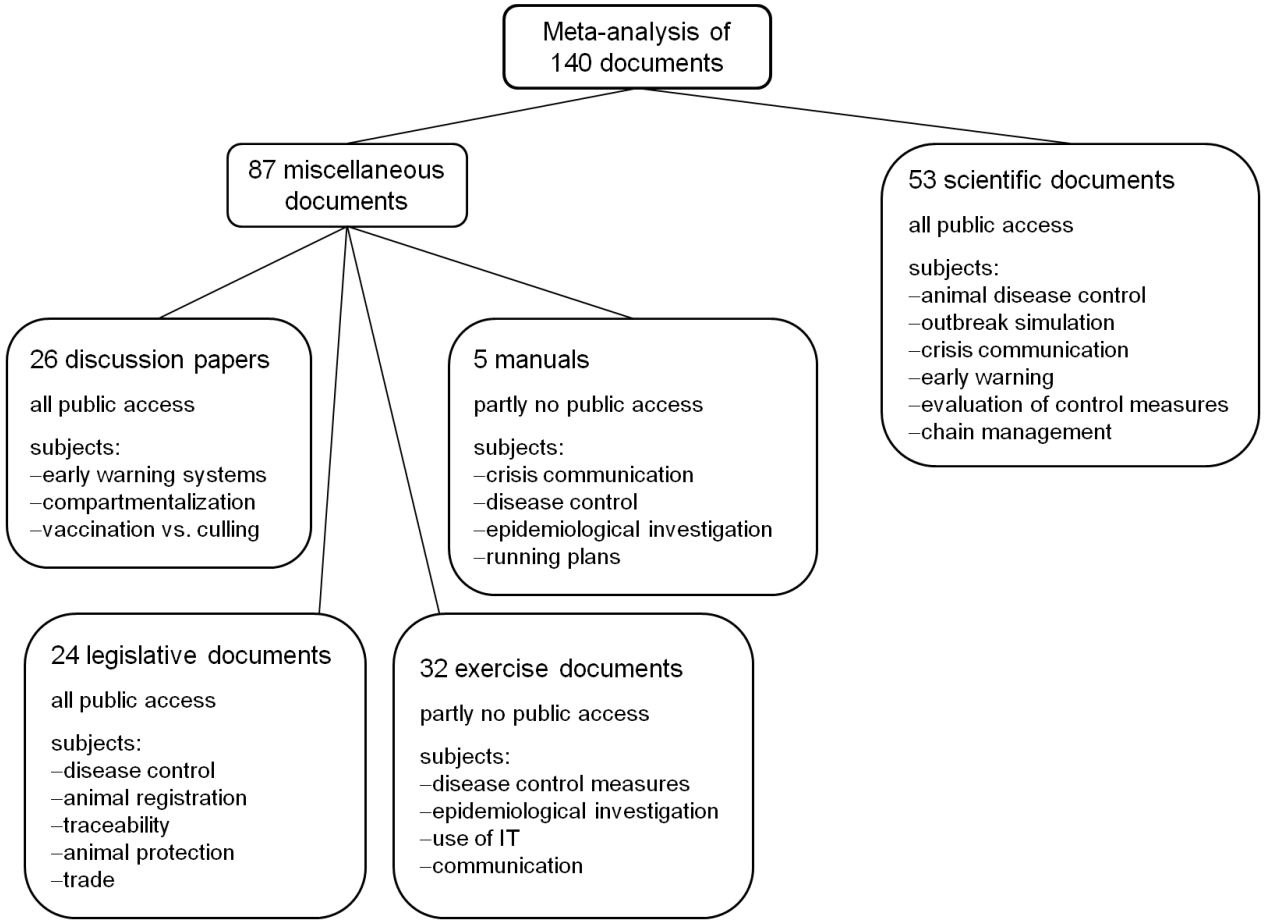


**Figure 4: Structural overview of all documents included into the meta-analysis (n=140)**

### 2.3.2 Design of expert interviews

In total, three categories consisting of 26 experts were interviewed. This included interview partners with special expertise either in official animal disease control or pig production or information and communication systems (ICS).

In case of a CSF outbreak, the decision making and communication is purely controlled by competent authorities and with the help of official ICSs. This fact and the federal structure in Germany led to the need to include competent German authorities at state and district level into the interview panel. The search for experts concentrated on the states of NRW and LS, as intensive regions of pork production. A further selection took place amongst district authorities with a high pig density or with close proximity to the Dutch border. The expertise category was

completed with interviewees from Dutch authorities with competence in animal disease control in the Netherlands. The category of experts on pig production was represented by a livestock trading organization with cross-border pig trade and pig farmers which, on the one hand, are located close to the Dutch border and, on the other hand, have been partially directly and indirectly affected by former CSF outbreaks. IT providers of systems for official veterinary control, animal disease control, traceability, early detection and private chain management represented the category of interviewees with expertise in ICS.

On the one hand, the interviewees had an overall view of the subject area of animal diseases and, on the other hand, could give insights into the fields of process management, data administration or execution of control measures against the background of animal disease control. All potential interviewees were contacted by phone and informed in general about the research subject. To be able to prepare the interview, an overview of the interview topics was mailed to the interviewees one week before their interview. Finally, 26 semi-structured interviews could be carried out. The interview guidelines are listed in the Annex and were developed with the support of the meta-analysis. The interviews lasted on average for 1.5 h. If available, a voice recorder was used for documentation and provided the interviewees previously agreed to this. In all other cases notes were taken. Subsequently, the recordings and notes were transcribed into a text protocol which was sent to the individual interviewee for a review.

As shown in Table 3, all experts could be categorized according to their type of involvement in past CSF outbreaks. At the time of the interviews with German authorities, the last CSF outbreak in Germany happened five years ago, but several outbreaks of Avian Influenza occurred after that. The EHEC crisis was at the time of these interviews just around the corner but had not yet occurred. The Dutch interviews took place roughly one year later and therefore after EHEC, six years after the CSF outbreak in Germany and 14 years after the long CSF epidemic in 1997/98. Just at the time of the interviews, the Netherlands was busy with investigations and evaluations on the Schmallenberg Virus. The farm of one interviewer belonging to the category of pig production was directly involved in culling measures at the CSF outbreak in 1997/98, and all interviewed pig producers were involved in the restrictions at the time of the CSF outbreak in 2006.

**Table 3: Overview of all expert interviews**

| Type of expertise | Number of interviews | Number of interviews depending on type of involvement in past outbreaks of Classical Swine Fever*/** (CSF) at the time of interview | | |
|---|---|---|---|---|
| | | Directly[1] | Indirectly[2] | Not[3] |
| **Official animal disease control:** | **17** | | | |
| - thereof in Germany | 14 | | | |
| - thereof at district level | 12 | 1*, 1** | 8* | 3* |
| - thereof at state level | 2 | 2*, 1** | | |
| - thereof in the Netherlands | 3 | 3** | 3* | |
| **Information and communication systems:** | **5** | | | 5*, 5** |
| **Pig production:** | **4** | | | |
| - thereof livestock trader | 1 | | 1*, 1** | |
| - thereof farmer | 3 | 1** | 3*, 2** | |

[1]affected by outbreak or direct control, [2]indirectly affected by restriction measures or crisis support, [3]not involved
*regarding CSF outbreak in 2006 (5 years before the interview)
**regarding CSF outbreak in 1997/98 (14 years before the interview)

The interview protocols were analysed by means of a qualitative data analysis supported by the software MAXQDA 11. In a first step, each interview protocol was divided into logical passages and encoded with general codes according to the following questions:

- In which position do you see your veterinary authority institution in crisis communication with private companies and across borders?
- How and what is communicated in which way?
- Which organizational processes and standards are backing this?
- What are the people's wishes, ideas, experiences and advices?

This delivered in total 14 subcodes which again could be assigned to four main codes according to the quality criteria communication, coordination, information logistics and knowledge integration by PASCH and co-authors (2013). Communication means how information is distributed. Coordination deals with responsibilities within an ICS. Information logistics defines the support of processes by information. Finally, knowledge integration aims at the covering of information demands by ensuring a suitable information offer. An overview of the coding scheme is given in Figure 5.

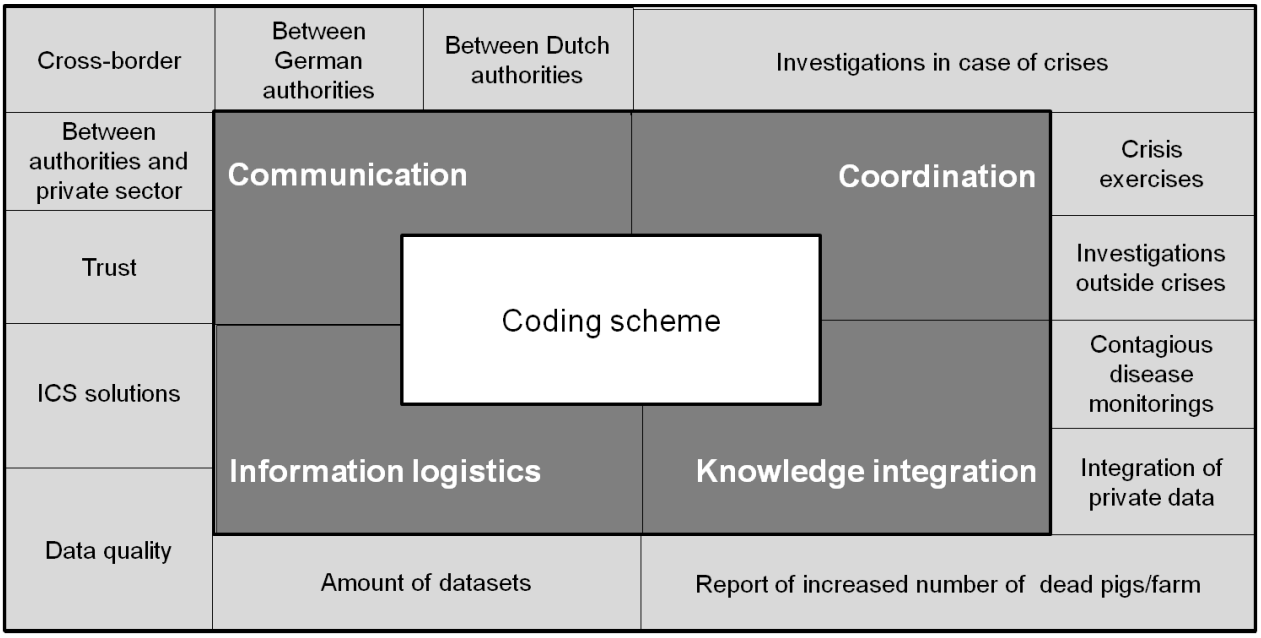


**Figure 5:** **Coding scheme for a qualitative analysis of expert interviews regarding crisis communication and its improvement**

After this qualitative evaluation of the interview contents, the subcategories were classified into descriptive parameters. That means each subcode was categorized under the aspects of “Valuation of status-quo” into the parameters ”good/much”, “sufficient/satisfying” and “improvable/not enough”.

Due to the scope of knowledge of experts and depending on the course of conversation, not every subcode could be assigned to each interview.

### 2.3.3 Design of the crisis control exercise and observations

The influence and meaning of individual behaviours and actions within the decision process in crisis control has been observed through participation in an official CSF control exercise. The exercise lasted two days (in March 2012) and focused on the implementation of necessary official measures to control CSF (epidemic investigations, set-up of restriction zones, processing of measurements). Inter alia, the following tasks were included:

- Visiting the affected pig farms in protective clothing,

- Epidemiological investigation on farms,
- Preparation of epidemiological data and creation of a disease report to be sent within 24 h to the EU,
- Planning and theoretical implementation of measures and completion of the epidemiological report taking the latest information into account.

Some people participated only during the first day (in total, 16 persons) and others only during the second day (in total, 24 persons). The group of participants was divided into groups as shown in Table 4 depending on the relevant exercise aspect.

**Table 4: Agenda of exercise day 1 and day 2**

| | **Exercise** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Day 1** | | **Day 2** | | | | |
| Morning | • Short introduction of the participants<br>• Presentation of the exercise scenario<br>• Division into two groups of epidemiological investigation | | • Short information about status-quo<br>• Division into five working groups of control measures | | | | |
| | *Group 1* | *Group 2* | *Group "Estimation & Culling"* | *Group "Locking and traffic control"* | *Group "Disinsecticication, cleansing & disinfection"* | *Group "Epidemiological investigation"* | *Group "Testing"* |
| | • Transfer to pig stock A | • Transfer to pig stock B | | | | | |
| | • Epidemiological investigation | • Epidemiological investigation | | | | | |
| Evening | • Set up of 24 h report | | • Final round table and feedback of participants | | | | |

The groups consisted of competent veterinarians from seven district authorities in NRW, administrative staff and fire and police forces. Indirect participants were two pig owners who were visited for initial epidemiological investigations in the framework of the scenario.

*Scenario*

At the beginning of the exercise, the exercise leader presented the exercise scenario and gave information on both pig stocks he knew from the official systems: address, type of animals, and number of animals. He also defined the relevant period of a possible infection with CSF. For this

exercise, the calculation was done as follows: twice the incubation period of CSF plus five days. Thus with antibody detection, the longest period of infection has to be estimated in this case with up to 6 weeks.

The first epidemiological investigations were done at the stock with the help of questionnaires which were distributed to the participants before visiting the stocks. The questionnaire is a template which is included in the TSBH, the German manual of animal disease control. The questionnaire was completed manually. Later, in the further course of epidemiological investigations, the determined contact structures were categorized in contacts with “very high risk”, “high risk”, normal risk” and “low risk” of introduction or spread of CSF.

The observations were recorded in the form of notes and quotes during the two days of exercise. On the second day, the exercise groups were switched to get an overall view of all control aspects. Upon conclusion, a final descriptive report was put down in writing. Subsequently, this report was reviewed by the exercise leader to prevent any false interpretation of processes and decisions because of missing background knowledge. Finally, the observation report was presented during debriefing of the exercise in which the veterinarians of all seven districts participated.

### 2.3.4 Design of quantitative survey

The quantitative survey was performed in the period between August and December 2012 with the aim of gathering information about the positive or negative trend if and for which kind of services and support for crisis management farmers would ask in case of animal disease outbreaks. Based on the results of meta-analysis and expert interviews, a questionnaire was developed. In addition to introducing questions for general validation (e.g. type of pig farmer, membership in a cooperative or other member structure), the core question was set, whether the farmers are looking for more support from livestock trading organizations in case of an animal disease outbreak in their region. The participants could select predefined answers and in addition had the opportunity to supplement these answers in the form of free text.

The questionnaires were addressed to pig farmers and the survey was carried out via online questionnaire, created and evaluated with the help of the online service EFS Survey (Unipark). The questionnaires were given to production managers of three livestock trading cooperatives which can be seen as representatives of an average German livestock trading cooperative who

passed them on to their farmers. The three cooperatives are located in the western, middle and northern region of Germany. In total, 302 farmers received the questionnaire. 38 farmers answered the central question above, thus the rate was finally at roughly 12%. Although the response rate can be described as low, the results could be used to derive information about the trends of opinions and for further interpretation of the interview results.

## 2.4 Results

### 2.4.1 Interpretation asymmetries complicate cross-border collaboration in public-private crisis communication

The pig supply chain in Germany is well connected to that of the Netherlands. In this context, the private sector has already become borderless, whereas the public sector with its authorities is still bound by national borders. Against the background of this study, it is reasonable to ask for an extension of the public-private communication strategy of the EEM regarding the cross-border aspect.

By taking a closer look at the animal disease control and communication systems of Germany and the Netherlands, some country-specific differences could be identified as crucial factors which complicate initial implementation of the EEM. After the enormous dimensions of the CSF outbreaks in 1997 and 1998, the Netherlands evaluated its disease control in detail and deduced strategies of prevention, early warning and control of CSF which differ from other countries such as Germany. Although the control strategies of Germany and the Netherlands are generally based on European legislatives, both countries developed different procedures to fulfil these European legislatives and refined them by additional country-specific regulations. In consequence, the execution of legislations at European level is often interpreted differently at national level. These interpretation asymmetries between both countries lead to the situation that information gaps in the Netherlands differ a lot from those in Germany. The following examples show that asymmetries in control procedures and legislative implementation of both countries are crucial hurdles to include a cross-border perspective at the initial level of an EEM implementation for public-private crisis communication. An overview of the main country-specific differences in animal disease control derived is given in Table 5.

**Table 5: Identified main differences in the framework of German and Dutch animal disease control**

| Aspect | Germany | The Netherlands |
|---|---|---|
| **Prevention** | – Check for CSF by offering official sections in official laboratory<br>– Further preventive measures (e.g. report of increased number of dead pigs on farm) depending on state | – Monthly CSF monitoring of farms with piglet production or breeding<br>– Check for CSF by offering removal of tonsils on farm for further laboratory testing<br>– Limitation of pig transports per farm |
| **Animal disease control** | – Federal government structure<br>– Control is aligned at each state level with appended districts<br>– No inclusion of private stakeholders in control procedure | – Decentral government structure<br>– Control is aligned in one central ministry and appended institutions<br>– Private stakeholders participate in control procedure to represent private interests |
| **Information** | – An epidemiological unit can consist of more than one farm unit<br>– Report of pig movements afterwards<br>– Low morale of reporting<br>– No comprehensive control of missing reports possible | – An epidemiological unit is equal to a farm unit<br>– Registration of pig transports before pig movement and its report afterwards<br>– High reporting morale because of need of permission for transport<br>– Comprehensive control of missing reports by comparison with transport permission |

One example for country-specific differences in control procedures is the inclusion of private stakeholders into Dutch Basisoverleggen. Basisoverleggen are meetings which consist of further planning of animal disease control measures, comparable to the German meetings within the Task Force. In Basisoverleggen, Dutch private stakeholders represent the opinions and interests of farmers, slaughterhouses and other actors involved of the private sector. Although the experts stressed that the stakeholders have no chance to influence further planning in a direct way, they emphasize the possibility of knowledge transfer and fast multiplication of information by involved private stakeholders and taking each other's interests into account. Assumptions of upcoming problems due to planned measures and its way of communication thus can be seen as a permanent reflection on Dutch animal disease control and communication. This kind of public-private meeting is not done in a similar way in Germany. Dutch stakeholders occupy a defined position within the official disease control which results in a public-private attitude of the actors involved in case of a crisis.

One German core problem is the unsatisfying reporting of pig movements which interferes with getting a quick overview of contact structures. Having a closer look on that kind of information offer in the Netherlands, the Dutch experts assess the information base of pig movements as almost seamless in the Netherlands. This is not surprising. The Dutch I&RVL system automatically compares the mandatory previously issued transport permits with the mandatory reports of pig movements which are drawn up afterwards. The information about pig movement thus is documented in more detail than in Germany, and by doing the reports twice, once before and once after movement, missing reports can be identified very easily. Additionally, all Dutch experts stressed that an epidemiological unit[1] is in contrast to German practices always limited to one Dutch farm unit, thus the dataset per farm unit can always be interpreted as the dataset of one epidemiological unit. In case of an epidemic and against the background of an accurate interpretation of an epidemiological unit, the combination of reports and permits of pig movements can be used immediately for a detailed risk assessment of spreading by transport contacts. In stark contrast to the German experts, the Dutch experts do not mention these information and interpretation problems at all.

A current overview on the nationwide CSF situation is missing in Germany but not in the Netherlands. This delivers another crucial country-specific difference in information demand between Germany and the Netherlands. According to the Dutch VVL (Verordening Varkensleveringen), the Netherlands perform a monthly monitoring on CSF at farms with piglet production or breeding. German authorities have no continuous monitoring information comparable to this. Another source of monitoring combined with a strategy of early warning is a more simple way of doing sections in the Netherlands to exclude CSF infections. Both countries offer this service to farmers, but whereas in Germany farmers have to transport suspicious dead pigs for section to official laboratory institutions by themselves, Dutch farmers are allowed to instruct their veterinarians to remove pig tonsils on the farm for further laboratory testing. This is easier to manage for farmers and results in a higher number of farmers taking advantage of CSF checks than in Germany. Against that background, the Dutch authorities might have the impression of being well prepared for an epidemic outbreak of CSF because of these prevention and early warning measures. The observations made during the expert interviews reinforced this assumption due to the fact that an innovative use of information from the private sector is not at all discussed as much as in Germany. In contrary, all Dutch experts seem to be rather satisfied

[1] “means a group of animals with a defined epidemiological relationship that share approximately the same likelihood of exposure to a pathogen” (OIE, 2010)

with their current information offer and more likely mentioned problems in cross-border communication instead of in public-private communication within the Netherlands.

The desire for a better cross-border communication in animal disease control finally unites both countries. All Dutch interviewees as well as the German interviewees at district level expressed a clear demand for cross-border communication at regional or district level in addition to the current single communication flow via state ministries. The reason for this desire is quite clear. The Dutch partner within the cross border communication who is directly involved in the executive task of animal disease has to communicate exclusively with prescriptive authorities at state and federal level in Germany, although their tasks are rather comparable to those of veterinary authorities at district level.

Although the private sector seems to have no borders, one can conclude from this cross-border view that country-specific differences inhibit a common public-private concept for initial implementation of the EEM. Nevertheless, the defined interpretation asymmetries of European legislatives between both countries still lead to a demand for the improvement of a cross-border public crisis communication and further alignment of German and Dutch regulations. This might form the basis for cross-border extension of public-private concepts.

### 2.4.2 Status-quo of public-private crisis communication

According to the four dimensions of collaboration quality (PASCH et al., 2013), a status-quo of information management within the framework of animal disease control could be derived from the information analysis.

*Communication*

In case of an outbreak, private actors demand for current and quick official farm-specific information as well as information on general restrictions and measures to avoid an introduction and spread of the disease by itself. The competence of this public-private communication lies with district authorities who also are in executive responsibility of control measures. In case of crises, they are often contacted via phone and fax by the private sector, and they in turn usually also use these channels for targeted individual information flow. In addition to the obligatory usage of couriers for postal distribution of official orders, these public-private communication methods are mostly considered to be very time-consuming and personnel-intensive for both, i.e.

the public and private actors. Against the background of high pressure because of market restrictions, especially farmers and livestock trading organizations assume a waste of precious time while waiting for their documents. Experiences from former crisis situations confirm this fear with numerous mentions on partially hourly phone calls for several days of farmers or of livestock traders who were assigned by farmers.

In other fields, such as quality management, a public-private data exchange is already practised, this is, however, not contemplated in the field of animal disease control. The authorities explain this by their high priority to use only trustworthy data for crisis management. Although all experts, public as well as private, are generally willing to implement a public-private exchange of data, a general fear of either palliate situations by missing reports or false information of the private sector or being blamed for intentional or unintentional wrong behaviour in case of crises by the public sector are main arguments against such initiatives.

Besides this, district authorities and Dutch authorities emphasize their demand for an improvement of cross-border communication. They are not officially connected to each other, and communication has to be done exclusively at federal level. In combination with the fact that data access is already limited to district authorities within Germany, the view on the pig netchain must just be seen as a regional segment of a meanwhile borderless private sector.

Table 6 shows a summarized fact sheet of the status-quo and untapped improvement potential of crisis communication in animal disease control under cross-border, public-private and trust aspects.

**Table 6: Identified status-quo and potentials of communication under different aspects**

| Communication aspect | Status-quo | Untapped potential |
|---|---|---|
| **Cross-border** | – Communication exclusively via prescriptive federal level | – Integration of districts as executive level |
| **Public-private** | – Communication with stakeholders depending on district work<br>– General information via public media (newspaper, dark site*, hotline)<br>– Distribution of individual enactment messages (e.g. for locking) via couriers<br>– Queries of farmers often and nearly almost exclusively by phone (personnel-binding communication channel)<br>– livestock traders hardly integrated in communication flow between authority and farmers<br>– no use of ICS or data stock from livestock traders<br>– service range of livestock traders is hardly known officially | – Legalizing digital distribution of individual enactment messages<br>– Interposition of network coordinators in communication between authorities and farmers<br>– Provision of digital public-private communication solutions instead of phone contact<br>– Integration of private ICS or data stock in animal disease control |
| **Trust** | – Level of general trust strongly influenced by number and quality of contacts between farmers and authorities<br>– Public fear of palliating situations by missing reports or false information of the private sector<br>– Private fear of being blamed for intentional or unintentional wrong behaviour in case of crises and to be seen as the trigger of a crisis | – Encouraging voluntary public-private initiatives<br>– Disclosure of manual for disease control<br>– Constant integration of stakeholders in animal disease control as passive participants |

* Dark site: is involved in the setup of a web presentation but invisible until its activation in crises

*Knowledge integration and information logistics*

To be prepared for epidemiological on-spot visits, the official veterinarians use official datasets. For further risk analysis, information usually is added by direct phone calls, fax and further on-

spot visits at already investigated contacts and discovered contacts of second and further degrees. The empiric analysis shows that further visits were contemplated in principle but were avoided where possible because of their negative influence on time and personnel resources.

The collection of official data during and outside of crises is accompanied by a discrepancy between effort and available resources of time and personnel. Therefore, official IT solutions permanently consist of current and non-current datasets. All public experts confirm that their personnel resources are not sufficient to carry out a continuous update of information from the private sector. In addition to this, the low morale of farmers regarding reporting of animal movements also obstructs data currency. In combination with the still existing low morale when it comes to reporting of pig movements, they are convinced that a time and personnel-intensive collection of information in case of an animal disease outbreak is unavoidable.

The results of the practiced on-spot investigations from the animal disease control exercise illustrate the variety of contacts and stock situations veterinary authorities have to expect at any time (Table 7). In total, at least 24 contacts, directly connected to one investigated stock, could be identified as risk for a CSF introduction or its spread. The contacts of the other stock could not even be defined numerically. In addition to that, it became clear during the exercise that a classification of investigated contacts according to risk factor is difficult because of the individual circumstances. In addition to taking the specific situations on a farm into account, every private statement is furthermore assessed regarding the following factors through a control of appropriate documents where this is possible:

- truthfulness and completeness
- temporal relevance for introduction or spread of CSF
- probability of further or former contacts
- accordance due to hygienic conditions

**Table 7: Additional information of the epidemiological on-spot investigations during crisis exercises by means of manual questionnaires**

| Additional information | Stock A (affected with CSF) | Stock B (within the 1000 m radius) |
|---|---|---|
| **Structure** | - Conventional pig fattening stock<br>- 1250 pig places, 907 pigs<br>- Biogas plant<br>- Processing of leftover foodstuff in biogas plants<br>- Feeding of leftover bread and bakery products<br>- 5 stables, 2 age groups<br>- Process of all in all out | - A kind of “hobby stock” of 2 mini pigs<br>- No further stock of animals at farm level<br>- Only pig stock apart from stock A in a 1000 m radius of affected stock A<br>- The entire land around the house is the area of both mini pigs<br>- Changing ownership of dogs (pig owner is also an active member in an organization for animal protection)<br>- dogs have contact with mini pigs |
| **Contacts in relevant period*** | - Farm unit builds epidemiological unit with another farm unit (same personnel): there, discovery of heads of wild boars in immediate proximity<br>- 10 slaughter transports (913 pigs)<br>- 6 stable visits of farm veterinarian<br>- 4 transports of rendering plant (11 pigs)<br>- 3 farm visits of service providers<br>- 1 private visit by farmer’s brother living in Brandenburg | - Access to dog imports from Spain<br>- Further transfer of 2 dogs<br>- Dogs had contact with mini pigs<br>- Dogs walk in immediate proximity to stock A<br>- Contact of mini pig owner with farmer of stock A during pickup of pig medicine |

* Period of possible infection, calculated for CSF here: twice incubation period plus five days
(Thus with antibody detection, the longest period of infection has to be estimated in this case with up to six weeks.)

Nevertheless, the investigated contact structures have to be categorized in very high, high, normal or low risk for the introduction or spread of a disease for the purpose of fulfilling the idealistic aim of finding the right introduction path. It was observed that knowledge about the hygienic conditions of contact stocks was included into such a risk categorization. Statements like these

> *“There are so many contacts. To do risk assessment you simply must use all information you can get.”*
>
> *“This cannot be checked, at this moment, we just have to believe it.”*

clearly show that in some cases an inclusion of information which cannot be proven within a sufficient time or not at all, is unavoidable in animal disease control. Against this background the use of the Failure Mode and Effects analysis (FMEA) might support a prepared risk analysis of

farm and contact structures in case of an animal disease outbreak. By using this procedure it can be investigated what kind of risks are connected to the implementation of a new measure (SCHMITZ, 2005). In Figure 6 insight is given in the procedure of risk assessment in case of animal disease outbreak according to the FMEA.

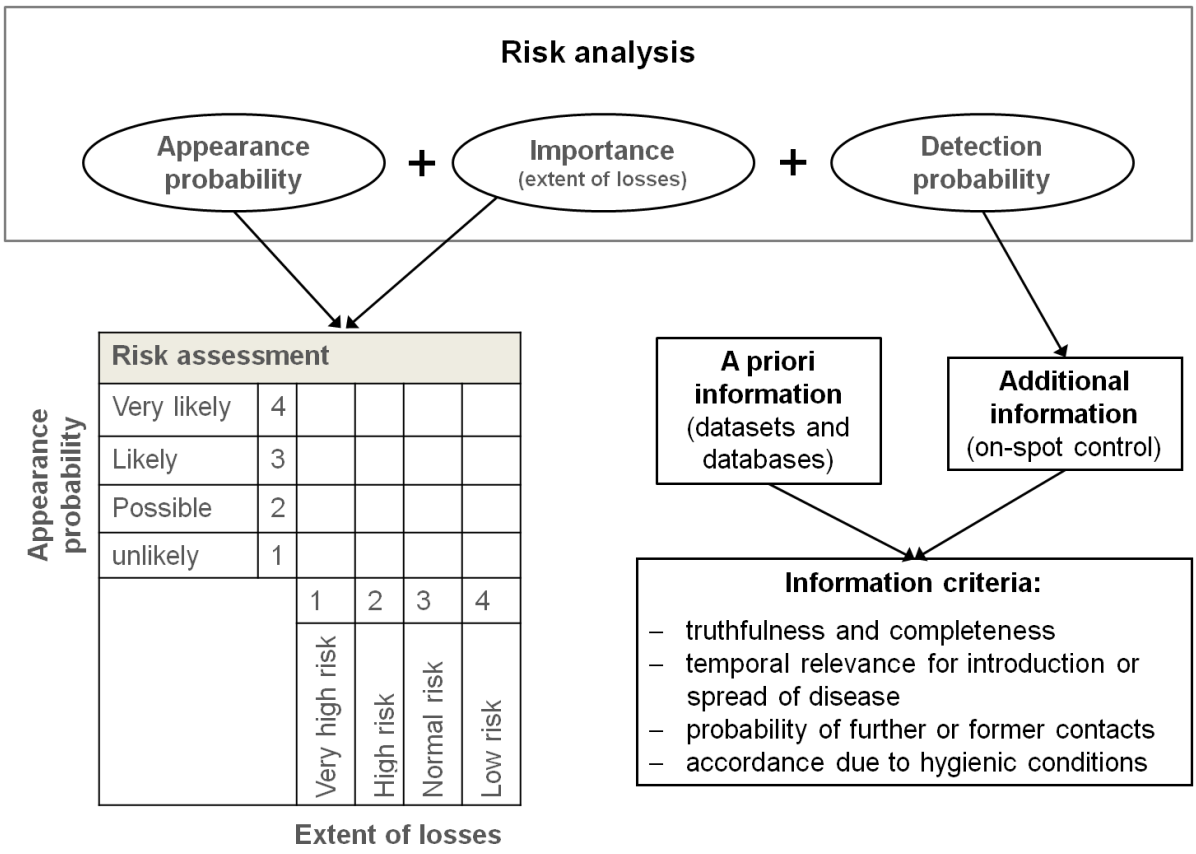


**Figure 6: Risk assessment in case of animal disease control according to FMEA**

*Coordination*

As is already known from literature, information and communication management on the private side is increasingly coordinated by private network coordinators such as livestock traders. Official veterinary authorities mention that livestock trading organizations have been used as mediator between authorities and farmers in previous crises. Private experts remember that during the CSF outbreak in 2006, services for crisis management such as communication with authorities, multiplication of the latest general as well as farm-specific information and the

organization of upcoming tasks during crises were demanded from livestock trading organizations by farmers. The survey shows that this demand still exists (Figure 7). When having a closer look at the farmers who participated in the survey, it becomes obvious that the farmers' demand is not depending on the experiences gained during past outbreaks. Only one farmer mentioned that he had already suffered substantial losses because of epidemics like CSF on his farm in the past 15 years. Quite on the contrary, it can be assumed that other farmers have no or hardly any experience in crisis management in case of an animal disease outbreak and therefore look for professional supporters in crisis management at farm level in case of epidemics.

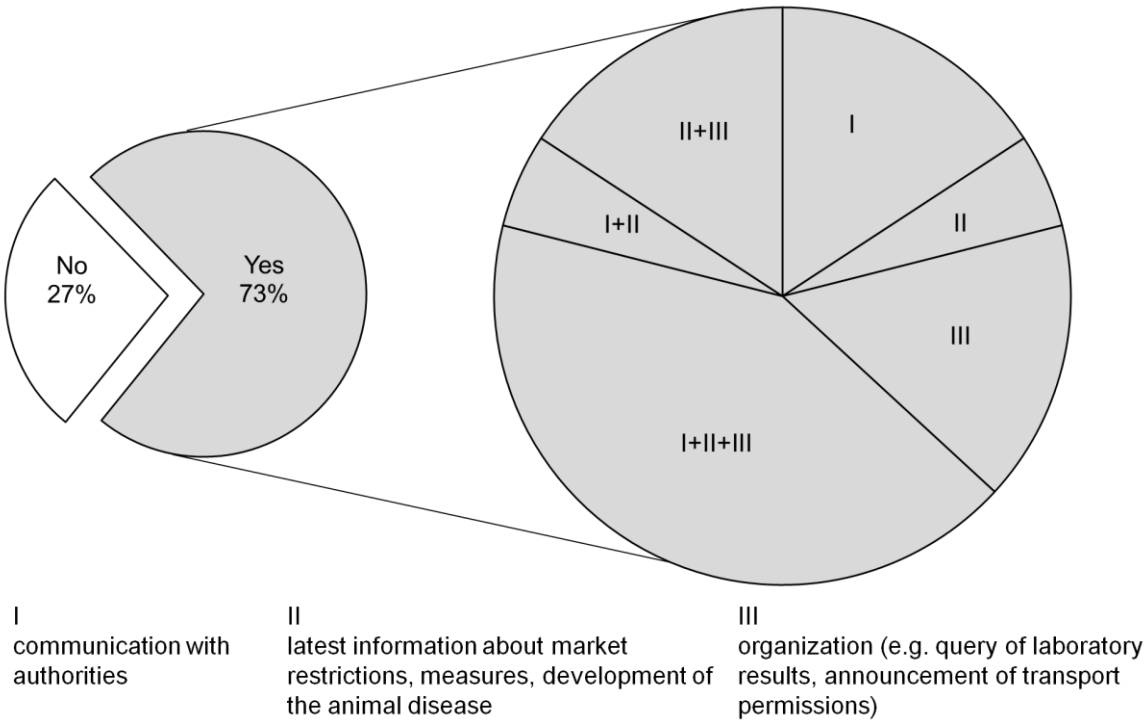


**Figure 7: Overview of trend analysis regarding the demand of pig farmers for support by livestock traders in case of animal disease outbreaks (n=38)**

*Untapped potential*

Against the background of the already mentioned results, the qualitative analysis of the interview results delivers a general comparison of all subcodes (Figure 8) which lead to untapped potentials for the improvement of crisis communication by the EEM approach.

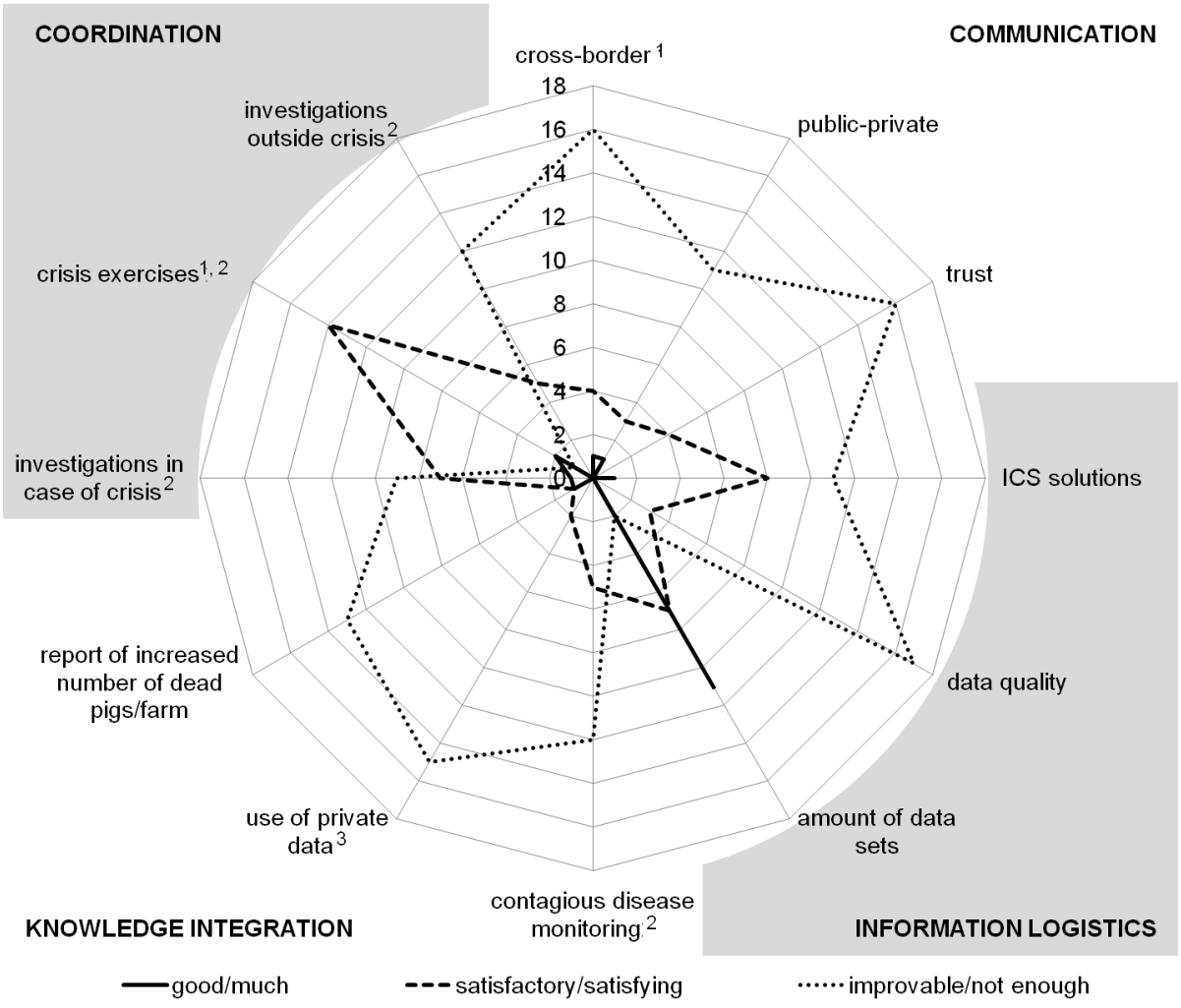


**Figure 8: Overview of the evaluation of the status-quo of different aspects in animal disease control to pursue an improved crisis communication (maximum of n=26, depending on conditions: [1] Dutch experts included, [2] IT experts excluded, [3] private sector experts excluded)**

Both, private and public expert groups point out that the general trust between public and private actors has to be improved. The level of general trust is strongly influenced by the amount and

quality of contacts between the private sector and authorities. Public as well as private procedures are not transparent enough to avoid mistrust. Therefore, it is not surprising that the great majority of experts hope to improve communication directly by strengthening mutual trust and especially for authorities to be able to select trustworthy data from private sector ICSs. In this context, all authorities mentioned especially wish to be informed about the current number of animals and movements per farm. This information is already obligatory without any leeway in terms of interpretation and additional core information for crisis management. Especially in NRW, authorities want to use these current stock data for an improved calculation of pig losses per farm in a certain period, because this is a tried-and-tested early warning tool in NRW. The index is used to detect epidemics by an increased number of losses. In that case, authorities will get informed and can take investigative measures. However, the index is calculated with partially non-current datasets, thus there is a permanent risk of miscalculation of the index. Therefore, the interest in using this well-known dataset from private systems is quite obvious.

Additional private data are not desired very much, however. The experts are satisfied with the available amount of datasets in crisis communication. On the one hand, missing trust is a reason. Data which is not trustworthy is not meaningful and therefore of no benefit. On the other hand, lacking knowledge about their general existence or their real importance for decision-taking in case of crises might be an obvious argument not to think about its integration. The crisis exercise reinforces this assumption. Private information which might be meaningful was collected in a time and personnel-intensive investigation. If the information could be checked, this was done, but if not, the information was not seen as generally useless. Therefore the linkage to private ICSs datasets is nevertheless an untapped potential for easy access to crisis-relevant information. In conclusion, Table 8 provides a detailed overview of the range of private information to support public crisis control.

**Table 8: Essential (e) or useful (n) information for investigations and decision-making in CSF control already included or able to be included in existing systems (ICS) of network coordinators (ICS)**

| Information content | Type of need | Type of ICS for network coordinator where information is included/can be included |
|---|---|---|
| Existence and condition of hygiene sluice | u | QS Platform |
| Date and result of latest QS audit | u | QS Platform |
| Participation in other quality systems | u | CRM system, Health Management system |
| Tour information of animal transport vehicle | e | Logistics system |
| Contact information of animal transport company | e | Logistics system |
| Place and time of loading (offloading) of animals | e | Logistics system |
| Number of transported animals | e | Logistics system, CRM system |
| Cleaning and disinfection of transport vehicles | e | Logistics system |
| Detergents for cleaning and disinfection | u | Logistics system |
| Information of stock visits in general (also non-professional visits by family members, for example) | e | - |
| Information on stock visits (veterinary, advisory) | e | CRM system, Health Management system |
| Date of feed delivery | e | CRM system |
| Contact information of feed company | e | CRM system |
| Tour information of feed transport vehicle | e | - |
| Date of visits by rendering plants | e | Health Management system |
| Tour information of rendering vehicle | e | - |
| Contact information of farm unit | e | CRM system |
| Number of animals | e | CRM system, Health Management system |
| Number of animal places | e | CRM system, Health Management system |
| Contact information of farm staff | e | - |
| Contact information of farm veterinarian(s) | e | Health Management system |
| Information on production system | e | QS Platform, CRM system |
| Feeding system | n | QS Platform, CRM system |
| Date and number of animal losses | e | Health Management system |
| Date and kind of medical treatments | e | Health Management system |
| Findings at the time of slaughtering (organ findings) | u | CRM system |
| Performance data | u | CRM system |
| Date of latest control of insects and rodents | u | Health Management system |
| Amount of infestations with insects and rodents | e | - |

CRM = Customer Relation Management
QS Platform: Online database of German quality assurance system QS

### 2.4.3 A strategic alliance as organizational concept of collaboration in public-private crisis communication

The previous sub-chapters provided an in-depth insight into the information needs and potentials for improvement of public-private crisis communication. The main improvement factors are:

- Fast and targeted communication
- Easy access and use of crisis-relevant information

Therefore, the EEM strategy for public-private communication can only be implemented when solutions for reinforcing of trust, reorganization of communication processes and technical support for both, public and private actors, are offered.

Collaboration in a strategic alliance presents a general framework for implementing these three aspects.

For this purpose and based on the example of CSF control, the term alliance means a useful collaboration between private and public players in crisis communication. In case of CSF, directly or indirectly affected actors are farmers, network coordinators and competent district authorities. The authorities at district level are responsible to gain an overview of the epidemic situation and to execute disease control. As pursued by a strategic alliance, requirements for synergy effects must be fulfilled. Therefore public and private partners expect a benefit from joining a common alliance in crisis communication before providing their own data and ICS resources to this alliance.

In general, farmers expect a benefit from getting more information in an easier and faster way of communication. Already used to support services of network coordinators, farmers ask also for supporting services in crisis management from network coordinators as bundling alliance partners. This applies to livestock trading organizations. They can offer a continuous update of essential and necessary information for district authorities from their existing information management system. This might include information on transports, contacts, biosecurity situations, animal health, feed and stock according to farms as well as their own organization. In turn, both private players expect quick and targeted official information to adjust their individual process management, to minimize their losses and in addition to that, livestock traders expect an extension of services for farmers in the range of crisis management. The current private and official information resources as well as the existing technology potentials of all players can be used and combined in an effective way to pursue these aims.

Additionally, in a strategic alliance, private network coordinators as well as farmers and authorities must be coordinated regarding their possibilities and duties as alliance partners. Therefore, specific agreements should be defined to clarify the amount and content of information exchange as well as the responsibilities and duties of all partners within the workflow of the strategic alliance. To enable responsible use in case of crises, these agreements should be mandatory and written down in valid alliance contracts. In this context, a public network coordinator has to be included in the alliance. District authorities are limited in responsibility to their district, and against the background of a super-regionally acting pig netchain, an effective strategic alliance should be implemented at least at state level. Therefore, alliance partners at state level might represent public network coordinators. Veterinary authorities at state level already supervise the control measures at district level and define the way of performance regarding animal disease control by manuals. This coordinating position could be extended to include the supervision of the strategic alliance.

Table 9 provides an overview of the involvement of different actors within an alliance to fulfill the elements of an effective collaboration. Depending on the position within the alliance the actors take over the function of responsibility for, implementation of and involvement in these elements.

**Table 9: Delegation of additional tasks of alliance partners to fulfill the elements of collaboration**

| Elements of collaboration | Delegation of additional tasks | | | |
|---|---|---|---|---|
| | Private network coordinator | Public network coordinator | Competent authority | Farmer |
| Coordination | IM | R | IM | I |
| Communication | I | R, IM | I | I |
| Information logistics | IM | R | IM | I |
| Knowledge integration | I | R, IM | I | I |

IM = Implementation; I = Involvement; R = Responsibility

In summary, the organizational structure of a strategic alliance and its support in knowledge integration, information logistics and communication can be visualized as shown in Figure 9.

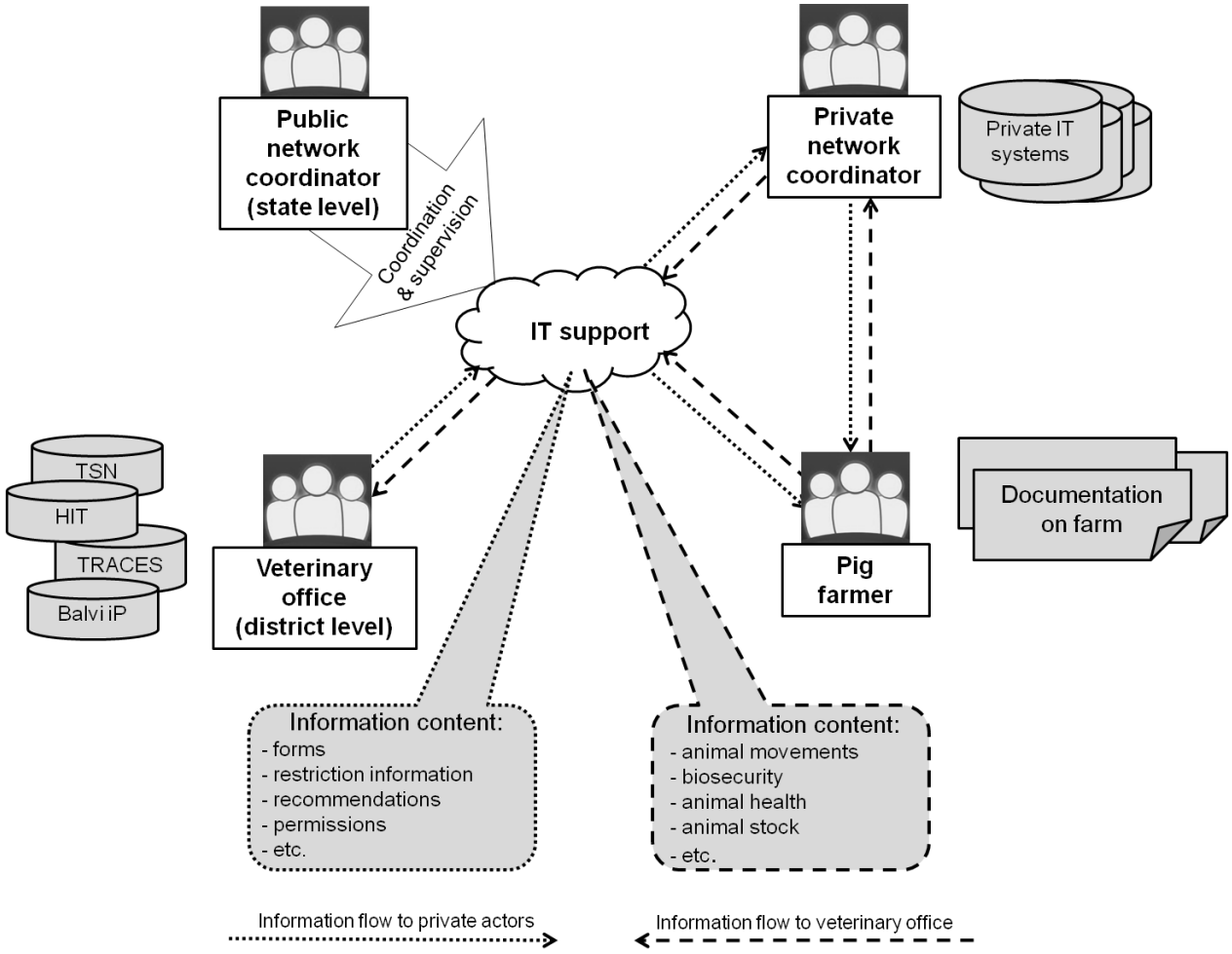


**Figure 9:** **Strategic alliance regarding information management for public-private crisis communication in animal disease control**

## 2.5 Discussion and conclusions

The objectives of this study were to identify the weak points and potentials for improvement in crisis communication between the pig supply chain and the competent authorities and to find a way to activate them with the communication strategy of the EEM approach.

On the basis of the example of CSF as a possible crisis trigger, the information analysis of public and private actors uncovered several potentials for improvement. BREUER and co-authors (2008) already identified a general need to improve crisis management between veterinary authorities and the private sector. The results of this study show that the pig production sector

demands current official information via a quick information flow to adjust individual process planning. It could be confirmed that farmers demand additional communication services from livestock trading organizations during a crisis and that these services were already used in former crises, although they have no sufficient support tools for that (SCHÜTZ, 2009, SLÜTTER et al., 2010). In addition to the strengthening of their position in the netchain (VOSS; 2011), they need official information as current decision basis for further services such as coordination of transport activities and planning of advisory visits.

In turn, authorities demand current information in order to update already exiting information to support epidemiological investigations and risk analyses. The future official use of additional digital information from private information and communication systems (ICSs) is still an untapped potential. The reasons for this were already mentioned by PICOT and co-authors (2003). Trust and knowledge about existing private information are little. In order to increase the level of trust in and knowledge about information and to simplify public-private communication, the concept of a strategic alliance between farmers, network coordinators and competent veterinary authorities was drawn up. A strategic combination of public and private ICSs provides additional beneficial effects in crisis communication such as saving personnel and time (GROENEVELD, 2006) by changes in communication flows and the use of extended services of network coordinators, and finally to review epidemiological on-spot investigations for risk-analyses.

LENDLE (2011) as well as PETERSEN (2012) emphasize that ad-hoc communication in crises in no optimal foundation for a trustworthy and well-organized crisis network. Therefore, all players in a strategic alliance have to learn their position and role as alliance partner by common crisis exercises and different crisis scenarios. This would enable a certain routine in communication between all alliance partners and consolidate their relationship already in times without any crisis.

In further studies, detailed technical and organizational requirements have to be determined to realize the implementation of the strategic alliance in a sustainable way. In addition, the different potential public and private alliance partners should be supported in getting prepared for their future participation in the alliance.

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# 3. Maturity model for the implementation processes of a strategic alliance in public-private animal disease control

## Abstract

Effective crisis management thrives on sufficient information resources and a quick as well as targeted communication strategy. The second chapter of this thesis established an organizational concept to use the existing potential for the improvement of information management in animal disease control. Private network coordinators, farmers and competent authorities form a strategic alliance to achieve mutual common access to currently isolated public and private information and communication systems (ICS). This delivers improvement potential for decision-making by public and private actors in crises and more targeted and faster communication channels. However, to initiate and establish an effective strategic alliance in public-private information management, public and private actors need a structured procedure to evaluate their suitability for being an alliance partner and to get prepared for entering the alliance.

The objective of this study was to create an appropriate evaluation framework which, on the one hand, allows potential alliance partners to examine the existence and quality of their organizational and technical requirements and, on the other hand, defines future development steps due to a continuous improvement process of the strategic alliance. For this purpose, the general methodological approach of maturity assessment according to ISO 15504 was used to set up a specific process reference model for the assessment of processes required for a strategic alliance. In addition, this method was exemplarily applied to selected livestock trading organizations which were assumed to be suitable to take on the role of private network coordinators within the alliance.

It can be concluded that the used approach delivers a structured roadmap for private and public actors to initiate and establish their participation in a public-private strategic alliance within the framework of animal disease control. The exemplary assessment confirmed the general potential of livestock trading organizations as strategic alliance partners but also revealed the necessary development steps.

## 3.1 Introduction

### 3.1.1 The potential of livestock trading organizations regarding crisis communication

Crises within the meat production sector have shown that supply chains can only react effectively and quickly if the various production steps can rely on a stable cooperation between decision-makers, companies and official actors (PETERSEN et al., 2007; PETERSEN, 2012; WILKE et al., 2013).

To improve this kind of public-private and inter-organizational communication situation in crises, the Engage Exchange Model (EEM) was established (BREUER et al., 2008). The model is based upon two different situations of communication flow. In normal times, there is a privately coordinated information exchange between private actors within the production chain. In contrast to this, during a crisis, previously defined information is engaged, and through the exchange of crisis-relevant information, effective and fast communication between authorities and private network coordinators is ensured (BREUER et al. 2008; KASPER et al., 2008; SLÜTTER et al., 2011). BRINKMANN et al. (2011) identified network coordinators as actors in bottleneck positions at the strategic level within the netchain. They implement strategies and initiate coordination mechanisms in the chain. In Germany, livestock traders might act as network coordinators or already do so because they form coordinating links between the stages of primary production as well as between the stages of fattening and slaughtering and the normative level (PETERSEN et al., 2007, BRINKMANN et al., 2011). In addition to a range of services in health management (PETERSEN et al., 2007, SCHÜTZ & PETERSEN, 2007), livestock trading organizations constantly expand their coordination services in the field of transport, crisis, process and audit management (SCHÜTZ, 2009; RECKE et al., 2011; VOSS, 2011) to strengthen their future position regarding this prevailing two-staged livestock trading in Germany.

Against the background of the EEM, it is assumed that livestock traders are able to act as strategic partners in an alliance of public-private information management in animal disease control. Since they are already acting as representatives of farmers, they might communicate farmers' inquiries and provide information to veterinary authorities or spread official information targeted to their private customers as a service of crisis management. This organizational concept for the implementation of the EEM has already been presented in the second chapter of this thesis (Figure 9).

In this context, PICOT and co-authors (2003) point out that potentials for a change in communication and an extension of collaboration in information management might require a new IT. But communication will always be impaired if only technical solutions are offered. The willingness for collaboration is also an important aspect which needs to be considered and strengthened (VAN DORP, 2004).

### 3.1.2 Process maturity assessment

Since the issue of development or extension of a specific ICS is still very innovative and novel, often extensive knowledge and experiences are missing. This leads to increased insecurity in the way how this ICS should be managed. In this context, various authors suggest maturity models as useful development support (SCHLICK & ROCHOLD, 2007; SCHMELZER & SESSELMANN, 2008; BACK & HAIN, 2010; LAUDON et al., 2010).

The methodological approach of the maturity model which was originally developed for software industries has meanwhile been applied across industries and sectors (WAGNER & DÜRR, 2008). The basic functions of this model are identification of the process quality, also known as process maturity, and their possibilities for improvement. In contrast to an audit where the compliance of processes with standards is checked, the maturity model determines the implementation of a process (SCHMELZER & SESSELMANN, 2008). Contrary to benchmarking, here processes are not compared with those of other organizations but the ideal state always forms the basis of process assessment. This offers detailed knowledge about strengths and weaknesses of certain processes (SCHLICK & ROCHOLD, 2007) and is seen as essential element within the continuous improvement procedure (LAUDON et al., 2010). Therefore, on the one hand, the activities for fulfilment of processes have to be defined. On the other hand, the quality of its implementation has to be assessed. This requires the inclusion of fundamental actions into an abstracted process model which serves as an evaluation framework and is generally termed as process reference model (PRM) (BRENNER et al., 2010). Within a PRM, purpose and aim of a process are defined. The purpose of a process describes the benefit, an organization can expect from its implementation. The aim of a process informs about what to expect from successful realization. A process aim could be, for example, a document or a state improvement. During assessment, these defined processes are compared with the existing processes in an organization. Various authors suggest to specify the PRM for a sector or particular issue and to combine it with the general evaluation framework of the maturity model

approach to process assessment models (PAM) (WALLMÜLLER, 2007; WAGNER & DÜRR, 2008; BRENNER et al., 2010). Figure 10 illustrates this two-dimensional assessment structure.

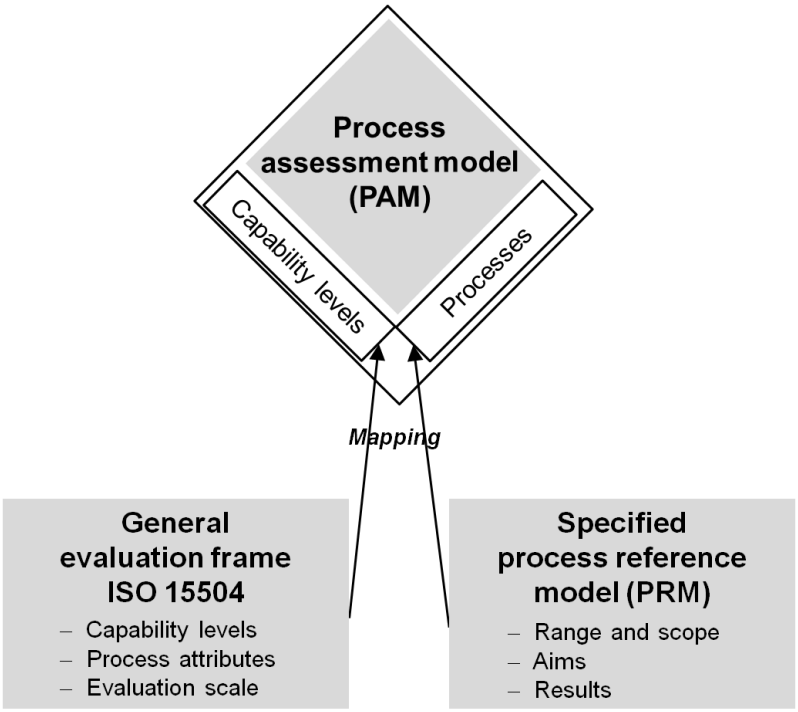


**Figure 10: Structure of the two-dimensional approach of the process assessment model (PAM) (mod. from WAGNER & DÜRR, 2008)**

The maturity of processes is rated by levels, so-called capability levels (CLs). The authors WAGNER and DÜRR (2008) describe CLs as evolutionary plateaus. This means the classification of a process into a higher CL implies the fulfilment of all lower CLs. The international standard ISO 15504 purports six levels based on each other. To examine which one of these can be allocated to the process, the authors suggest the definition of process attributes (PAs).

Table 10 contains an overview of the individual capability levels and their general process attributes. CL 0 possesses no attribute because at this level the process result is not or partly not fulfilled. To simplify the assessment of PAs, specified indicators have to be assigned. These might be activities, resources or even results which support the fulfilment of an attribute

(HÖRMANN et al., 2006). Due to the ISO 15504, a process fulfils a particular attribute if its assigned indicators are met to more than 85%. The degree of fulfilment is generally classified in "not achieved" (N, 0-15%), "partially achieved" (P, 16-50%), "largely achieved" (L, 51-85%) and "fully achieved" (F, 86-100%).

**Table 10: Interpretation of capability levels (CLs) and required process attributes according to ISO 15504**

| CL | Interpretation | Process attribute (PA) |
|---|---|---|
| 0 | *"Incomplete"*<br>Purpose of process is not fulfilled, process is not implemented | none |
| 1 | *"Executed"*<br>Purpose of process is fulfilled, results are achieved | PA 1.1 Process implementation |
| 2 | *"Managed"*<br>Process is planned, results are controlled | PA 2.1 Management of process implementation<br>PA 2.2 Management of process products |
| 3 | *"Established"*<br>Process is standardized, results are predefined | PA 3.1 Process definition<br>PA 3.2 Process application |
| 4 | *"Predictable"*<br>Process is analysed and directed, results are predictable | PA 4.1 Process evaluation<br>PA 4.2 Process control |
| 5 | *"Optimized"*<br>Process improvements take place | PA 5.1 Process innovation<br>PA 5.2 Process optimization |

For the implementation of the EEM approach, an effective strategic alliance is a suggested organizational concept for public-private information management. Therefore, public and private actors in animal disease control need a structured procedure to evaluate their suitability for being an alliance partner and to get prepared for entering the alliance. Hence, the objective of this study is to create an appropriate evaluation framework which, on the one hand, allows potential alliance partners to examine the existence and quality of their organizational and technical requirements and, on the other hand, defines future development steps due to a

continuous improvement process of the strategic alliance. In this context, the following hypotheses are examined in this study:

- The conversion of the methodological approach of the maturity model into a specific reference model enables the potential participants structured implementation of the strategic alliance.
- Livestock trading organizations basically meet the conditions to occupy the role of a private network coordinator within the strategic alliance.

## 3.2 Methodical framework

The following sections of this sub-chapter describe the application of the methodological approach for process assessment according to ISO 15504 to the processes of public and private partners in a strategic alliance for information management of animal disease control. An overview of the methodological framework is given in Figure 11.

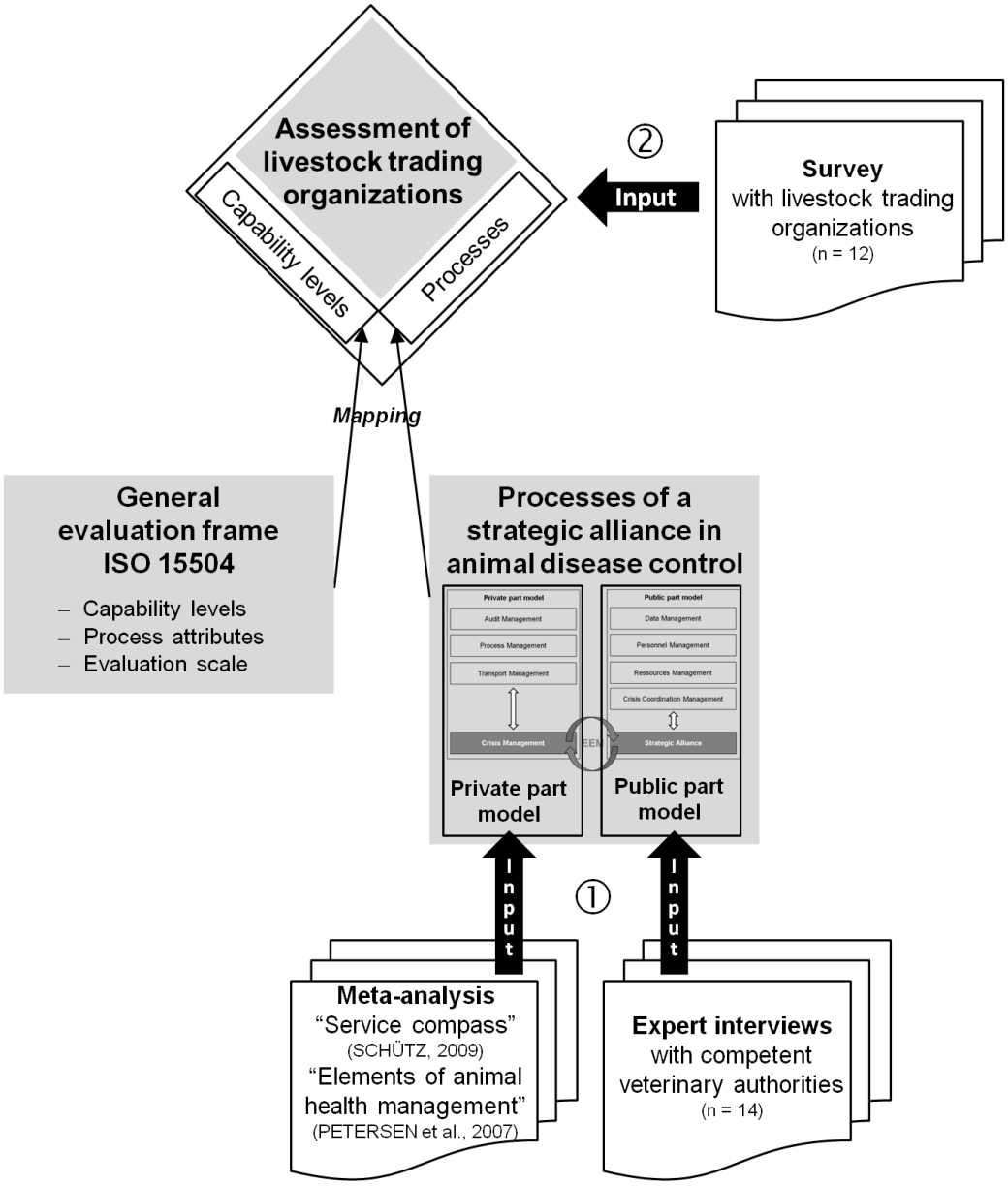


**Figure 11:** **Methodological framework to establish a process assessment model for public-private information management due to the strategic alliance (Step ①: identification of a process reference model, Step ②: exemplary assessment)**

### 3.2.1 Definition of elements of the process reference model

Initially, a PRM had to be established as a basis for further assessments of potential alliance partners. Due to the fact that the strategic alliance combines partners from quite different

management areas, namely public and private sector, the decision was taken to divide the PRM into a private and a public PRM. This implied the identification of processes and the definition of assessment indicators for a strategic alliance referring either to the public or to the private side.

Private network coordinators occupy a key position within the alliance. An extensive research activity in the field of inter-organizational process and information management was carried out. The findings of PETERSEN and co-authors (2007) and SCHÜTZ (2009) finally served as the main basis for defining the relevant private processes and indicators for private network coordinators in a strategic alliance. In contrast to the situation of private processes, there existed only little suitable literature for public information management of animal disease control apart from legislative documents and administrative regulations which could have offered enough potential to derive public processes for a strategic alliance in public-private information management. Therefore, an additional data collection was accomplished by interviews with German authorities.

In the field of official animal disease control, decision-making and communication are purely controlled by competent veterinary authorities and with the help of official IT systems. The federal structure in Germany led to the need to include competent German authorities at state and district level. The selection of interview partners could be limited to the states of North Rhine-Westphalia (NRW) and Lower Saxony (LS) because they are known as intensive regions of German animal and meat production. Again, within these states, districts with an intensified meat production were selected.

In total, 31 authorities of both states were contacted by phone. Initially the responsible heads of animal disease control at the relevant authority were called and informed in general about the research subject and subsequently asked for an interview. Nearly every second one agreed to participate, and 14 semi-structured interviews were carried out (Table 11). In some cases, the responsible head summoned colleagues with an executive role in animal disease control to join the interview or to represent the responsible head.

Initially, a pre-test was carried out to check and optimize the interview guideline. In order to give all interviewees a simple opportunity to identify official processes in animal disease control according to the aim of this study, process definitions were pre-formulated and subsequently tested for their understanding, possible errors and insufficiencies by directly addressing and also by context questions from the interviews. For the preparation of the interviewees, an introduction of the interview topic, a presentation of the research approach and an overview of the main

interview questions was mailed to the interviewees one week before their interview. The interview guideline is listed in the Annex.

The interviews lasted on average 1.5 h. A voice recorder was used for documentation if the interviewees had agreed to this. Otherwise notes were written down. Later the recordings and notes were transcribed into a text protocol which was sent to each interviewee for review.

**Table 11: Overview of data collection carried out by means of expert interviews with competent veterinary authorities in North Rhine-Westphalia (NRW) and Lower Saxony (LS)**

| Authority level | Competence in animal disease control | In total (NRW and LS) | Sample size (N) | Interviews (n) | Response rate |
|---|---|---|---|---|---|
| Supreme veterinary authority | indirect | 2 | 2 | 1 | 50% |
| Higher veterinary authority | indirect (in special cases direct) | 2 | 2 | 1 | 50% |
| Lower veterinary authority | direct | 85 | 27 | 12 | 44% |

### 3.2.2 Definition of an application scenario for maturity assessment

After the establishment of a PRM for a strategic alliance of public-private information management in animal disease control, an exemplary assessment was done with livestock trading organizations as potential private network coordinators.

It was possible to use raw datasets, originally collected for benchmark analyses by SCHÜTZ (2009). The data collection represented raw data of interviews with employees on management level of 12 livestock trading organizations in total which prospectively wanted to extend their primary services of livestock trading to other services in the field of health and quality management. This sample, taken in 2008, represented and still represents the range of variation of totally 97 co-operative livestock trading organizations in Germany at the time of examination (Table 12). For further methodical details at this point, reference is made to the methodological provisions by SCHÜTZ (2009).

**Table 12: Range of variation of co-operative livestock trading organizations interviewed for the purpose of a benchmark analysis by SCHÜTZ (2009)**

| Number of | Minimum | Maximum | Average (n = 12) |
|---|---|---|---|
| **employees** | 6 | 205 | 38 |
| **Customers (pig and/or cattle farming)** | 115 | 13,206 | 1,609 |
| **Pig farming** | 55 | 930 | 424 |
| **Cattle farming** | 0 | 12,806 | 1,186 |

## 3.3 Results

According to the methodical steps, the following sub-chapters present in a first step the process reference model as an evaluation frame for implementation of the organizational concept of strategic alliance, subsequently in a second step, the results of the exemplary assessment for the private side is illustrated.

### 3.3.1 Process reference model of a public-private strategic alliance

The EEM generally consists of public-private information exchange to support crisis control and to minimize the damage on the private sector. As already mentioned in Chapter 2, an organizational solution for the implementation can be to collaborate in form of a public-private strategic alliance for crisis communication. One main requirement for this is the involvement of network coordinators on the private side to offer crisis support for directly and indirectly affected actors and to act as an information hub for public and private information exchange. Another main requirement is the supervision and coordination of this strategic alliance by a public network coordinator as well as an effective animal disease control by competent authorities on the public side.

The capability model of the strategic alliance therefore consists of two part models: (i) the part model with crisis management as a core process on the private side, and (ii) the part model with strategic alliance management as a core process on the public side. Both part models are not independent from each other but multiply linked to ensure general implementation of the EEM by

forming a strategic alliance and its further improvement process. A general overview of both core processes and their sub-processes is given in Figure 12.

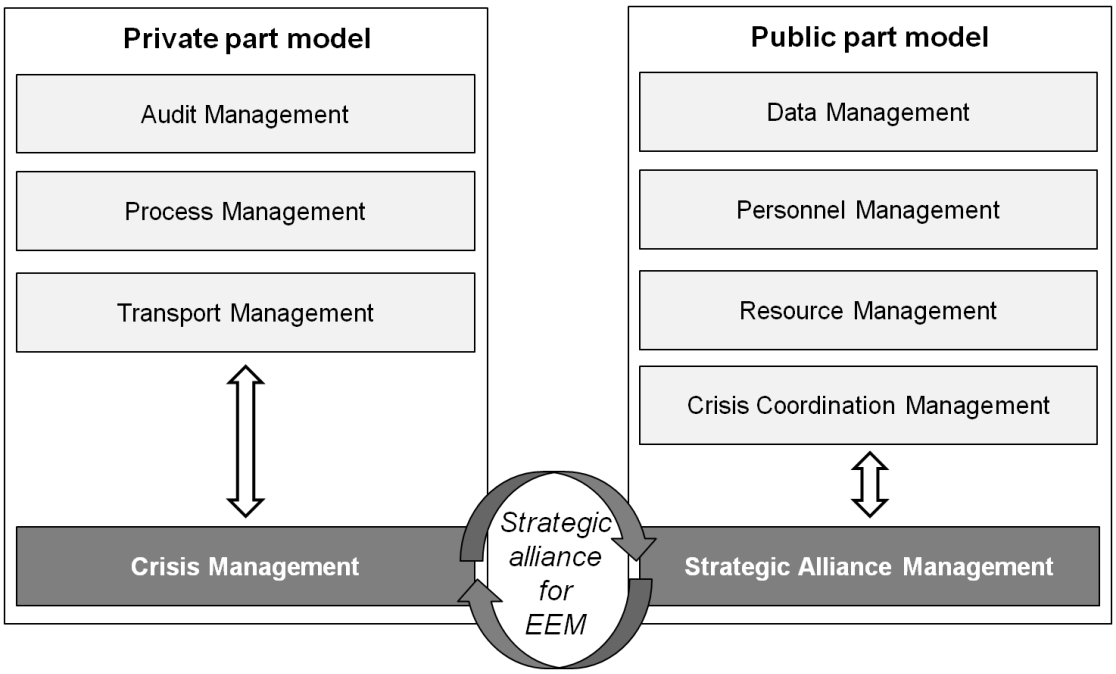


**Figure 12:** **Management processes to maintain the Engage Exchange Model (EEM) for animal disease control**

*Private part model*

The main tasks of a strategic alliance on the private side include the provision of private information to authorities as well as the transfer of public information to farmers. This kind of information hub pursues to support public and private decision processes to minimize losses and improve the efficiency of control measures. The information hub on the private side is coordinated by the core process crisis management which again is continuously connected to the sub-processes audit management, transport management and process management. On the one hand, these sub-processes are sources for information demanded by authorities. On the other hand, these sub-processes have to be supplied with public information to be able to perform in an efficient way. Due to the requirements of ISO 15504, the purpose and outcome of the (sub-) processes is defined subsequently in Table 13.

**Table 13: Name, purpose and outcome of process dimensions in the private part model for the strategic alliance**

| Process name | Process purpose | Process outcome |
|---|---|---|
| Crisis Management | Transfer of private information to authorities and provision of public information to farmers | – Communication with authorities<br>– Steering of crisis documents<br>– Distribution of official information |
| Audit Management | Validation of private information and supervision of private actors | – Internal and external procedural audits<br>– Product audits<br>– Steering of documents<br>– Audit reports |
| Process Management | Fulfilment of reporting obligations | – Business rating<br>– Benchmarking<br>– Process documentation |
| Logistics Management | Decision support for transport activities | – Valuation of food chain information<br>– Planning of purchase and sale<br>– Checking of product and process KPIs<br>– Valuation of suppliers |

*Public part model*

The main tasks on the public side of the EEM are the supervision of the public-private collaboration according to the EEM as well as animal disease control. The first one is coordinated by the core process strategic alliance management which is continuously connected to the animal disease control and its sub-processes, i.e. resource management, personnel management, data management and crisis coordination management. The process of strategic alliance management includes the requirements which were already mentioned in Chapter 2. The public sub-processes have to be supplied with private information to be able to perform in an efficient way. Due to the requirements of ISO 15504, the purpose and outcome of the (sub-) processes are defined subsequently in Table 14.

**Table 14: Name, purpose and outcome of process dimensions in the public part model for the strategic alliance**

| Process name | Process purpose | Process outcome |
|---|---|---|
| Strategic Alliance Management | Supervision and coordination of exchange of knowledge and information between alliance partners | – Solidary principles<br>– Strategic agreements<br>– Teamwork coordination |
| Resource Management | Supply of crisis actors with immaterial (information) and material resources | – Immaterial input<br>– Material input |
| Personnel Management | Prevention of asymmetries in human resources in case of crises | – Qualitative personnel policy<br>– Quantitative personnel policy |
| Data Management | Collection, validation and distribution of data by technical support | – Data provision<br>– Valid data<br>– ICS and IT support |
| Crisis Coordination Management | Taking timely, targeted and concrete decisions and prevention of double work | – Crisis control and communication<br>– Knowledge management |

The public and private core processes and sub-processes are influenced by each other as illustrated in Figure 13. The private sub-processes transport and process management deliver information for strategic crisis management and, in turn, get information for effective planning and reaction in case of a crisis. The audit management provides in addition to this general quality information of farms for better interpretation of risks and also guarantees trustworthy data by using a structured and generally accepted private quality system such as the German quality assurance system QS. The strategic alliance for public-private information management in animal disease control is finally established by linking both core processes, i.e. crisis management on the private side and the strategic alliance management on the public side. At this point, the public-private information exchange is enabled. Against that background, the strategic alliance management supervises and coordinates information management. It enables competent authorities to get access to crisis-relevant private information, and to coordinate data access and define regulations to integrate private information into public crisis management, and all subsequently involved processes such as personnel management or resource management.

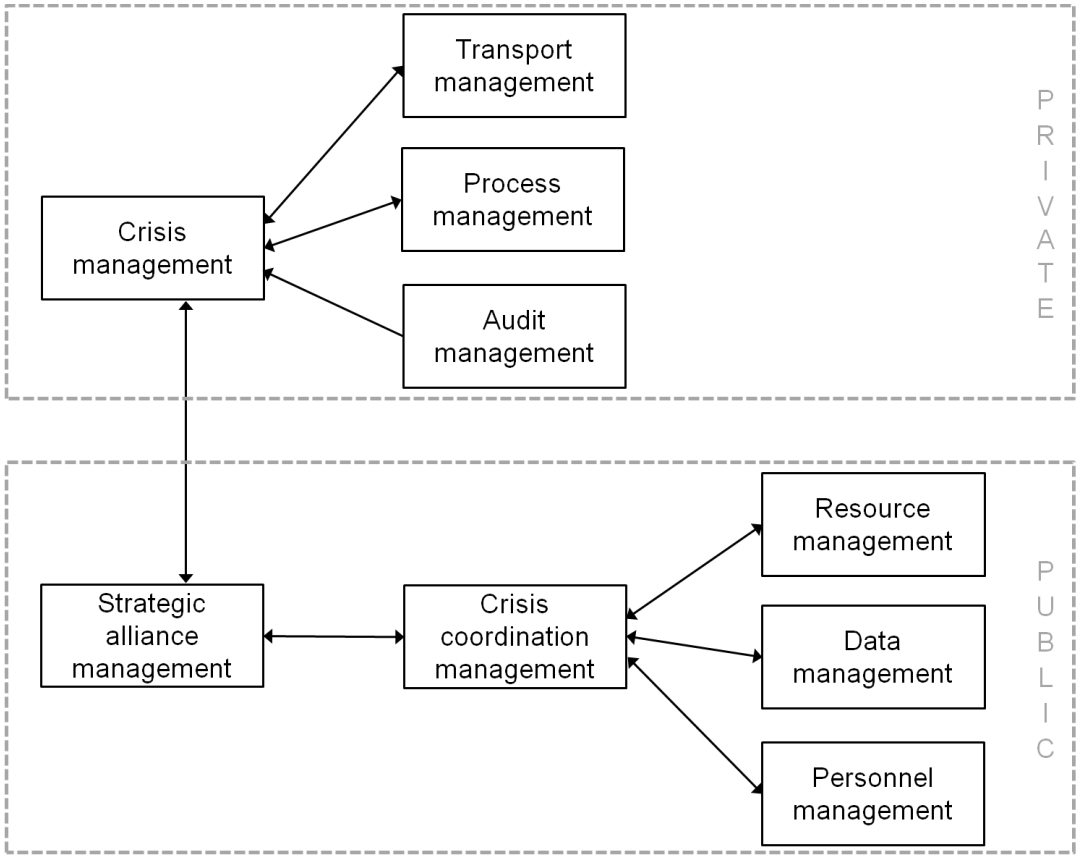


**Figure 13: Influence of private and public processes on each other within the strategic alliance**

### 3.3.2 Capability dimension of the public and private part models

Due to the existence of two part models for implementation of the EEM, process assessment has to be done separately on the public and on the private side. In conclusion, the assessment delivers two capability levels which might differ. However, both part models are jointly considered for implementation of the EEM, and the capability levels of each model have to be combined. Following this logic, not every combination of capability levels of both part models, which is possible in theory, is also rational in reality.

Therefore, the following combinations of capability levels of the private part model ($CL^{private}$) and the public part model ($CL^{public}$) must be seen as impossible combinations for the EEM.

$CL^{private}$ 0 and $CL^{public}$ 1/2/3/4/5: Without a crisis management which pursues to provide private information and to use public information, the process of information engage and exchange cannot be implemented at all.

$CL^{private}$ 1 and $CL^{public}$ 2/3/4/5: Without planned processes and controlled results on the private side, the private input cannot be seen as trustworthy and cannot be used effectively on the public side for resource planning or further decisions.

$CL^{private}$ 2 and $CL^{public}$ 3/4/5: The processes of crisis management are not standardized, therefore private information cannot be provided in a uniform information quality, and the public side is not able to predefine results.

$CL^{private}$ 2/3/4/5 and $CL^{public}$ 0: Without a strategic alliance which pursues to provide public information and to use private information, the process crisis management cannot be planned and has to remain initially on the private side.

$CL^{private}$ 3/4/5 and $CL^{public}$ 1: If the information exchange on the public side is not planned, the processes of private crisis communication cannot be standardized or even predicted.

$CL^{private}$ 4/5 and $CL^{public}$ 2: The processes of the strategic alliance are not standardized, therefore public information cannot be provided in a uniform information quality and the private side is not able to predict their results.

After exclusion of these combinations mentioned above, 15 possible combinations of part capability levels for crisis management and strategic alliance remain for the implementation and improvement process of the EEM as is presented graphically in Table 15.

**Table 15: Possible combinations of capability levels (CL) of private and public part models for implementation of the EEM**

| | | Public part model | | | | | |
|---|---|---|---|---|---|---|---|
| | CL | $CL^{public}$ 0 | $CL^{public}$ 1 | $CL^{public}$ 2 | $CL^{public}$ 3 | $CL^{public}$ 4 | $CL^{public}$ 5 |
| Private part model | $CL^{private}$ 5 | | | | | | |
| | $CL^{private}$ 4 | | | | | | |
| | $CL^{private}$ 3 | | | | | | |
| | $CL^{private}$ 2 | | | | | | |
| | $CL^{private}$ 1 | | | | | | |
| | $CL^{private}$ 0 | | | | | | |

Improvement process

Due to the process attributes defined by ISO 15504, in a first step, the general purpose of the strategic alliance has to be fulfilled; that means a public-private exchange of information must be achieved in CL 1. For a sustainable improvement, this exchange will have to be qualitatively extended via CL 2, which means that the exchange will be planned and the results for the sub-processes will be controlled, up to CL 5, when the exchange will continuously be optimized through new IT applications and additional network coordinators or processes.

### 3.3.3 Exemplary assessment of livestock trading organizations as pilot organizations

ISO 15504 requires specific indicators at each CL of a process which subsequently supports detailed assessment. The indicators are due to ISO 15504 expressed by work products and basic practices.

To assess the suitability of livestock trading organizations for occupying the role of a private network coordinator in a strategic alliance, the four processes which are included in the present private part model have to be seen as the maximum range of services and information a livestock trading organization can occupy as a private network coordinator within the pig supply chain. They deliver the necessary informative, organizational or technical input for a public-private information management in animal disease control. In consequence, when acting as a private network coordinator within the strategic alliance, the performance of all four processes is obligatory for livestock trading organizations. Otherwise informational, organizational and

technical gaps are included in the strategic alliance which have to be filled by other service providers to guarantee an effective public-private information management.

Exemplary assessment of livestock trading organizations for $CL^{private}$ 1 should provide information about their general willingness to become private network coordinators in the strategic alliance, and if they are not willing, where further process improvement is needed or perhaps if other types of network coordinators have to be involved for an effective establishment of the strategic alliance. SCHÜTZ (2009) identified a series of system functionalities for each process, expressed by specific activities and documents. These functionalities served as indicators in the process assessment model of the private part model at level $CL^{private}$ 1 because they are necessary for the execution of tasks within crisis management, audit management, process management and transport management. In summary, 19 specific basic practices and 34 specific work products are included as checkable indicators for the defined process outcome of the private part model. Table 16 shows the summarized list of document types and activities.

**Table 16: Process indicators (work products and basic practices) at $CL^{private}$ 1**

| Basic practices | Work products |
|---|---|
| – Individual counselling<br>– Production counselling<br>– Feed counselling<br>– Specific counselling feed or climate<br>– Integrated veterinary stock supervision<br><br>– Purchase and sale counselling<br>– Health evaluation<br>– Health monitoring<br>– Epidemiological monitoring<br>– Crisis communication | – Specifications for health check<br>– Specifications for monitoring<br>– Specifications for auditing<br>– Specifications for feed or climate analysis<br>– Specifications for integrated veterinary supervision<br>– Specifications for crisis communication<br>– Evaluation reports of health check<br>– Evaluation reports of monitoring<br>– Evaluation reports of auditing<br>– Evaluation reports of feed or climate analysis<br>– Evaluation reports of suppliers<br>– Contracts of monitoring<br>– Contracts of integrated veterinary stock supervision<br>– Contracts of auditing<br>– Contracts of information exchange |

At $CL^{private}$ 1, these basic practices and work products were checked merely regarding their existence and not for further quality criteria of these indicators; this is done at the next CLs level for planning or delivering predictable information.

On the one side, when interpreting the average of all single assessment results (

Figure 14) in terms of maturity assessment, the present services and corresponding documents and procedures of the investigated livestock trading organizations are not sufficient to reach the maturity $CL^{private}$ 1 and therefore to participate as a network coordinator in a strategic alliance. However, on the other side, it is clearly evident that the outcome of processes which are meant to be core competences of livestock traders can be classified at least as partially achieved according to the indicators of the private part model.

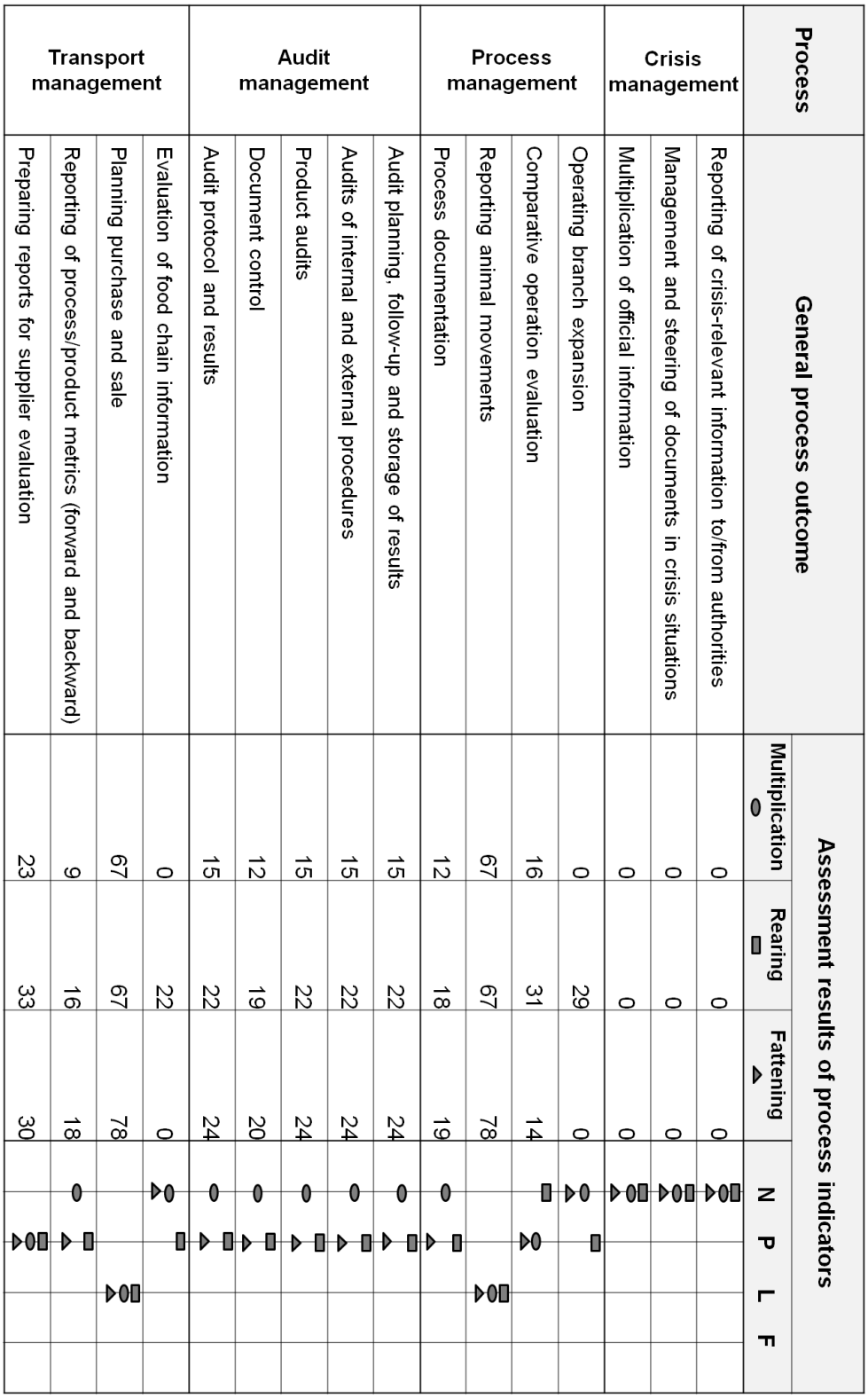


**Figure 14:** **Results of the assessment of livestock trading organizations regarding their suitability as private network coordinators in the strategic alliance at level $CL^{private}$ 1 and divided into target groups of production steps (degree of achievement: N = not, P = partially, L= largely, F = fully) (n=12)**

In summary, this assessment confirms that livestock trading organizations already have the potential to be a private network coordinator for public-private information management in animal disease control due to their range of services. Although depending on the production step, they have already implemented a wide scale of required processes. But it becomes also obvious that the core process crisis management is not supported by any document or technical and organizational standard procedure at all. Although livestock trading organizations often emphasized their important role as information hub for their costumers especially in crisis situations, they still have not developed or have not been able to develop and implement specific supporting documents, procedures and techniques which support this service. This leads to the identification of crisis management as the main weak point of livestock trading organizations, i.e. they have to improve on their way of becoming private network coordinators in the strategic alliance.

## 3.4 Discussion and conclusions

The objective of this study was to create an appropriate evaluation framework to examine the existence and quality of organizational and technical requirements of potential alliance partners and to define future development steps by means of a continuous improvement process of the strategic alliance.

As various authors suggest (WALLMÜLLER, 2007; WAGNER & DÜRR, 2008; BRENNER et al., 2010, a new process reference model was specified for the general requirements of the strategic alliance. In order to give public as well as private potential partners the opportunity to use this PRM as an evaluation frame and taking into account that public and private organizational and technical conditions have to be linked with each other in the alliance, the maturity model of the strategic alliance was divided into a public and a private part model with individual CLs which depend on each other. The combination of $CL^{public}$ and $CL^{private}$ offers information about the status-quo of the strategic alliance in general. Considered individually, each CL discovers weak points and potentials of single public or private partners within the alliance. The ICS of a strategic alliance required by the EEM approach is an innovation which is not yet based on extensive knowledge and experiences. Therefore, there exists no detailed plan about how this new ICS has to be managed, and the implementation of supporting new ITs is as described by PICOT and co-authors (2003). In this context, the application of the flexible approach of maturity assessment (SCHLICK & ROCHOLD, 2007; SCHMELZER & SESSELMANN, 2008; BACK &

HAIN, 2010; LAUDON et al., 2010) is useful. New indicators can be added to the PRM when requirements of the strategic alliance would change during the further development process. Each CL of the strategic alliance is a development step, an evolutionary plateau (WAGNER & DÜRR, 2008) on which indicators of the next levels might be added or corrected according to the technical and organizational solutions which are developed or chosen at the current level.

Regarding the assessment of 12 livestock trading organizations it has to be noted that the exemplary assessment was taken from raw data material collected in 2008. Meanwhile, especially the development of the private process crisis management is generally supported by several European research projects. Thus it can be assumed that innovative actions within this process framework might have happened at the level of livestock trading organizations (PETERSEN, 2012). It is also conceivable that livestock traders subdivide their range of services for processes into services they can offer themselves and such services they might give to other service providers for example by outsourcing (SCHÜTZ, 2009). It is indisputable that further preparation and implementation processes carried out by willing and interested potential alliance partners such as livestock trading organizations and competent authorities cannot be achieved by individual innovation processes. For example, crisis management on a smaller scale of the development as well as information management on a larger scale of the establishment of the strategic alliance need technical innovations and common regulations which only can be developed and also financed effectively within the framework of a further common public-private project work.

In conclusion, one can say that through the application of the maturity approach, the required processes of a sustainable strategic alliance in public-private animal disease control could be defined and made assessable by specific indicators. This serves as a general roadmap on which potential public and private partners might rely when preparing their successful participation. Further development steps could define more detailed or additional indicators which would be easy to integrate into the established model, thus the function as a tool for assessment and development support will remain effective. The first assessment of willing livestock trading organizations revealed several weak points, particularly technological and organizational structures for crisis management are missing. But the assessment also made it obvious that the majority of required private processes already exist in many approaches undertaken by livestock trading organizations, thus they need to be extended instead of generally rebuilt. Apart from the fact that meanwhile several projects support elimination of these weak points, the chosen livestock trading organizations were willing to participate in innovative public-private ICS like this,

which in turn increases their potential to become a suitable private network coordinator in the strategic alliance.

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# 4. Implementation and validation of the EEM application concept in animal disease control

## Abstract

In animal disease control, information has to be collected, analysed and communicated, in particular on the public side by veterinary authorities, but also in the private sector for the adjustment of production management. Until now, this is done in a personnel and time-consuming way. Although both, private sector and authorities, developed several information and communication systems (ICS) to support official control measures and the private production process, they are hardly interconnected and do not pursue an effective public-private communication.

A public-private approach of information management, the Engage Exchange Model (EEM), was set up to improve information management by a temporary mutual exchange of crisis-related data between public and private actors in crises. Based on empirical studies with comprehensive literature review and numerous interviews with public and private experts, a first technical and organizational implementation of the EEM was carried out in a fixed pilot environment for use in animal disease control.

Against the background of a continuous improvement process, this chapter deals with validation of the technical and organizational implementation of the EEM in an ICS prototype. Therefore a workshop was held with several public and private experts who are in a position to occupy potential responsibilities regarding further implementation in the user environment of animal disease control in Germany.

The validation results showed that this concept provides a practical possibility to improve communication between authorities and the private sector due to the approach of the EEM. The experts classified both, the organizational concept of a strategic alliance as well as the prototypical and technical concept of the web-based IT tool “SafeGuard-AAM”, as useful to support public-private information management in case of animal disease outbreaks but also in the broader field of food and feed security. On the public side, in the private sector and within the field of agricultural research, there is interest in further concrete testing of this innovative concept to get the opportunity to answer further questions in connection with validation such as the amount of costs and benefits achieved due to implementation of this new ICS.

## 4.1 Introduction

When an animal disease breaks out, European legislation prescribes control measures which include the search for possible channels of entry and distribution of the epidemic and its extent of damage for the public and private sector. The emphasis here is on fact, the more current the available data, the more accurate and efficient the selection of measures for combating the disease.

In Germany, competent veterinary authorities use the official ICS systems HI-Tier and Balvi iP for a quick IT-supported view on data of animal movements performed and official monitoring results. For further processing and documentation, this crisis-relevant data is brought together in TSN, the obligating crisis module for animal disease control. Due to necessary compromises on reporting deadlines and execution of on-the-spot controls, official datasets cannot always be kept up to date for all livestock, farms and related companies. For example, a farmer is allowed to report animal movements into HI-Tier up to seven days after receipt of the animals, and the amount of a farm's livestock must be officially recorded only once a year. Additionally, on-the-spot controls on farms are executed in the framework of the official veterinary and food control activities. They update outdated or erroneous datasets. However, according to the discrepancy between human resources and personnel costs, this occurs risk-based and with random sampling. For this reason and moreover for up-coming specific issues in case of an epidemic, a series of investigations on the spot on infected and suspicious livestock as well as manual investigative activities on further direct and indirect contacts are unavailable but necessary. Regarding efficiency of animal disease control, these actions are very time and personnel-consuming and, in case of farm visits, represent a further risk factor for the introduction and spreading of the epidemic.

As a result of the increasing requirements to guarantee food security in the agricultural sector, private actors are confronted with complex information management for product and process-related quality management, traceability and production transparency (PETERSEN, 2003; BEULENS et al., 2005; LUNING et al., 2006). This led to the development of a series of private information systems to exchange product and process-related data along the meat supply chain. These systems are increasingly web-based due to a strong increase in Internet use (ELLEBRECHT, 2008; FICK, 2010; PETERSEN et al, 2010). This trend is confirmed by the nationwide survey of PRODUKT UND MARKT (2013) which states that more than four-fifth of

German farmers in 2013 used PCs or laptops. Almost every fifth farmer already possesses a smartphone and every second farmer is even younger than 30 years.

In principle, the digital datasets of private systems can offer specific knowledge within a short time span. The systems contain data on animal health, production quality and traceability, all of them potentially relevant to crises such as animal disease outbreaks. Competent authorities might use them to select, rank and prepare epidemiological investigations on the spot as well as to support the decision process of control measures (ELLEBRECHT, 2008). In turn, private actors could receive official information easier and quicker to support intra-organizational and inter-organizational crisis management along the production chain. The demand for such public-private information management concepts grows, especially in and immediately after crisis situations (KASPER et al., 2008; SCHÜTZ, 2009). However, organizational and technical concepts of a fast and coordinated information exchange like this do not exist in a satisfactory way (ELLEBRECHT, 2008; SCHÜTZ, 2009). The great majority of information systems must be seen mainly as isolated systems. They cover only specific issues of food security (THEUVSEN et al., 2007; BAHLMANN et al., 2009). Within the framework of animal disease control, the possibility of a public-private crisis communication has not yet been implemented, and the systems cannot realize data transfers and communication flows outside their usual communication partners (PETERSEN et al., 2007; DEIMEL, 2010). Owing to this, various authors point out that information management between the private sector and authorities should be improved in general in order to discover animal diseases earlier and to minimize their damages (ELLEBRECHT, 2008; SCHÜTZ, 2009; SLÜTTER et al., 2010; THEUVSEN & ARENS, 2011; WILKE et al., 2013; PETERSEN & NÜSSEL, 2013).

In consequence, it becomes necessary to develop an organizational and technical information management concept which enables a public-private partnership for crisis communication. The basis for this is seen in the Engage Exchange Model (EEM). This communication model is based upon two different situations of communication flow as shown in Figure 15. In normal times, there is a privately coordinated information exchange between the individual business partners within the production chain. In contrast to this, during a crisis, in this exceptional situation previously defined information is engaged, and through the exchange of crisis-relevant information, effective and fast communication between authorities and private network coordinators is ensured (BREUER et al. 2008; KASPER et al., 2008; SLÜTTER et al., 2011).

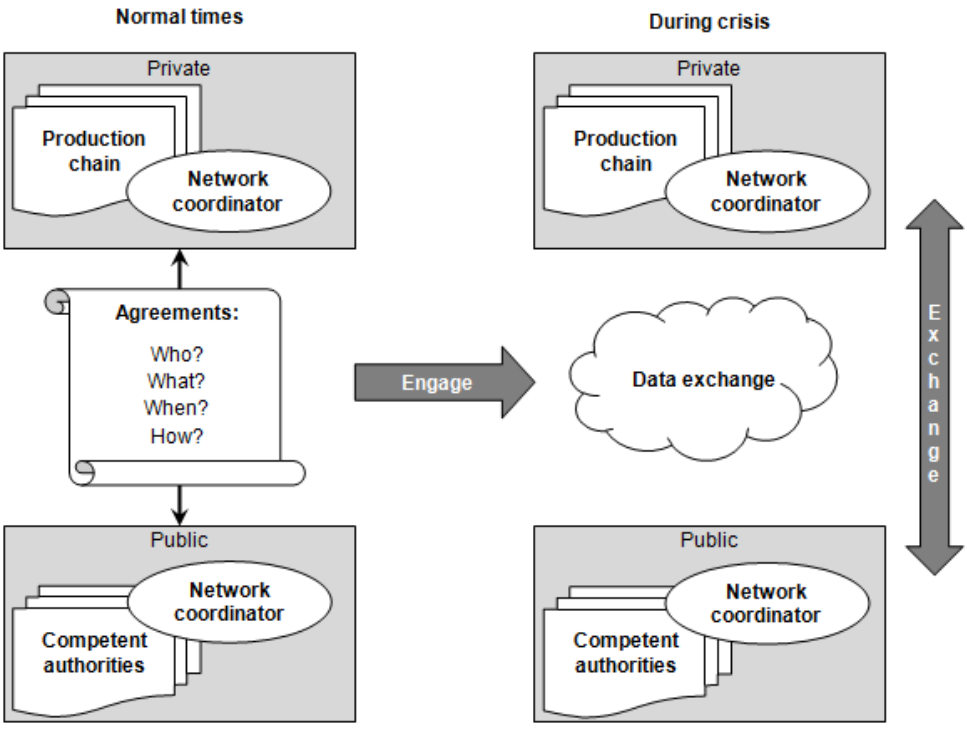


**Figure 15: Elements of the Engage Exchange Model (mod. from BREUER et al., 2008; SLÜTTER et al., 2012; WILKE et al., 2013)**

In this context, network coordinators on the private side, such as livestock traders, are crucial information partners of a public-private information management. They serve as bottlenecks between the different steps of the production chain. Apart from their conventional core services, network coordinators meanwhile offer a wide range of supporting services for data management and document control in the framework of quality and production management as well as traceability. As a result, they develop, provide and operate their own inter-organizational information system or use systems of other network coordinators (PETERSEN et al., 2007; SCHÜTZ, 2009; VOSS, 2011).

Often missing technologies are mentioned as a reason for absent information exchange. To possess the right techniques is in fact helpful but actually the problem consists of legal requirements or is a political one. For example, information transfer always includes the disclosure of information and hence must be combined with the risk of legal consequences or generally with changes in regulation (WILLIS et al., 2009). For this reason, it must be ensured that all deliverers of information also receive useful information in turn. In this context, WILLIS and co-authors (2009) point out that for private actors the fact that they offer their information to

authorities is not as important as the fact what authorities do with this private information. Accordingly, a potential refusal of public-private information management is not only based on additional activities regarding the current way of information management by public and private actors, but also on doubts and concerns. As a consequence, HOLLMANN-HESBOS (2008) deduces that people's behaviour and opinions, on the one hand, can promote the necessary developments to optimize information management, but, on the other hand, can obstruct them too. On this account, ROGERS (2003) emphasizes that first of all innovators and early users must be convinced of an innovation. They act as opinion-former for the broad majority of potential users and minimize their insecurities to use the innovation.

Hence, a first concept of the organizational and technical implementation of the EEM is developed in the framework of a pilot environment, and consequently in this study, a first validation should lead to the answer if the theoretical approach of the EEM can be implemented practically.

## 4.2 Methodological framework

### 4.2.1 Implementation approach of an EEM application

To enable discussion and assessment of a sustainable development of this theoretical approach, the EEM had to be implemented within the framework of public-private information management according to the system development approach of prototyping.

The reason for this is that sustainable implementation of a new ICS includes more than a successfully technical implementation. It contains also changes in requirements or organizational structures. New or modified ICSs can be technically perfect but fail because of social or political processes which were not taken into consideration (LAUDON et al., 2010). For this purpose, the organizational and technical status-quo of animal disease control as presented in the previous chapters of this thesis was taken into account in the process of system development for an ICS application of the EEM.

The traditional system development is the oldest model to prepare ICS. It requires a disciplined procedure which avoids repeating single working steps through its examination and documentation before going to the next step. This model of system development is very practicable for large projects and complex systems because it is very explicit in documentation

and structure. However, the traditional system development, although theoretically appealing, has some disadvantages, above all, the developed ICS cannot be used before implementation in practice. This led to several extensions and modifications of the model, whereas a more agile one is prototyping. A general definition of prototyping is given by CONNELL and SHAFER (1989):

*"A software prototype is a dynamic visual model providing a communication tool for customer and developer that is far more effective than either narrative prose or static visual models for portraying functionality. It has been described as:*

- *functional after a minimal amount of effort*
- *a means for providing users of a proposed application with a physical representation of key parts of the system before system implementation*
- *flexible modifications require minimal effort*
- *not necessarily representative of a complete system."*

LAUDON and co-authors (2010) add that a prototype can be developed within a short time. It remains flexible in comparison with traditional system development because of several validations and revisions of the prototype during the on-going development process (Figure 16). Thus, changing or missing aspects according to users' requirements and the application environment can be integrated easier.

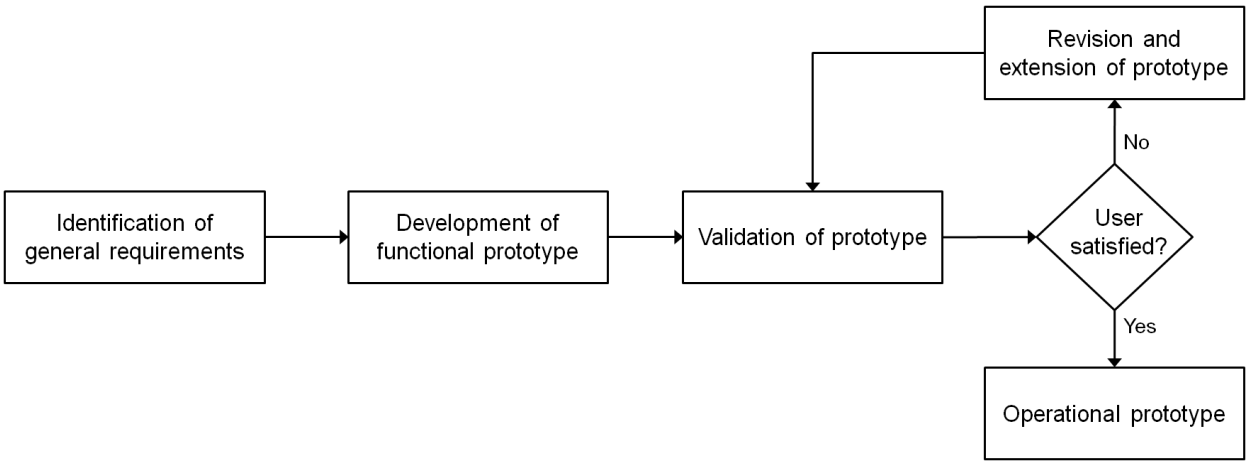


**Figure 16: The process of prototyping (mod. from LAUDON et al., 2010)**

Prototyping promotes early and intense interactions between developers and potential users (CERVENY et al., 1986). When potential users are involved in the development process, the success of sustainable implementation is supported. On the one hand, it becomes more probable that the new ICS complies with potential users' requirements. On the other hand, the involved people are able to manage the results of system development. LAUDON and co-authors (2010) assume that they will react more positively and feel more responsible to support the final implementation process out of the pilot environment because they participated actively in the development process.

### 4.2.2 Pilot environment

According to the software development model of prototyping, a first functional prototype of the EEM was developed in order to verify the hypothesis that the EEM can be implemented practically. A pilot environment based on already determined general requirements of public-private crisis communication in animal disease control was created as described in the previous chapters of this thesis.

The Strategic Alliance forms the organizational element of the prototype. Therefore, competent German District authorities on the public side, and network coordinators and farmers on the private side occupy key user positions in the first prototype version developed. As the development was depending on the financial support and limited to the running time of the projects SafeGuard and QUARISMA, the decision was taken to use the chain management system ChainPoint as a system approach for technical development of the EEM prototype. It is a modular software platform and allows cooperating organizations and their coordinators to manage their collaboration (CHAINFOOD, 2013). As presented in Figure 17, ChainPoint comprises a set of applications upon which organizations can improve and maintain communication with each other.

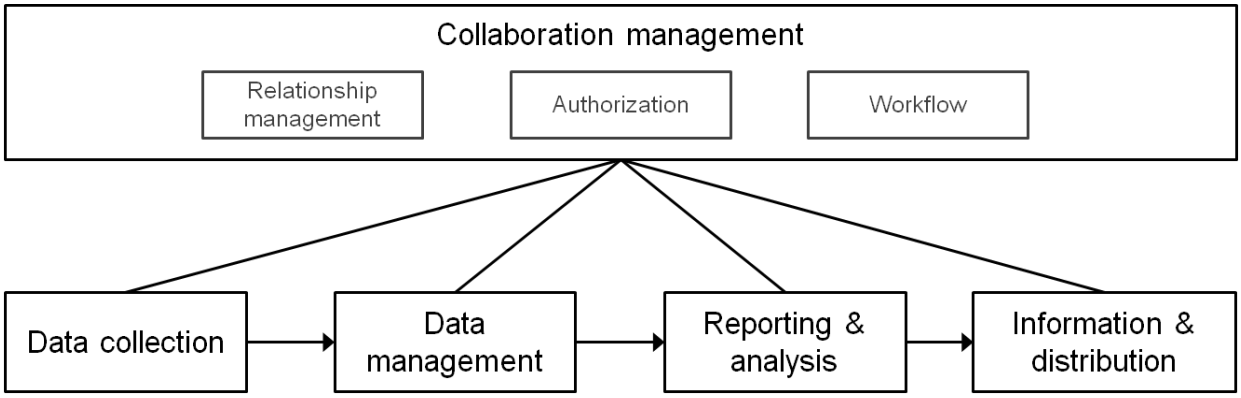


**Figure 17: Structure of the system approach ChainPoint (mod. from CHAINFOOD, 2013)**

These applications served as a basis for the system structure of the prototype “SafeGuard-AAM”. Relevant data can principally be brought together from a range of different sources or via a web interface, and authorized users have access to all gathered details via a secure internet connection. In the course of the development process within this study, interfaces between existing public information systems and the first prototype were not yet implemented. This would have implied that public systems were allowed to implement this action by law or under the responsibility of official institutions, but since they were not included in the project framework, they had no or only little ambition to take active part in the development process. On the private side, a livestock trading organization agreed to be available as a pilot partner and provide its chain information system as a connected information system on the private side in the framework of the validation procedure. Because of the service range during audit, process, transport and crisis management, the organization can be defined as a private network coordinator.

The collection of private data is done in the inter-organizational IT system of the network coordinator. In normal times, the system is used for daily data management and contains individual access profiles for farmers, farm veterinarians and network coordinators. During an animal disease outbreak, the access profile for official veterinarians is extended and crisis-relevant data can be exchanged between public and private users. Depending on the pilot environment on the private side, the following datasets can automatically be exchanged via “SafeGuard-AAM”:

- Process management: addresses, contact details, name, species, stable places
- Production management: losses, animal treatments, counselling visits

- Supplier management: date and name of delivery of feed and livestock
- Audit management: QS status

In turn, official general information such as recommendations, forms and information about restrictions can be submitted to the system for rapid distribution to the network coordinator. Additionally, it is possible to address specific access profiles for fast individual communication as required for example to distribute results about laboratory investigations on animal diseases in combination with transport permissions to specific farmers. In light of the fact that there was no user experience to rely on in connection with the prototype, reporting and analysis tools were principally integrated in the prototype system, however, they were not developed in detail or for specific issues. Since the prototype is based upon a secure web technology, there is no need to install local software applications, and the web application can be managed in any desired location. For practical reasons, the decision was taken to leave this location under the responsibility of the system developer during prototyping. To ensure smooth communication between users, the technical conditions of potential users are taken into account. Therefore, communication media with nearly full coverage use, such as fax or mobile phone, were integrated into the online communication. By the application of gateway technologies for example, an official online request on specific additional information can be transferred via SMS to achieve the addressee within an adequate timespan even if he or she is offline.

An overview of the access profiles and functionalities of the prototype in normal times and during a crisis is shown in Figure 18.

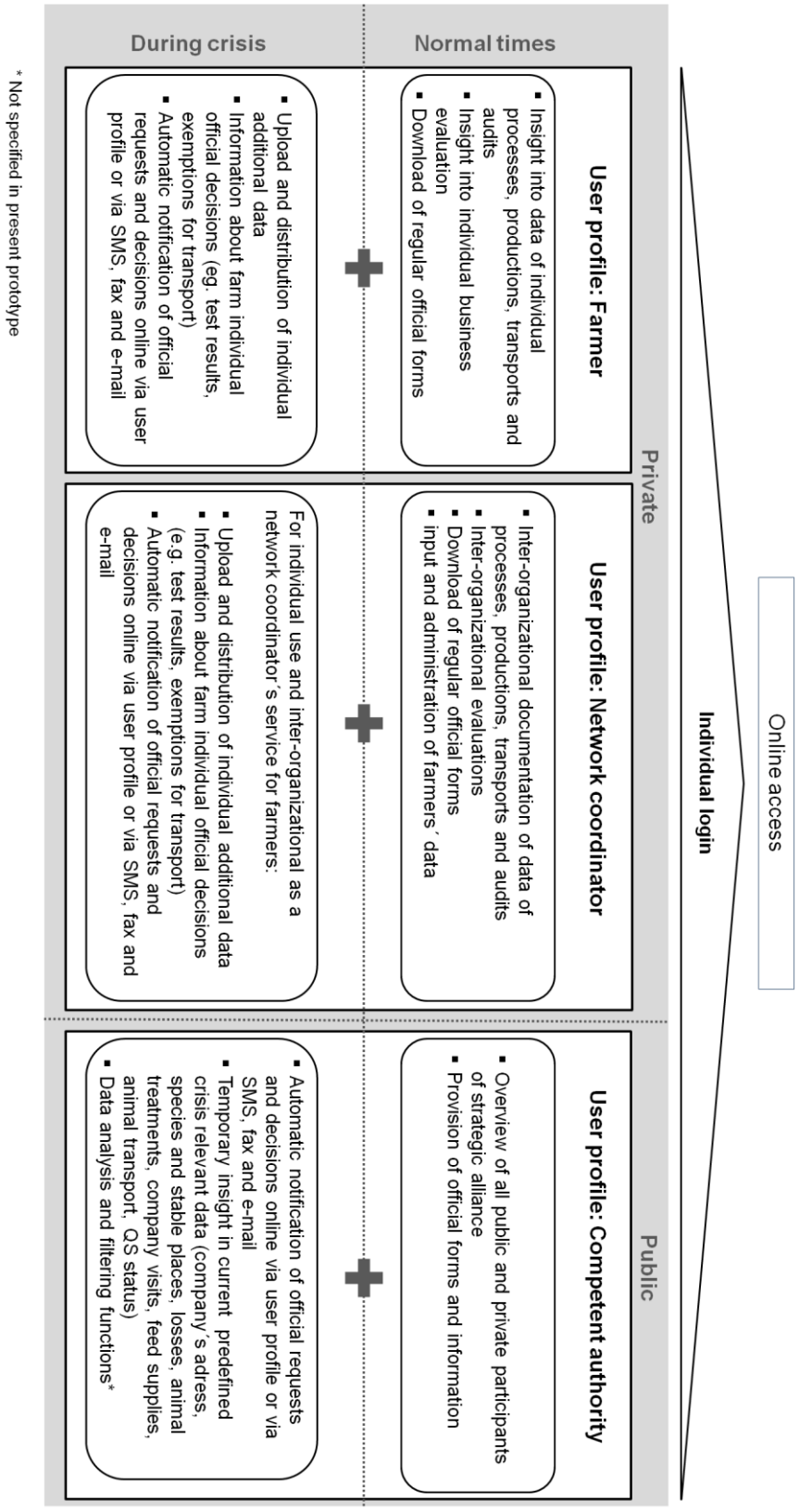


**Figure 18:** **Overview of elements and functions of the IT prototype on public and private side at normal times and during crisis**

### 4.2.3 Procedure of validation

Not all aspects of the prototype, which principally might be validated, could be included in the validation procedure presented in this chapter. The main reason for this is that some requirements for a concrete pilot testing by potential users such as interfaces and trainings could not be implemented during the research period due to their long-term development and tuning process.

*Validation issues*

The validation focused on the issues of functionality and sustainable use of the implemented improvement concept EEM as an IT prototype for crisis communication in case of CSF and further possible applications in the area of food safety. These issues were suited for validation because of the following reasons:

- Acceptance and sustainable implementation of the prototype create a foundation for identification and adjustment of further research efforts.
- The improvement strategy of the EEM can be discussed using the example of a concrete implementation concept.

Therefore, the validation issues could be defined and limited as shown in Figure 19.

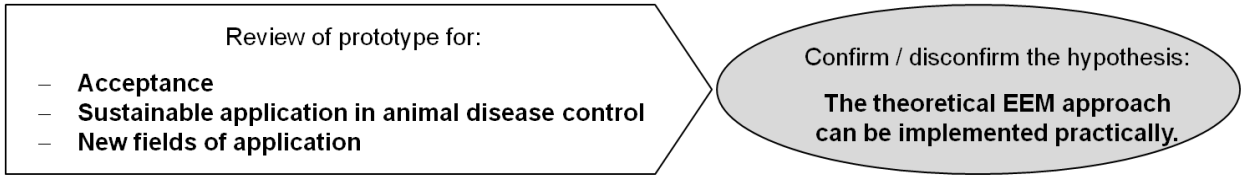


**Figure 19: Validation aspects**

*Organization and data collection*

The validation was organized as a public-private expert workshop with a duration of three hours. In total, 13 experts participated in the validation. All participants represented potential actors and decision-makers in the context of public-private crisis communication in animal disease control and food safety such as veterinarians of authorities at different federal levels in Germany,

livestock traders and IT specialists as well as researchers. Due to the fact that the participants work in different functional areas in the field of animal disease control, the validation procedure could take a broad range of knowledge, experiences and perspectives into account. A triangulation of validation methods was used to cover a larger quantity of data for validation than could have been possible using a single method. It was also expected that triangulation would avoid the false statements of single methods. Therefore, the validation procedure consisted of four methods, i.e. survey, pilot demonstration, discussion and report. They were divided into five components as presented in

Table 17. The aim was, on the one hand, to guarantee that all participants have the same knowledge of the validation objects of strategic alliance and IT prototype and, on the other hand, that all possible private, public and scientific perspectives were included in the validation procedure ensuring at the same time that misunderstandings were excluded.

**Table 17: Components of data collection for the validation procedure**

| Time | Component | Contents | Intention |
|---|---|---|---|
| During workshop | 1st survey | Anonymous questionnaire on general aspects of animal disease control | Conclusions from the participants' experiences in animal disease control and their opinion regarding general requirements for an improved crisis communication |
| | Demonstration | Introduction to the organizational and technical concept by a demonstration of the<br>– strategic alliance<br>– functionalities of the IT prototype<br>on concrete datasets in a specific pilot environment | Ensuring that all participants have the same knowledge of the research background and the organizational and technical concept |
| | Discussion | Open discussion regarding<br>– acceptance<br>– sustainable application in animal disease control<br>– new fields of application<br>of the concept | Documentation of concrete criticism, ideas and open issues |

| | | | |
|---|---|---|---|
| | 2nd survey | Anonymous questionnaire on the discussion points<br>– acceptance of the concept<br>– its sustainable application in animal disease control<br>– new fields of application | Enabling the participants to express their opinions and to make proposals in an anonymous way regarding the discussion points |
| After workshop | Report | Summary and combination of the data collected during the workshop and distribution to all participants for review | Ensuring that no misunderstandings or false statements are included |

After a short introduction, the participants were informed about the research background leading to the development of the IT prototype for the EEM. Then, an anonymous questionnaire on general aspects of animal disease control was filled in by all participants. Subsequently, the validation objects of strategic alliance and IT prototype were demonstrated by means of a scenario of a CSF outbreak. After that, a discussion took place. To avoid that the discussion would stray from the topic, it was led by one of the researchers, and the general validation issues acceptance, sustainable application in animal disease control and new fields of application of the concept were omnipresent on a flip-chart. The main discussion results were written down on a poster showing the EEM in general, as already presented in Figure 15, to support further discussion and to avoid straying from the point during the discussion. Additionally, all statements, questions and discussion points mentioned in the workshop were noted in a discussion protocol by another researcher. The workshop ended with handing out an anonymous questionnaire on the main validation issues which had to be filled in by all participants at the end of the workshop, directly after the workshop discussion.

Following the workshop, a report was prepared including all survey results, main discussion points and validation results. Subsequently, this report was sent to and reviewed by all participants to detect potential misunderstandings during the discussion process.

## 4.3 Results

The following validation results are based on the answers and statements within the framework of the workshop. The included survey shows that the pool of 13 workshop participants in total consists of suitable experts for a validation (Figure 20). The participants, except for one, assigned their working fields directly or at least indirectly to animal disease control. More than half of the experts from the pool have already gained experience by direct or indirect

involvement in decision processes in the context of animal disease control. Half of the remaining experts with no experiences at least assume to get involved in these processes in the future.

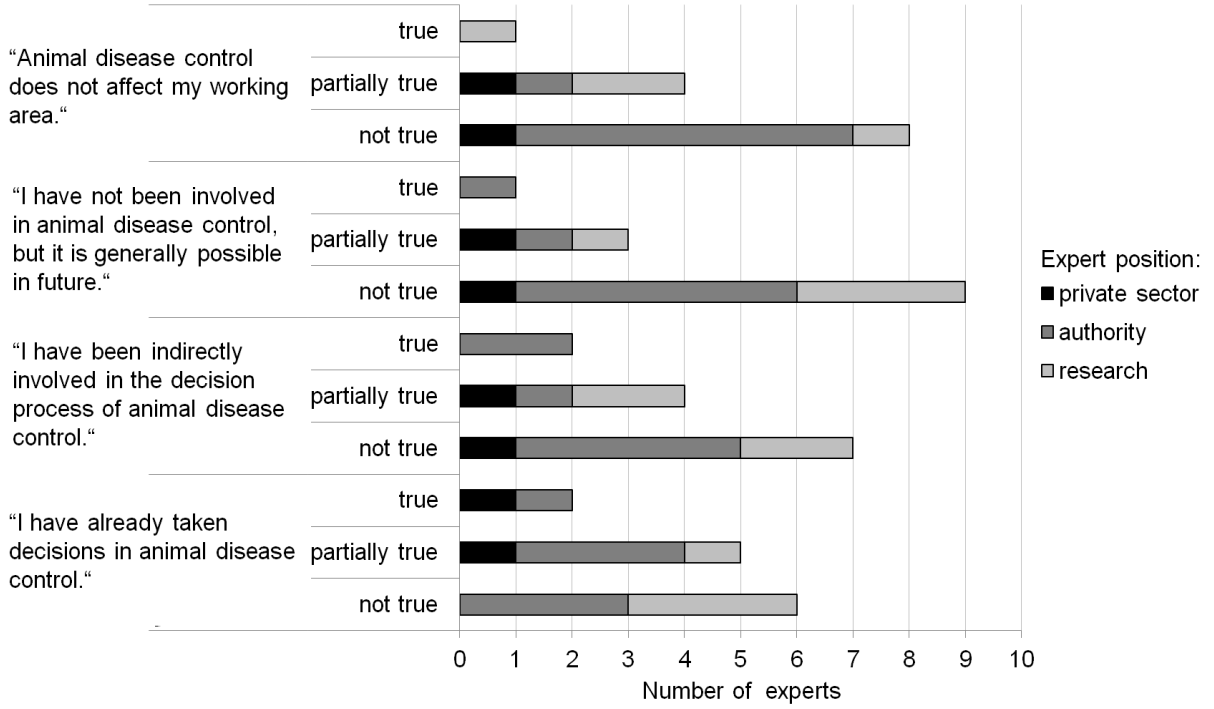


**Figure 20: Experts' experiences in animal disease control (n=13)**

The following sub-chapters describe the results of the validation procedure, whereas, on the one hand, the acceptance of the concept for the organizational and technical implementation of the EEM approach had to be identified, and, on the other hand, the requirements for a sustainable implementation in animal disease control and further application fields had to be defined.

### 4.3.1 Level of acceptance for an implementation of the EEM application

In addition to the results described in the previous chapters of this thesis, the medium to high expectations of a new ICS for public-private information management once again show that information management during a crisis should be improved.

As illustrated in Figure 21, most of the experts classify their expectations of a new ICS to improve the situation of information already in normal times as medium to high. Only a few experts have low expectations regarding single aspects such as the extension of available information, its systematic and quick processing and target group-focused distribution. Especially improvement aspects such as an acceleration of data collection and an improvement of the information quality are expected from a new ICS. During an animal disease outbreak, these expectations of new systems increase.

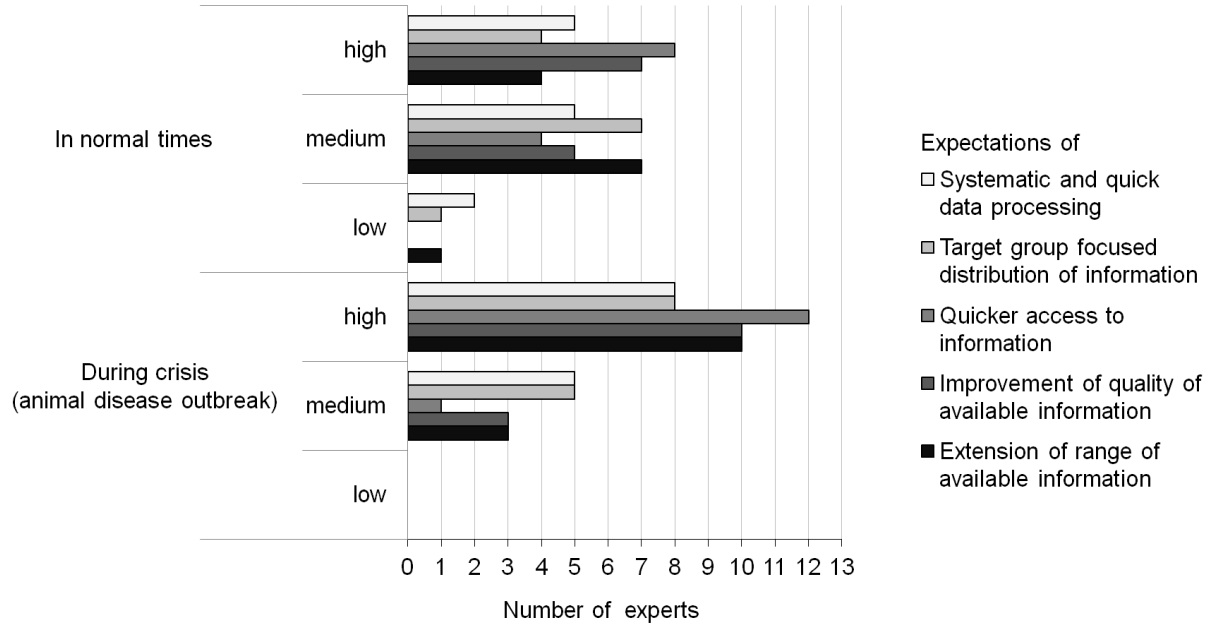


**Figure 21: Experts' expectations of new information and communication systems for public-private information management (n=13)**

A systematic preparation of the information exchange between public authorities and the private sector is obviously classified as a precondition for the development of a new ICS for public-private information exchange. On the other hand, the experts are restrained about the necessity that both sides, public and private sector, have to know the existing datasets and data bases, although the majority of experts are not sure if all information is suited to be exchanged. Figure 22 gives an overview on the experts' opinion on given statements in this framework.

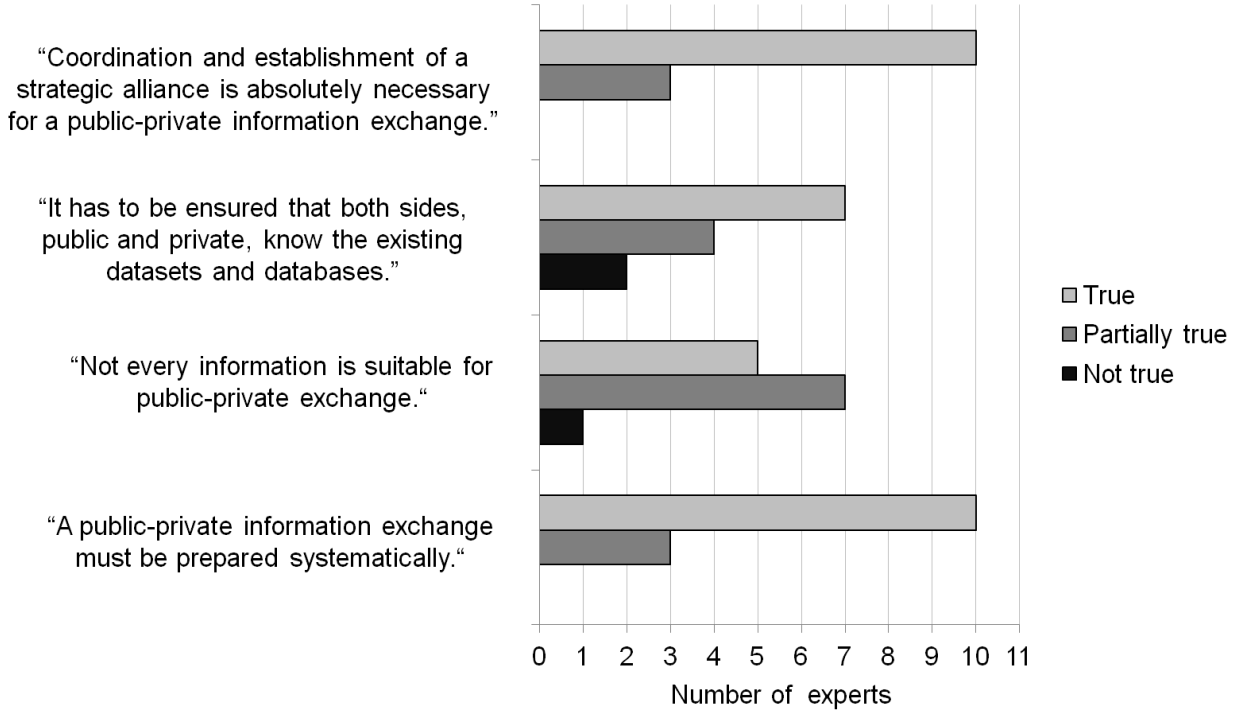


**Figure 22:** **Experts' opinions on conditions to establish an ICS for a public-private information exchange (n=13)**

All experts assess the coordination and establishment of a strategic alliance, which is already described in detail in the second chapter of this thesis, as a necessary precondition to implement the EEM approach organizationally.

Private network coordinators occupy key positions in this strategic alliance. In this context, 12 out of 13 experts agree that livestock trading organizations are able to take on this role on the private side. Additionally, it is mentioned several times in the discussion that the occupation of the position as private network coordinator is seen as a coordinating task of the private sector. Further on, other types of private institutions and organizations along the production chain have to be checked regarding their potential to act as a private network coordinator, too. The experts suggest stakeholders as well as organizations belonging to the management fields of quality, animal health or supply as possible network coordinators (Table 18).

**Table 18: Experts' suggestions regarding potential private network coordinators in addition to livestock traders**

| Management field | Suggested organizations and institutions |
|---|---|
| Quality management | – QS GmbH<br>– QS bundling organizations |
| Animal health | – Animal health management systems in general<br>– Animal Health Agency TiGA e.G.<br>– Veterinarians |
| Supply | – Suppliers in general<br>– Feed companies<br>– Feed suppliers<br>– Animal slurry suppliers |
| Stakeholder | – Associations in general<br>– Farmers' associations<br>– Chambers of Agriculture<br>– State control associations |

The discussion statements about the reliability of farmers as partners in a strategic alliance and the experts' assumptions about their use intensity of the demonstrated concept lead to the opinion that network coordinators represent a neutral position within public-private crisis communication in case of an animal disease outbreak. While farm-individual needs are assumed to have quite a negative influence on the farmer's information behaviour in public-private communication, the network coordinator tries to offer advantages to the broad customer base by providing services in crisis management. The fact that the network coordinator in some situations replaces the farmer as a direct communication partner for authorities is generally not seen as problematic because crisis-relevant data are retrieved in any case when they are needed and their public-private communication cannot be circumvented by the farmer anyway. This could be defined as a service for public-private communication on behalf of the livestock trading organizations.

The large majority of experts defend the view that in terms of the EEM, which is organizationally implemented by the strategic alliance, public network coordinators have to be integrated in addition to those on the private side. The reasons for this are the implicit needs of

- Control of time and activities to engage information
- Management of the interaction between competent public authorities and private coordinators
- Ensuring communication beyond the boundaries of the public authorities

- Monitoring, control and maintenance of organizational and technical functionalities
- Funding and support

There was a general agreement about the point that such a network coordinating role would not be a feasible task located at district level. This task requires a well-functioning state level. The common IT server solution IDV (Integrierte Datenverarbeitung) of North Rhine-Westphalia as well as the nationwide used IT monitoring system Balvi iP are to function as possible network coordinators on the public side.

In addition to validation of the organizational part of the implementation concept, the technical part in form of the IT prototype was also assessed by the experts. With the exception of one abstention, they indicated in the concluding survey that they comprehend the functionalities of the demonstrated IT prototype as a support for public-private crisis communication in case of an animal disease outbreak. Thus, it can be assumed that the previous demonstration of the prototype and the subsequent discussion had removed any possibly existing ambiguities about the functionalities of the prototype.

The functionalities for the private side of the IT prototype are considered as a quite reasonable support because in case of animal epidemics farmers could get information about the current situation much quicker. In this context, several experts remembered previous epidemics where livestock trading organizations already functioned as private crisis coordinators. A representative of the private sector within the expert group confirms this by his own work experiences in such an organization. During the last epidemics, farmers, veterinarians as well as transport organizations were informed about the current animal disease situation two or even three times a day because the public information was constantly changing. The official representatives agree that considering the developments in the private sector towards a general coordination along the production chain, livestock trading organizations can take a meaningful position in crisis communication. This opinion is supported by officials' individual experiences in previous outbreak situations of Avian Influenza and other diseases, where it was difficult to convey when which products can be transported whereto. These communication problems might be avoided by the IT prototype.

The use of the developed IT tool to distribute individual enactments, which is currently a very personnel-intensive process, is seen as questionable. Although the IT system includes a confirmation function for important messages and stores the user's history of evidence for communication activities, it does not rule out the risk that negative messages are not even read

or an acknowledgment fails. Therefore, a verifiable, legally binding dispatch cannot be offered by the prototype.

The supporting effects on information supply for authorities in case of an animal disease outbreak are assessed as ambivalent. Direct support of the prototype alternatively on or in addition to the epidemiological investigations is classified as improbable by the experts on the public side because of their assumption that in a prospectively nationwide implementation, the EEM will be still missing. A main argument for this assumption is that new or additional procedures caused by the integration of this tool in official animal disease control have to be legally binding. It is a fact that right now there exist no legal agreements on the private or public side which define the use of the prototype in case of a crisis as well as the included datasets. The tool would be very attractive when all contact structures such as feed transport, veterinary visits and pickups of rendering plants would be included. Because of the missing nationwide implementation and uncertainties regarding the possible inclusion of epidemiological data by a query within the system, the current measure of epidemiological investigation cannot be replaced. However, for all experts it is quite conceivable that the demonstrated tool could support the epidemiological investigations in the further course of data analysis and planning of control measures by providing private information. This private information is merely seen as additional information to support detailed interpretation of the already available official information. In that case, a nationwide implementation of the IT tool is desired, but actually not necessary.

The survey, completed at the end of the workshop, shows that the presented implementation of the improvement approach EEM generally met with approval from all workshop participants.

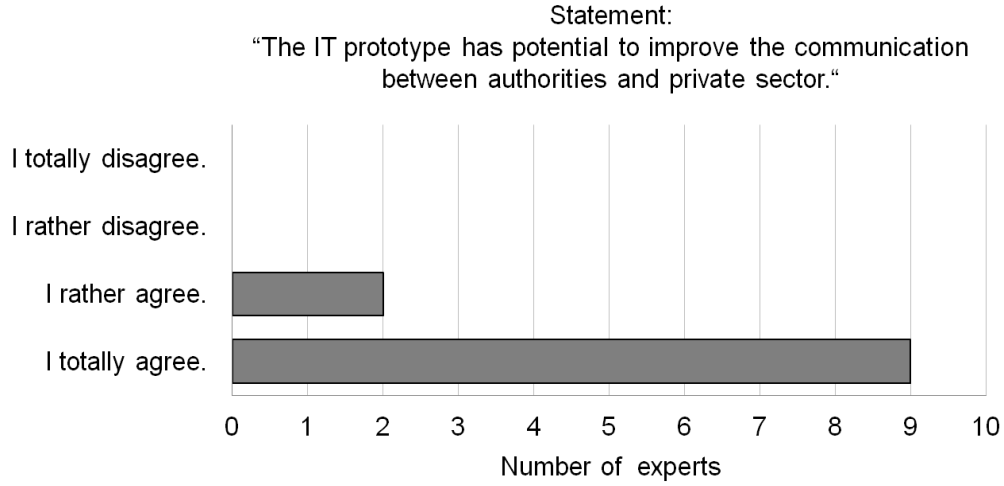

**Figure 23: Expert's acceptance of the IT prototype as a technical implementation of the EEM (n=13)**

The potential of the prototype to enhance the communication between the private sector and authorities in case of animal diseases is clearly seen. There exists also considerable interest in the development of the IT prototype for all representatives to pursue a desired nationwide use. This would improve the quality of information and in consequence would increase its credibility and benefits. The fact that the product maturity of the prototype is lacking because of a currently missing nationwide implementation of the organizational and technical concept, particularly on the public side, is not reliable enough to replace specific official investigations. But the potential of it as a support tool for investigations in the framework of animal disease control is clearly seen. In this regard, the majority of experts, which represent potential users of the IT tool, ask for a more practicable user interface, additional evaluation functions for a better interpretation of information and additional features which strengthen a public-private partnership of the alliance partners also in normal times.

### 4.3.2 Proposal of further fields of application in animal disease and food control

To promote a sustainable implementation of the organizational and technical concept, several experts repeatedly indicate their demand for a pilot integration of the IT tool into practice. A pilot application in the framework of crisis exercises or field tests with concrete user scenarios as well as a first launch on regional level is seen as a possibility for further development. These discussion results are underpinned by the survey results presented in Figure 24.

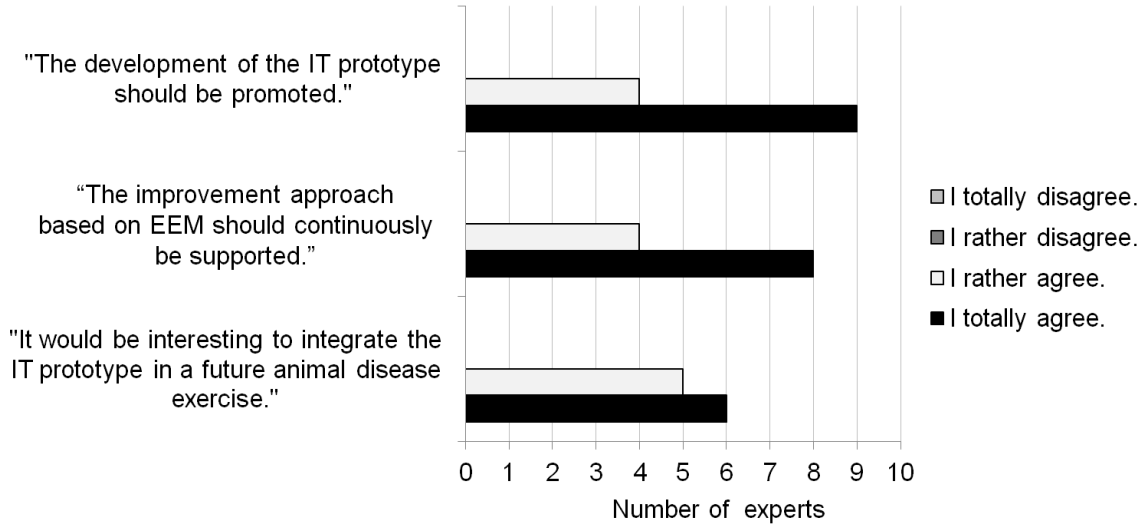


**Figure 24:** **Experts' opinion on statements for a sustainable implementation of the organizational and technical concept to use the EEM (n=13)**

The survey also gives insights into the experts' heterogeneous opinions on current technical and organizational hurdles of a public, private or public-private information exchange (Figure 25).

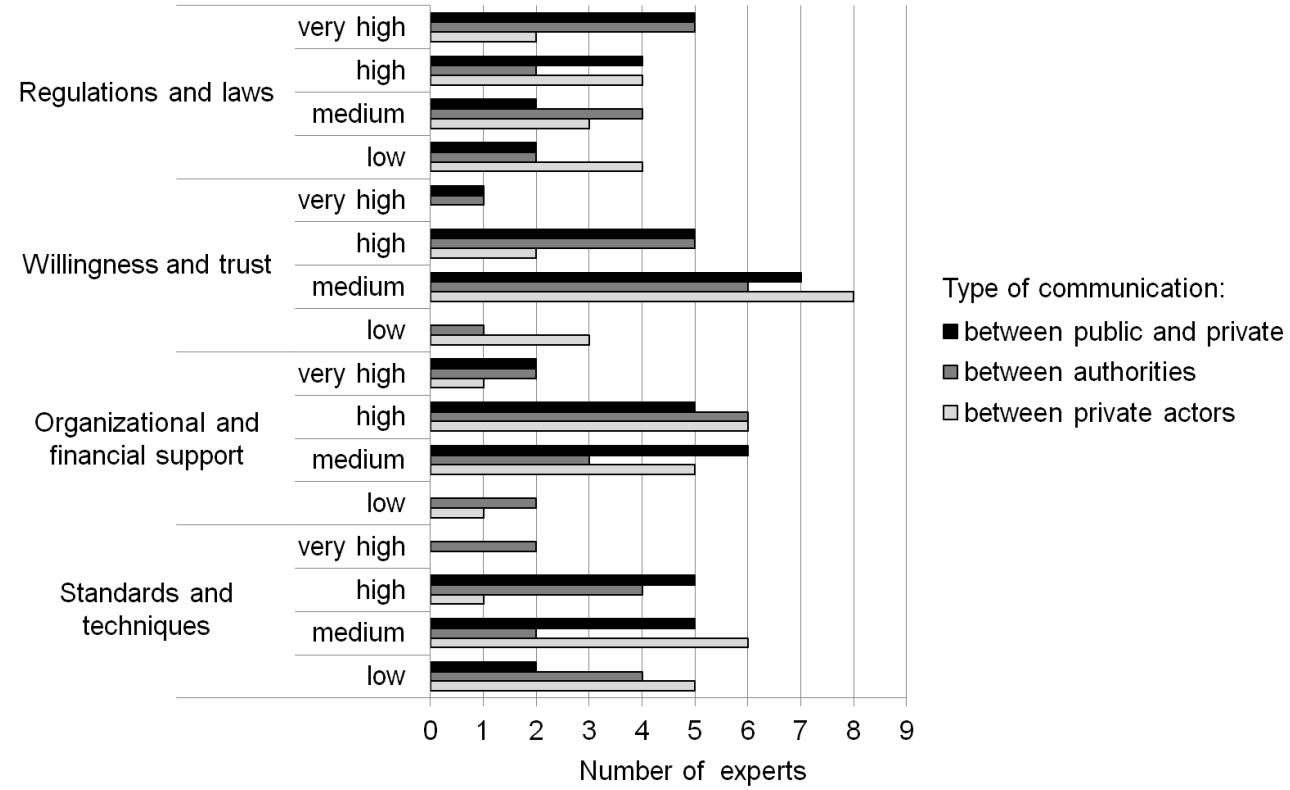


**Figure 25:** **Experts' assessment regarding different types of potential hurdles for the implementation of a public, private and public-private communication (n=13)**

The discussion results deliver an explanatory approach for the various assessments of the aspects. For pure private sector communication, the obstacles are considered to be low. Reasons for this can be found in the present economic interest in common standards and techniques along the production chain and the existing well established relationship of trust by the trend towards a communication through private network coordinators. The quality and amount of available information and techniques and by inference the official communication varies a lot between experts, even between those on the public side because in this regard, they have had divergent experiences in the past.

It can be summarized that to pursue a sustainable development of the prototype and its integration on the public side, intensive work on all four types of hurdles is needed. Resulting from the already existing inter-organizational systems of private network coordinators, in the private sector, a first joint basis for integrating the IT tool is offered. However, on both sides, public and private, sustainable support, especially financial support, is required for a sustainable development of the IT prototype.

To pursue sustainable establishment of a strategic alliance, the workshop participants agree that all alliance partners must draw benefits from use of the IT and from being a member of this alliance. The advantages of private network coordinators are obviously the extension of their service range to include crisis management and an improved decision basis for other service processes such as animal transports in times of restrictions. The suggested incentive for farmers to join the alliance because of the expected general advantages gained from shortening the high-risk phase of a crisis or an earlier discovering of epidemics is not assessed as a sufficient individual benefit to convince single farmers to join the alliance. An incentive system based on individual financial benefits such as reduced contributions to the German animal disease fund seems to be difficult to implement due to the lack of controllability of a functional crisis communication of the alliance partners during normal times. It is regarded as more meaningful by the experts to integrate alliance participation into the requirements of quality systems in the private sector. The integration into the QS quality standard is conceivable, for example. Already established as a recognized structured and certified quality system, it is able to provide the necessary reliability of an incentive system.

In addition to the issues of acceptance and sustainable implementation of the concept, the validation procedure identified other application fields apart from animal disease control.

Depending on the definition and availability of private network coordinators, an application of the concept in the fields of official food and feed monitoring is suggested to deliver support for different aspects. In detail, these aspects are residue monitoring, product recalls, traceability and quicker communication of results from private laboratory tests.

## 4.4 Discussion

The initial validation of the organizational and technical solution concept performed for an improved public-private information management in case of crises provided numerous results on the issues, laid down at the beginning of this study:

- Acceptance of the organizational and technical concept
- Sustainable application of the concept in animal disease control
- New fields of application

Altogether, the results confirm the hypothesis that the theoretical approach of EEM can be implemented practically. The experts assess the concept for the implementation of the approach not only suitable for the field of animal disease control, but also in the general field of feed and food monitoring.

The chosen triangulation of methods provided the opportunity to compare, add and scrutinize the results of each method. However, due to the fact that with 13 experts the amount of samples could be assessed as low, a quantitative confirmation or disconfirmation of single statements, assumed trends or correlations could not be given. That was no obstacle, however, to finish this first validation procedure successfully because the concept had not been validated as an end product. As LAUDON and co-authors (2010) emphasize, the development process of a prototype remains flexible. Changing or missing aspects according to users' requirements and the application environment can still be integrated easily as new or additional functions in the prototype "SafeGuard-AAM". Due to the advantages of prototyping, these functions will be confirmed in future validation procedures.

According to literature findings, at the moment there exist no satisfactory organizational and technical concepts for a fast and coordinated information exchange (ELLEBRECHT, 2008; SCHÜTZ, 2009). The discussion and surveys indicated that the concept of combining the organizational aspect of the strategic alliance with the technical one of the IT prototype

“SafeGuard-AAM” represents a new practical solution to improve the current situation of public-private communication.

With this prototype, the authorities get mutual access to private information via individual user profiles. Specific additional information could be queried and in turn engaged and exchanged ad hoc by a communication tool which offers several communication channels. Although the popularity of internet and smartphones is increasing (PRODUKT UND MARKT, 2013), the web-based prototype developed does not exclude farmers without these media. The described gap between isolated private and public ICS (PETERSEN et al., 2007; DEIMEL, 2010) might be definitely closed with a further development of the strategic alliance and the IT prototype. The demand on the private side to improve its crisis communication with the use of the prototype’s functionalities could be recognized, which establishes once more the statements of KASPER and co-authors (2008) as well as SCHÜTZ (2009). This could be confirmed additionally for the public side by this thesis. Private experts confirm the high demand placed on network coordinators to support farmers’ crisis management by services. Therefore, network coordinators such as livestock traders or other suggested inter-organizational service suppliers such as veterinarians or stakeholders could extend their service range to strengthen their position and role along the production chain (VOSS, 2011). In addition to those private coordinators, the experts also assessed public network coordinators as obligatory partners within the strategic alliance. They should be entrusted with the official tasks of managing, monitoring and defining legal and financial requirements for an implemented EEM.

Private experts indicated the functions of the IT tool “SafeGuard-AAM” on the private side as a reliable support tool to communicate with authorities. In contrast to this, public experts commented mental reservation to integrate the tool as a support in epidemiological investigations made in case of an epidemic. HOLLMANN-HESBOS (2008) derives that people’s behaviour and opinions, on the one hand, can promote necessary developments to optimize information management, but, on the other hand, can hamper them, too. The embodiments of WILLIS and co-authors (2009) emphasize that the mentioned missing regulations by law, which could define how to use the IT tool and when to integrate private information by digital exchange into public, control activities had to be defined as barriers for further implementation. Missing technologies might be one reason for the absent information exchange, but actually the problem consisted of absent legal requirements. This complied with the remarks of WILLIS and co-authors (2009) and HOLLMAN-HESBOS (2008) that a potential refusal of public-private information management is not only based on additional activities complementing the current information management, but also on doubts and concerns of the potential users.

To avoid uncertainties causing these doubts and concerns, further validation steps were seen as necessary items of the further process of prototyping and related adjustment and development of “SafeGuard-AAM”. Prototyping promotes early and intense interactions between developers and potential users (CERVENY et al., 1986). The experts preferred the integration of the IT tool into crisis exercises. Within the meaning of a strategic alliance as a public-private partnership, they suggested the inclusion of public decision makers, system providers and responsible people in the private sector in a common exercise. This would follow the statements of ROGERS (2003) that first of all innovators and early users must be convinced of an innovation. They act as opinion-former for the broad majority of potential users and minimize their insecurities in connection with the use of the innovation. It is assumed that they will react more positively and feel more responsible to support the final implementation process out of the pilot environment because they participated actively in the development process (LAUDON et al., 2010).

Nevertheless, to convince potential users as much as possible of a sustainable nationwide implementation of the concept, all experts agreed that a cost-benefit analysis will have to be done during further development. The basis for this analysis might deliver the experiences and findings of future pilot tests of the innovation in distinct user scenarios and pilot chains as mentioned above. Additionally, an operating concept has to be defined during the continued prototyping process to be able to establish the strategic alliance, to identify the costs of the related new ICS and finally to guarantee its sustainable implementation.

## 4.5 Conclusions and implications

The aim of this study was the primary validation of the technical and organizational concept for an implementation of the EEM in animal disease control. The validation results showed that this concept provides the possibility to improve communication between authorities and the private sector due to the approach of the EEM. The experts classified both, the organizational concept of a strategic alliance as well as the prototypical and technical concept of the web-based IT tool “SafeGuard-AAM”, as useful to support public-private information management in case of animal disease outbreaks but also in the broader field of food and feed security. On the public side, in the private sector and within the field of agriculture research there exists interest in concrete testing of this innovative concept, for example with common animal disease exercises.

In the course of further development of the concept, additional issues have to be integrated in the validation process to achieve sustainable implementation of the concept. This includes, for example, the execution of a cost-benefit analysis, which reveals to potential users the primary, visible benefits of this innovation as well as the secondary, invisible benefits of it. The basis for this might be the experiences and findings of several pilot tests of the innovation in defined user scenarios and pilot chains, which was already demanded by the experts in this study. Additionally, an operating concept has to be defined during the continued prototyping process to be able to establish the strategic alliance and to provide and finance the new ICS in a sustainable way.

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# 5. General discussion and conclusion of the thesis

## 5.1 Introduction

In the area of food production and animal husbandry, one will speak of a crisis if serious damage is caused to humans and animals, and if enormous economic losses for specific companies or sectors occur (PETERSEN & NÜSSEL, 2013). In this regard, epidemic diseases can be seen as common triggers of crises. Having a closer look at the German and Dutch pig supply chains, there is a permanent risk for an outbreak of Classical Swine Fever (CSF) (MEUWISSEN et al., 1999; FRITZEMEYER, 2000; BACKER et al., 2010) because of a common private pig production sector. Although CSF is not infectious for humans and does not cause human health risks, it can cause other serious damages. In addition to high animal losses and enormous financial losses caused by the stamping-out strategy of the EU (JAEGER, 2006; BOSMAN & SAATKAMP, 2010), damages at the consumer and social level are also negative effects (MOENNIG, 2008).

Effective crisis management thrives on sufficient information resources and a quick and targeted communication strategy as well as an adequate information base. Due to the discrepancy between the need for collecting data and the existing time and personnel resources available to the authorities, compromises on report deadlines and execution of on-the-spot controls are necessary and not all official datasets can be kept up to date, and therefore in case of crises, partially extensive investigations must be carried out.

Against the background of numerous food crises, the collection and storage of process data is requested not only by the legislation but also by private initiatives. They pursue a seamless documentation and traceability in the context of product liability (LUNING et al., 2006; LEIBLE et al., 2013). As a result, a series of private information systems have been developed to exchange product and process-related data along the meat supply chain (TRIENEKENS & VAN DER VORST, 2006; ELLEBRECHT, 2008). In principle, the digital datasets of these private systems can offer specific knowledge within a short time span. The systems include data for animal health, production quality and traceability, all of them potentially relevant to crises such as animal disease outbreaks. The competent authorities might use them to select, rank and prepare epidemiological investigations on the spot as well as to support the decision process of control measures (ELLEBRECHT, 2008). In turn, private actors could receive official information easier

and quicker to support intra-organizational and inter-organizational crisis management along the production chain. The demand for such public-private information management concepts grows, especially during and immediately after crisis situations (KASPER et al., 2008; SCHÜTZ, 2009).

However, the organizational and technical concepts of a fast and coordinated information exchange like this do not exist in a satisfactory way (ELLEBRECHT, 2008; SCHÜTZ, 2009). The objective is to ensure the supply of decision-relevant information to the actors involved in the public and private field in case of a crisis. One proposed approach to reach this aim is the Engage Exchange Model (EEM) (SLÜTTER et al., 2012; WILKE et al., 2013). In normal times, there exists a privately coordinated information exchange between the individual business partners within the production chain. In contrast to this, during a crisis, previously defined information is exchanged and ensures a sufficient decision base (BREUER et al. 2008, KASPER et al., 2008; SLÜTTER et al., 2011). In consequence, this thesis developed a concrete approach to use the Engage Exchange Model for information management in crisis communication and animal disease control.

## 5.2 Answers to the research questions

The main objective of this research was to examine whether the EEM is actually an improvement approach for crisis communication during animal disease outbreaks. Against that background, further objectives of partial studies were the shaping of engage and exchange situations using the example of the outbreak of CSF as one possible crisis scenario to draw and validate a conceptual framework to enable the transfer of the general EEM into a specific implementation approach. Furthermore, this included also the establishment of a roadmap to support a further implementation process of the approach at individual public and private ICSs.

The general research process of information analysis, initial implementation and validation was based on STRAUCH (2002) and SCHULZE ALTHOFF (2006) and included quantitative and qualitative methods such as surveys and expert interviews as well as the integration of knowledge via meta-analyses, crisis exercise observations and workshops to avoid the inadequacies and gaps of single research methods (STRUCKMEIER, 1997; HOLTEN, 1999).

The main findings from each chapter of this study are summarized in the following:

*Strategic alliance for crisis communication*

Whereas the private sector has a clear demand for a quicker flow of information, public authorities need to improve data quality. The official use of additional digital information from private information and communication systems (ICSs) is an untapped potential because trust and knowledge about existing information are little. Against the background of the communication strategy of the Engage Exchange Model (EEM), a strategic combination of public and private ICSs was suggested to provide additional beneficial effects in crisis communication such as saving of personnel and time in epidemiological investigations or further measures, an extension of the service range of private network coordinators such as livestock trading organizations, and a general decision support in public and private process management. In order to increase the level of trust in information and to simplify public-private communication, the concept of a strategic alliance was established. Alliance partners are farmers, competent veterinary authorities and public and private network coordinators which occupy bundling and supervising positions in the public and private sector.

*Maturity model for public-private information management*

The methodological approach of the maturity assessment according to ISO 15504 was specified as the purpose of becoming a partner within the organizational concept of the EEM, the strategic alliance of information management for crisis communication and animal disease control. A specific process reference model, consisting of a public and a private part, was derived for the assessment of processes of potential public and private participants in the strategic alliance. An exemplary maturity assessment was applied to selected livestock trading organizations which were assumed to be suitable to take over the role of private network coordinators within the alliance. The assessment confirmed the general potential of livestock trading organizations to act as strategic alliance partners. Initial implementation of required strategic processes is already evident but not sufficient to reach its full scope of purpose. Further development steps in each required private process are necessary to join the strategic alliance as private network coordinators. The specified process reference model can be assessed as an evaluation framework and structured roadmap for private and public actors who want to initiate and establish their participation in a public-private strategic alliance within the framework of animal disease control.

*Prototype to use the EEM*

Based on the strategic alliance as the conceptual framework for implementation of the EEM in the field of animal disease control, the research in this chapter led to concluding findings regarding the general objective of this thesis. Within the framework of a workshop with several public and private experts, a concrete implementation of the EEM, the ICS prototype “Safeguard-AAM”, was presented and validated. The experts classified both, the organizational concept of a strategic alliance as well as the prototypical and technical concept of this web-based ICS as useful to support public-private information management in case of animal disease outbreaks. Also, in the broader field of food and feed security, a potential for application was assumed. On the public side, in the private sector and within the field of agricultural research, there exists interest in future concrete testing of this innovative concept. The main advantage of these public-private initiatives might be the opportunity to address issues of further validation such as the amount of costs and benefits of implementation of this new ICS approach.

Two main limitations were necessary during the research process. On the one hand, the research field of animal disease control was initially limited to CSF. This was necessary in all cases where certain information contents and communication partners had to be defined. As a result of this, only private experts of the pig production sector were selected for the interviews and survey and the experts at the public level were located in regions with a high pig density.

On the other hand, a limitation had to be made in the phase of information management. Against the background of a more and more borderless pig production, a potential improvement of cross-border crisis communication (BREUER and co-authors, 2008) was taken into account. Therefore experts from Germany and the Netherlands were interviewed. However, the results of the information analysis showed that there exist crucial interpretation asymmetries between both countries regarding information demand, information offer and information quality. These asymmetries led to difficulties in the definition of exchange and engage functions of the prototype for the EEM planned later and weakened the German pilot environment prescribed for the project which was based on a two-staged marketing of pigs via livestock trading organizations as this is usual for the German pig sector. Owing to this, no cross-border aspects could be integrated in the further development process of prototyping. Nevertheless, the prototype “SafeGuard-AAM” is ready to operate, but still in the phase of prototyping. This, now, offers the opportunity to include the ICS into future cross-border studies.

## 5.3 Suggestions for further research

The research of this thesis closes with the establishment of a prototype which includes a first technical and organizational concept for use of the EEM. This approach offers potentials for further research.

Considering the concept of this prototype just developed, further research will have to be done to enable sustainable integration of the prototype in existing ICSs in future due to the strategy of the EEM. Further validation steps in the framework of an on-going prototyping process are seen as necessary to avoid uncertainties, doubts and concerns of potential alliance partners and users of the new ICS. The integration of the concept in public-private crisis exercises should be a suitable initiative. Nevertheless, a cost-benefit analysis will have to be undertaken during further development to convince potential users as much as possible of a sustainable nationwide implementation of the concept. It will reveal potential users the primary, visible benefits of this innovation as well as the secondary, invisible advantages of using the new ICS. The basis for this analysis might deliver the experiences and findings of future pilot tests of the prototype in defined user scenarios and pilot chains. Additionally, an operating concept still has to be defined to identify the costs of the new ICS and to finally guarantee its sustainable implementation.

In connection with the concept of this developed prototype, the testing of applying the concept in other fields is suggested as an objective of future research projects. Although crises have many triggers and affect different sectors, during initial development, the presented concept had to be established limited to CSF. Nevertheless, this does not exclude an extension, and suggestions for further potential application fields could already be derived. Thus, one possible application might be the feed industry with the Dioxin scandal still in mind.

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# Appendix

## Interview guideline for the competent German authorities:

*Formales:*

Datum des Interviews:
Interviewpartner:
Interviewer:
Gesprächsdauer:

*Hintergrund:*

Das Projekt SafeGuard enthält neben den drei Schwerpunkten Tierseuchen, Zoonosen und Lebensmittelqualität noch einige Querschnittsthemen, die allen Arbeitspaketen zugutekommen. Diese übergeordneten Projektaktivitäten befassen sich mit Informations- und Kommunikationssystemen, Kommunikationskonzepten und der wirtschaftlichen Optimierung von Frühwarnsystemen.

Die unterschiedlichen Phasen einer Krise lassen sich wirkungsvoll verkürzen, wenn es gelingt, Verantwortliche und Betroffene möglichst rasch mit Informationen zu versorgen, die sie für ihre jeweiligen Entscheidungen im Krisenmanagement benötigen. Ziel des Arbeitspakets 4.1 im Projekt SafeGuard ist die Entwicklung organisatorischer und technischer Innovationen zur Unterstützung von Akteuren in der Krisenprävention und im Krisenmanagement. Dazu wird ein Vorgehensmodell entwickelt, das festlegt, welche Informationen die im Krisenfall beteiligten Akteure benötigen und welche Daten hierzu in welcher Weise zwischen privaten und behördlichen Organisationen zeitlich begrenzt oder aber ständig ausgetauscht werden sollten.

*Gesprächsverlauf:*

Nachfolgend sind die Hauptfragen aufgelistet, aus denen sich der Gesprächsinhalt ergibt. Je nach Antwortverlauf ergeben sich evtl. weitere Fragen.

1. Gibt es ein festes namentlich bestimmtes Krisenkommunikationsteam, das Information sammelt, verteilt und weitergibt?

2. An welcher Größenordnung haben Sie sich für die eingeplanten Personalressourcen orientiert (Erfahrungswerte, Richtwerte, gesetzl. Empfehlungen etc.)?

3. Sind Mitarbeiter/innen in der in Frage 2 definierten Größenordnung benannt und geschult worden (Krisenfall)?

4. Liegen aktualisierte Listen mit den Erreichbarkeiten (Adresse, Festnetz- und Handynummer für den Notfall) der Entscheidungsträger und Mitarbeiter vor?

5. Werden Nachrichten die Krisenkommunikation betreffend schriftlich (per Brief, Fax oder Email) versandt oder gibt es auch den „kurzen Dienstweg“? (d.h. gibt es eine abgestimmte vorgegebene Kommunikationsart?)

6. Ich lese Ihnen jetzt eine Definition zum Krisenmanagement vor, wobei der Zweck des Prozesses im Vordergrund steht. Muss (nach dieser Definition) noch etwas berücksichtigt werden? (Vorlage A „Definition Aufgabenfeld Krisenmanagement“)

7. Sind klare arbeits- und dienstrechtliche Vereinbarungen mit den Personalvertretungen getroffen (z.B. Bereitschaftszeiten im Krisenfall), damit die Organisation im Krisenfall handlungsfähig bleibt, insbesondere für den Fall, dass eine 24h-Arbeitsfähigkeit über einen längeren Zeitraum aufrechterhalten werden muss?

8. Es gibt keine AVV-Düb (vgl. Allgemeine Verwaltungsvorschriften über die Übermittlung von Daten aus der amtlichen Überwachung nach lebensmittelrechtlichen und weinrechtlichen Vorschriften sowie aus dem Lebensmittelmonitoring) für die Übermittlung von Daten im Tierseuchenfall. Würden Sie es begrüßen, wenn es eine „AVV-Düb“ für Tierseuchendaten geben würde?

9. Liegen Nachweise über Standardisierungen der Daten in der Behörde vor?

10. Besitzen Sie die Möglichkeit, nachzuweisen, dass die Daten vollständig empfangen und korrekt interpretiert worden sind?

11. Wäre es Ihrer Meinung nach sinnvoll, eine zentrale Stelle zu benennen, die Kontaktdaten, Tiergesundheitsdaten, Lieferdaten und Auditdaten für alle KOB und Ministerien (je Bundesland) sammelt und technisch verwaltet? (eine Alarmierungsfunktion bei Überschreitung definierter Kennzahlen wäre in solch einem System ebenfalls denkbar)

12. Ich lese ihnen jetzt eine Definition des Datenmanagements vor, wobei der Fokus auf den Zweck des Prozesses liegt. Muss nach dieser Definition noch Weiteres Berücksichtigung finden? (Vorlage B „Definition Aufgabenfeld Datenmanagement“)

13. Welche Daten benötigen Sie für die Tierseuchenprävention, welche benötigen Sie für die Tierseuchenbekämpfung/im Krisenfall?

14. Wie werden diese Daten derzeit erhoben?

15. Wie viel Zeit nimmt dies in Anspruch im Verhältnis zu den anderen Aufgaben in der Krisenbewältigung?

16. Werden folgende Datenbestände in den behördlich genutzten IT-Systemen eingepflegt und sind aktuell abrufbar? Bitte antworten Sie mit JA oder NEIN und dem entsprechenden Datensystem und ergänzen ggf. entsprechende Daten.

    - Stammdaten (Kontaktdaten, Bestandsdaten, Standorte)
    - Prozessdaten (Tierarten, Produktionsarten, Haltungssysteme, Bestandszahlen)
    - Auditdaten (Teilnahme an Qualitätsprogrammen, Auditergebnisse)
    - Lieferantendaten (Tierbewegungen, Handelspartner, Tourdaten)
    - Krisenrelevante Daten (Tiergesundheitsdaten, Hygienedaten)

17. Stellen Sie sich folgendes Szenario vor: Die KSP bricht aus und das Betriebssystem oder Teile fallen aus. Wie geht ihre Behörde hier vor?

18. Gibt es entsprechende Strategien und Vorbeugungsmaßnahmen, um diese Informationsverluste zu kompensieren bzw. die Informationen sicherzustellen? (bzw. gibt es einen Plan B für die Krisenkommunikation?)

19. Gibt es vorbereitete Handlungsanweisungen für die Mitarbeiter/innen und vorbereitete Sprachregelungen / Satzphrasen für den Fall von Medienkontakten?

20. Werden zeitlich regelmäßig Übungen durchgeführt (z.B. ausreichend sensibilisiert, um frühe Signale einer Krise zu erkennen, richtig zu deuten und in zielgerichtetes Handel umzusetzen) und werden diese dokumentiert?

21. Ich lese Ihnen jetzt eine Definition zum Personalmanagement vor, wobei der Zweck des Prozesses im Vordergrund steht. Können sie mir sagen, was ich hier (nach dieser Definition) noch berücksichtigen sollte? (Vorlage C „Definition Aufgabenfeld Personalmanagement“)

22. Sind Nachweise über Organigramme für die Krisenstaborganisation für jeden Stabsbereich (Funktionen, Erreichbarkeit) vorhanden? (Anfrage von Organigrammen für Ruhephase, Krisenphase der Behörde)

23. Ich lese ihnen jetzt eine Definition zum Ressourcenmanagement vor, wobei der Zweck des Prozesses im Vordergrund steht. Können sie mir sagen, was ich hier (nach dieser Definition) noch berücksichtigen muss? (Vorlage D „Definition Aufgabenfeld „Ressourcenmanagement“)

24. Stimmen Sie sich mit anderen Einsatzstäben ab? (THW, Feuerwehr, Polizei, TBA)

25. Wie wird in der Krise alarmiert? Welche Medien werden hauptsächlich genutzt? Sind z.B. Telefonabfolgen vereinbart?

26. Gibt es automatische telefonische oder elektronische Alarmierungssysteme?

27. Wäre eine Ergänzung zu den bisher erfassten / zur Verfügung gestellten Informationen sinnvoll, um schneller und in der Krise effizienter zu handeln bzw. Krisen früher zu erkennen?

28. Wenn Behörden sagen würden „Wir brauchen keine zusätzlichen Daten“, was würden Sie diesen entgegnen?
    Was sind Gründe für solche Aussagen? (Personal, Kosten, Aufwand?)
    Wurde bereits eine entsprechende Nutzen-Kosten-Analyse für zusätzliche Daten vorgenommen?

29. Verfügen ihre Behörden über Kenntnisse der Systemanforderungen anderer Behörden?

30. Welche Frühwarnsysteme zum Erkennen von Tierseuchenkrisen werden von Ihnen genutzt und warum? (z.B. aufgrund der Inhaltsstärke, aufgrund ihrer Allgemeingültigkeit, da z.B. in die HIT-Datenbanken „geschlossene Systeme“ nicht melden müssen, da sie nicht aufnehmen)

31. Welche Frühwarnsysteme stecken Ihrer Meinung nach noch in den Kinderschuhen (z.B. keine genügende Aussagekraft, Ableitung von evtl. Krisen nicht möglich)? (Beispiel „10-Punkte-Plan NRW“)

32. Wie oft werden Falltierzahlen gemeldet?

33. Wäre eine Falltierzahl auf aktueller Berechnungsgrundlage (aktueller Tierbestand) wünschenswerter als das bisherige System?

34. Welche IT-Systeme werden von Ihnen im Tagesgeschäft und welche im Krisenfall genutzt?

35. Begrüßen Sie Schnittstellen bzw. einen automatischen Abgleich von Datenbanken wie bspw. HI-Tier, Balvi ip oder TSN?

36. Ich lese ihnen jetzt eine Definition zur strategischen Allianz vor, wobei der Fokus auf den Zweck des Prozesses liegt. Können sie mir sagen, was ich hier (nach dieser Definition) noch berücksichtigen muss? (Vorlage E „Definition Aufgabenfeld Strategische Allianz“)

37. Wie wird nach außen (allg. Öffentlichkeit, Landwirt, Wirtschaft, Ausland) kommuniziert?

38. Immer mehr Landwirte nutzen vermehrt Dienstleister wie Viehhandels-, Beratungs- oder Bündlerorganisationen für Ihr eigenes Datenmanagement (Daten aus Lieferanten-, Krisen-, Audit-, Prozessmanagement). Könnten Sie sich vorstellen, dass diese als Mittler zwischen Behörde und Landwirt fungieren? (Vorlage F „AAM-Konzeptvorschlag“)

39. Findet eine Nachbearbeitung der Krise statt?

40. In anderen Branchen wird für einen stetigen Verbesserungsprozess die Reifegradmethode (ISO/IEC 15504) angewandt. Man deckt durch eine Reifegradbestimmung Schwachstellen auf und kann daraus Lösungsvorschläge ableiten. Im Gegensatz zum QM-System mit Vorgaben für die Prozessergebnisse wird das Unternehmen hier am Idealzustand der Prozessdurchführung gemessen (d.h. nicht nur ob, sondern auch wie eine Aufgabe erledigt wird). Auch im Projekt soll dies für das Krisenmanagement angewendet werden (Vorlage G „Prozess-Referenz-Modell AAM Behörden“). Könnten Sie sich vorstellen, eine für die Reifegradbestimmung erstellte Checkliste in Ihrer Behörde durchzugehen, um Lösungsvorschläge zu bekommen, wie in ihrer Behörde die Durchführung des Krisenmanagements verbessert werden könnte?

Vielen Dank für Ihre Teilnahme am Interview

*Vorlagen:*

Vorlage A:
Der Zweck des Krisenkoordinationsmanagements ist es, sicherzustellen, dass mittels des Wissensmanagements zeitnahe, zielgerichtete und konkrete Entscheidungen getroffen werden und Doppelarbeiten vermieden werden, wobei eine „anschlussfähige“ Kommunikation vollzogen wird. („Anschlussfähig“ bedeutet, dass die kommunizierten Inhalte nutzerspezifisch aufbereitet werden, verstanden werden und zeitnah erfolgen)

Vorlage B:
Der Zweck des Datenmanagementprozesses ist es, sicherzustellen, dass Daten gewonnen, validiert und gelenkt werden, wobei die technische Anforderungsanalyse zur Unterstützung dieser Aktivitäten dient. (Die technische Anforderungsanalyse beschreibt die Anforderungen an das Gesamtsystem, bestehend aus verschiedenen Hardware- und Softwarekomponenten, und an das Zusammenwirken dieser Komponenten.)

Vorlage C:
Der Zweck des Personalmanagements ist es, sicherzustellen, dass mittels der Personalpolitik (qualitativ und quantitativ) strukturelle Ungleichmäßigkeiten bzw. Mängel im Bereich der Personalressourcen im Krisenfall (KSP) vorgebeugt werden.

Die qualitative Personalpolitik umfasst grob:

- Personalbestand
- Kenntnisse über die Personalfähigkeiten (z.B. Softwarekenntnisse, Fremdsprachenkenntnisse)
- Förderung der Personalfähigkeiten und Identifizierung neuer Entwicklungspotenziale (Weiterbildungsworkshops, Tierseuchenübungen)
- Schlüsselfunktionslisten (z.B. rote Telefonnummern, Rollenzuweisungen)

Die quantitative Personalpolitik umfasst grob:

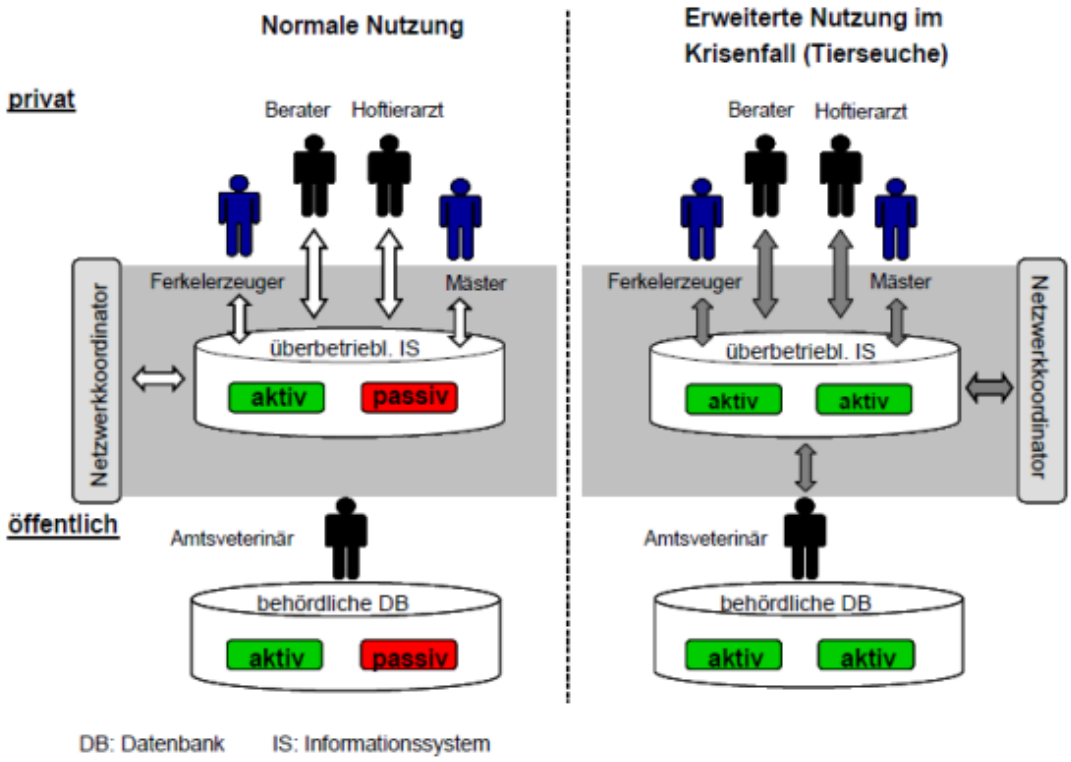
- Personalbestand versus Personalbedarf
- Strategien zur Sicherstellung des Personalbedarfs

Vorlage D:
Der Zweck des Ressourcenmanagements ist es, sicherzustellen, dass alle involvierten Akteure im Tierseuchenfall mit zeitnahen immateriellen Ressourcen (Informationen) und materiellen Ressourcen versorgt werden.

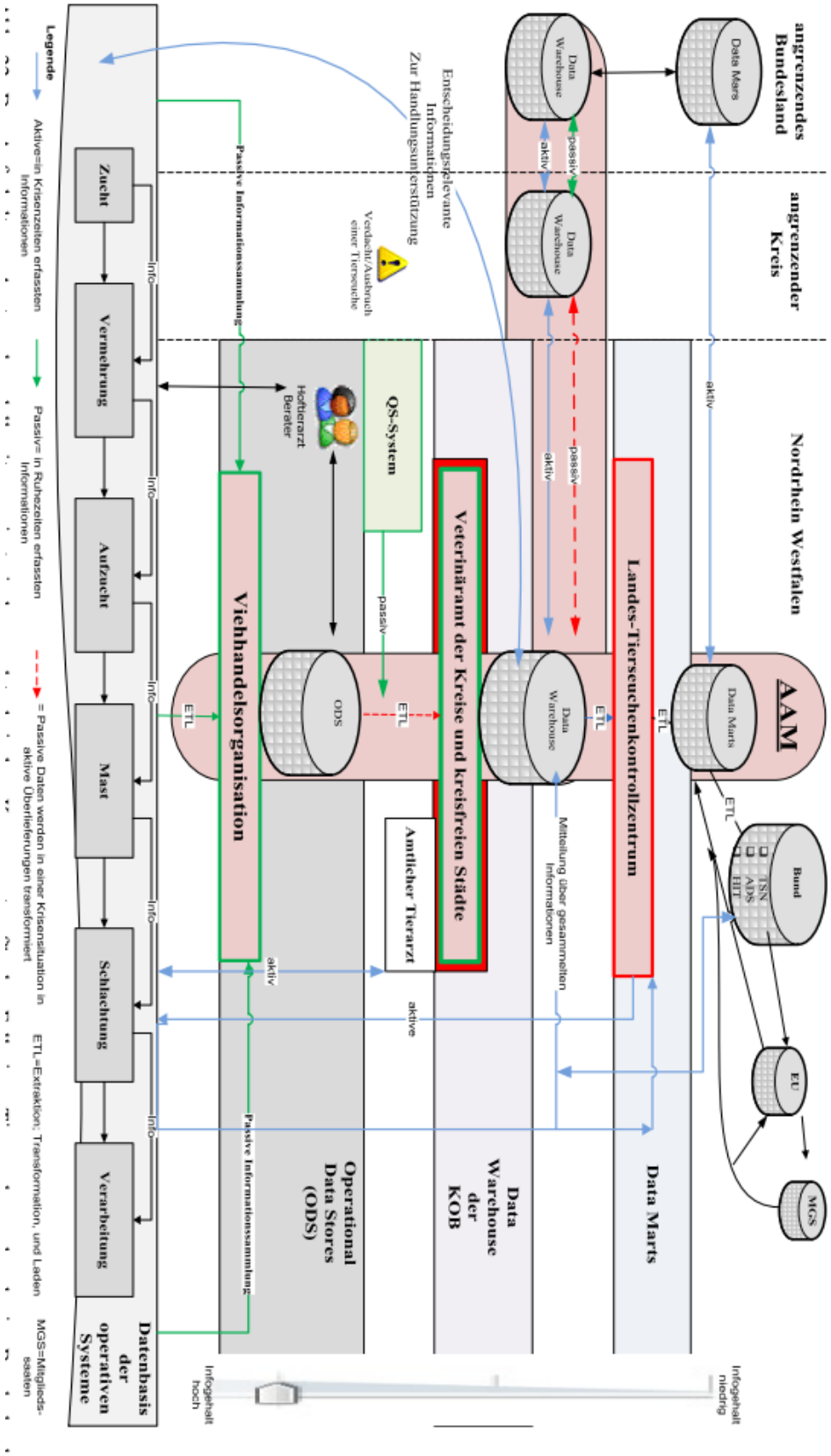
(Das Personalmanagement wurde bewusst vom Ressourcenmanagement getrennt betrachtet, da die Ressource „Arbeitskraft“ eine zentrale Stellung im Tierseuchenfall aufweist, sowohl strategisch als auch operativ)

Vorlage E:
Der Zweck der Strategischen Allianz ist es, sicherzustellen, dass (mindestens) zwischen zwei angrenzenden Bundesländern über einen Kooperationsvertrags materielle und immaterielle Ressourcen sowie Erfahrung zeitnah ausgetauscht werden.

Vorlage F:



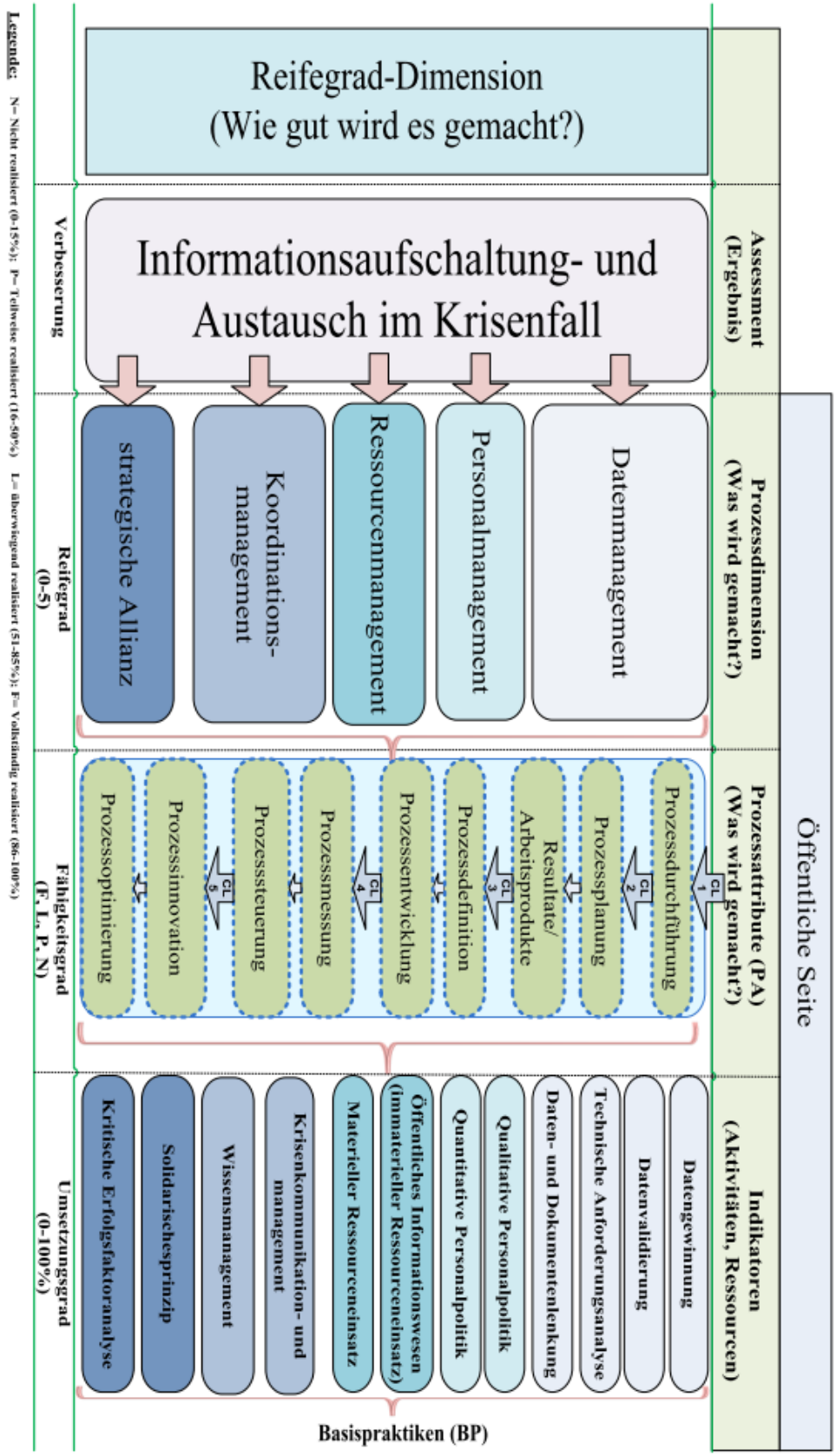
Vorlage G:


angrenzendes Bundesland
angrenzender Kreis
Nordrhein Westfalen
Data Mars
Data Warehouse
aktiv
passiv
Entscheidungsrelevante Informationen Zur Handlungsunterstützung
Verdacht/Ausbruch einer Tierseuche
Passive Informationssammlung
Hoftierarzt Berater
QS-System
Veterinäramt der Kreise und kreisfreien Städte
Landes-Tierseuchenkontrollzentrum
AAM
Data Marts
ETL
Bund
TSN
ADS
HIT
EU
MGS
ODS
Viehhandelsorganisation
Amtlicher Tierarzt
Mitteilung über gesammelten Informationen
Data Warehouse der KOB
Operational Data Stores (ODS)
Passive Informationssammlung
Info
Zucht
Vermehrung
Aufzucht
Mast
Schlachtung
Verarbeitung
Datenbasis der operativen Systeme
Infogehalt hoch
Infogehalt niedrig
Legende
Aktive=in Krisenzeiten erfassten Informationen
Passiv= in Ruhezeiten erfassten Informationen
= Passive Daten werden in einer Krisensituation in aktive Überlieferungen transformiert
ETL=Extraktion, Transformation, und Laden
MGS=Mitgliedsstaaten

## Interview guideline for farmers

*Formales:*

Datum des Interviews:
Interviewpartner:



Interviewer:
Interviewdauer:

*Ziel:*

Ziel des Interviews ist eine genaue Beschreibung der Gegebenheiten und dem Verlauf der Handlungen bei KSP-Verdacht/Bestätigung auf dem Betrieb

- Situationsbeschreibung
- Informationsanfrage der Behörde
- Informationsbedarf des Landwirts
- Kommunikation zwischen Landwirten, Viehhändel, Tierärzte, Behörden und Dritte

*Hintergrund:*

- Tierseuchen verursachen Schäden für die gesamte Branche (Keulung, Stand Still, Imageverlust, Exportverbote…)
- Behördliche Tierseuchenbekämpfung baut auf Daten aus HIT, Vor-Ort-Kontrollen und jährlichen Bestandsmeldungen, Informationslücken und Falschinformationen sind daher nicht vermeidbar.
- Privatwirtschaft konnte in der Vergangenheit nicht immer aktuell über den Status-quo z.B. von Handelsbeschränkungen oder Freigaben informiert werden, so dass Missverständnisse und Unsicherheiten entstanden.

*Projektziel*

- Annahme:
  Verbesserung der Kommunikation zwischen Behörden und Privatwirtschaft im Krisenfall verschafft schnell eindeutige Entscheidungsgrundlage für beide Seiten und damit die Möglichkeit einer effizienteren Bekämpfung und Krisenkommunikation und folglich Minderung des Schadensausmaß durch schnellere Krisenbewältigung.
- Ergebnis:
  IT-Konzept zur Unterstützung der Krisenkommunikation und Verbesserung der Informationsbasis im Krisenfall.

*Leitfaden*

<u>Situationsbeschreibung:</u>

1. Wie lief die Situation genau ab?
2. Wer war alles involviert?
3. Welche Aufgaben kamen hierdurch auf den Betrieb neu hinzu bzw. änderten sich?
4. Wie waren die Reaktionen der Kollegen und Dienstleister?

<u>Informationsanfrage der Behörde:</u>

5. Mit welchen Behörden hatten Sie Kontakt?
6. Welche Informationen fragten diese Behörden von Ihnen ab?
7. Wie wurden diese Informationen abgefragt und wann (d.h. einmalig oder stückweise…)?
8. Wie war Ihr Eindruck vom Kontakt mit den Behörden?
9. Wie war Ihr Eindruck vom Wissenstand der Behörden?

<u>Informationsbedarf des Landwirts:</u>

10. Welche Informationen benötigten Sie in dieser Situation?
11. Wer konnte Ihnen diese Informationen geben und an wen wendeten Sie sich zuerst?
12. Welche Fragen oder Wünsche hatten sie an die zuständigen Behörden?

13. Wie wurden diese beantwortet/bearbeitet?
14. Welche Vor-/Nachteile ergaben sich daraus für Sie bzw. für Ihren Betrieb oder auch für Dritte?

Kommunikation zwischen Landwirten, Viehhändel, Tierärzte, Behörden und Dritte:

15. Kommunizierten Sie mit Berufskollegen? Und falls ja, wie und was wurde kommuniziert?
16. Wie war dies bei Viehhändlern, Tierärzten und weiteren Dienstleister?
17. Welchen Eindruck hatten Sie von dieser Kommunikation?
18. Wie beurteilen Sie den allgemeinen Wissenstand zur der damaligen Lage?
19. Wie kommunizierten Sie mit Behörden?
20. Welche Vor- und Nachteile ergaben sich daraus für Sie?

Sonstiges:

- Protokoll wird zugesendet mit Bitte um evtl. Korrektur bzw. Ergänzungen
- Anfrage um Erlaubnis der Nutzung der Daten in anonymisierter Form

Vielen Dank für das Gespräch.

## Interview guideline for Dutch authorities

*Aim*

The aim of this interview is to get information from private and public experts about:

- Which information demand exists to control animal disease?
- Which information is available in case of an outbreak of an animal disease?
- How can information be communicated between the different involved actors and also across borders during animal disease control?

using the example of Classical Swine Fever (CSF).

*Background*

Decision-making in animal disease control depends mainly on the quality and availability of the relevant information. Some information from official systems is incomplete or not current. Private inter-organizational information systems of organizations in central positions of the supply chain (so-called network coordinators) could add this needed information currently and online from their own current data base. To support the information flow between public and private sectors as well as across borders in QUARISMA, an IT-support concept will be developed. Country-specific differences between the organizational structures as well as between the information management in animal disease control of the Netherlands and Germany are inhibitory factors which must be overcome in a technical concept of the IT-support system. But in the context of establishing inter-organizational structures and information systems within the pig supply chain, the purpose is to include these systems more in official animal disease control and to achieve information synergies by strategic alliances of public and private actors.

*Key questions*

**Animal disease control (of CSF) in the Netherlands and in Germany:**

1. What experiences have you drawn from past outbreaks of Classical Swine Fever (1997 in the Netherlands, 2006 in NRW)?

2. Which consequences could be derived from that experiences for animal disease control
    a. in the cross-border communication with Germany?
    b. in the implementation of animal disease control in the Netherlands?

**Organization of animal disease control in the Netherlands:**

3. The federal structure of Germany causes problems in animal disease control because the regional authorities can only act at district level (Kreis) and have no access to the entire information management of Germany or even within NRW or Lower Saxony (Bundesländer). Data storage is carried out at district level, and relevant data can be viewed only by the relevant authority within the specific district.
    a. Which advantages can be derived from the more centrally organized animal disease control in the Netherlands?
    b. What disadvantages can possibly also be determined?
4. Is there a specific way of communication in an outbreak situation where all involved actors (public and private) communicate and exchange information?
5. The competent authorities in Germany are supported by the IT bsupport TSN (Tierseuchen Nachrichten System), a crisis support module, in case of animal disease control.
    a. Was this IT module presented to you at least once, and have you had the opportunity to test its functionalities?
    b. Does a similar support system exist for animal disease control in the Netherlands?
6. Which IT systems do you usually use for your daily business (prevention and monitoring), and which systems do you usually use to control a disease which has broken out?
7. Are animal disease control exercises performed in the Netherlands?
8. Do you know about the system requirements of other public authorities (e.g. in Germany)?
9. Do you think the German authorities know about the requirements of the Dutch system?

**Information management in animal disease control carried out by the Netherlands:**

10. Which information is needed for prevention of animal diseases, which information is needed for its control?
11. How is this information currently collected?
12. Is the following information contained in the official IT systems, and is it available in a current version?
    Please answer with YES or NO and mention the corresponding data system and eventually complement missing further information segments:
        - master data (contact information, farm places, number of animal places)
        - process data (species of animals, production step, production system, current number of animals)
        - quality data (participation in quality programs, audit results)
        - transport data (animal movements, transport organization, tour data)
        - crisis-relevant data (animal health data, hygiene management data)
13. Would it be useful to complement the information already collected with more current data to be able to act in times of an outbreak in a faster and more efficient way and/or to use them to detect outbreaks earlier?
14. Do rendering plants report the number of dead pigs during a defined period per farm (comparison: German system of “Falltierzahlen”)?
15. Which early warning systems for detecting animal disease outbreaks are used in the Netherlands and why (e.g. due to their information content, due to their universality etc.)?

**Expert opinion:**

16. Would it be an advantage, if there was an IT support between public and private information systems to update or add own data memories in case of animal disease control?

**Innovation:**

17. More and more farmers increasingly use services for their own data management (animal movements, crisis control, audit management, process management etc.). In Germany these services are usually offered by organizations like livestock traders, advice or QS-bundling organizations.
    a. Could you imagine what type of organization in the Netherlands currently occupies a central information position within the chain or, keeping the trend in mind, will become such an organization?
    b. Could you imagine that such an organization could act as an intermediary and/or multiplier between authorities and farmers?

# Acknowledgements

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