Risk classification in the compound feed sector

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Contents

Samenvatting

Door verschillende contaminatiecrisissen in de laatste jaren is de discussie omtrent productaansprakelijkheidsverzekeringen voor mengvoederbedrijven opgelaaid. Recent onderzoek toont aan dat er in tijden van een crisis volgens een meest waarschijnlijk scenario een directe schade tussen de 25-34 miljoen euro zal ontstaan in de primaire en verwerkende sector. Heeft nu elk bedrijf een productaansprakelijkheidsverzekering nodig van 30 miljoen of kan er onderscheid gemaakt worden tussen individuele bedrijven? Risicoclassificatie is een hulpmiddel om individuele bedrijven te classificeren.

Hoewel risicoclassificatie breed wordt toegepast door verzekeraars zijn er weinig voorbeelden te vinden met betrekking tot productaansprakelijkheidsverzekeringen in de agri- en food business. In de literatuur zijn drie voorbeelden gevonden die als doel hebben om bedrijven te classificeren. Deze classificatiemethodes zijn ontwikkeld voor een diergezondheidsfonds, een gewassenverzekering en voor mengvoeder bedrijven om leveranciers te classificeren.

Om in het huidige onderzoek mengvoederbedrijven te kunnen classificeren hebben deskundigen een vragenlijst ingevuld. In de vragenlijst zijn zes verschillende attributen (bedrijfskenmerken) beoordeeld met een cijfer van 1 tot 7. Deze attributen hebben (a) een waarschijnlijk verband met het productaansprakelijkheidsrisico en (b) een mogelijk onderscheidend vermogen tussen mengvoeder bedrijven. De gebruikte attributen en bijhorende attributenniveaus zijn: “Product” (mengvoer of vochtrijk voer), “Distributie aan de V.S.” (ja of nee), “Certificaat” (GMP+ of GMP+ en meer), “Gescheiden productielijnen” (ja of nee), “Geleverd aan” (productie- of vleesbedrijven) en ”Grootte” (productie van >100.000 ton kg of <100.000 ton kg).

De scores van de deskundigen zijn geanalyseerd met behulp van een conjoint-analyse. Hieruit is gebleken dat de attributen “Product” en “Distributie aan de V.S.” het belangrijkst zijn (32% en 30% respectievelijk) gevolgd door “Certificaat” en “Gescheiden productielijnen” (11% en 11% respectievelijk) Het minst belangrijkst zijn attribuut ”Grootte” en “Geleverd aan” (8% en 7% respectievelijk) (zie tabel 0.1).

Drie verschillende methodes van classificeren zijn ontwikkeld (tabel 0.1). Deze methodes zijn gebaseerd op de mediaan, het gemiddelde en het gewogen gemiddelde. Aan de hand van één van de drie methodes zijn de bedrijven waar de deskundigen werkzaam zijn geclassificeerd in categorie “hoog risico” of “laag risico”. Attributen “Distributie aan de V.S.” en “Geleverd aan” zijn niet meegenomen tijdens het classificeren omdat geen van de bedrijven exporteert naar de V.S. en alle bedrijven leveren aan productie- en vlees bedrijven. Tevens is attribuut “Product” niet gebruikt, omdat de scores uit de conjoint-analyse niet overeenstemde met de literatuur en het twee uitlopers veroorzaakte tijdens het classificeren met dit attribuut. Uiteindelijk zijn de verschillen tussen “hoog risico” of “laag risico” veroorzaakt door drie attributen: “Certificaat”, “Gescheiden productielijnen” en ”Grootte”.

Op basis van het huidige onderzoek lijken risicoprofielen tussen mengvoederbedrijven te verschillen. Door de relatief kleine groep van deskundigen die ondervraagd is, is het echter niet aan te bevelen de risicoclassificatie rechtstreeks in de praktijk te brengen.

Tabel 0.1 Samenvatting

Attribuut	Belangrijkheid	Attribuut levels	Sample bedrijven (n=14)
Product	0.32	Mengvoeder	12
		Vochtrijk voer	-
		Beide[1]	2
Distributie naar V.S.	0.30	Ja	14
		Nee	-
Certificaat	0.11	GMP+	3
		GMP+ en meer	11
Gescheiden productielijnen	0.11	Ja	6
		Nee	8
Grootte (ton kg)	0.08	> 100.000	12
		<100.000	2
Beleverde veehouderijen	0.07	Productiebedrijven	-
		Vleesbedrijven	-
		Beide[1]	14
Risico classificatie[2]			
Mediaan risico score			
- Laag risico			10
- Hoog risico			4
Gemiddelde risico score			
- Laag risico			10
- Hoog risico			4
Gewogen gemiddelde risico score			
- Laag risico			6
- Hoog risico			8

[1] Attribuut level *"Beide"* is niet gebruikt in de conjoint-analyse.

[2] Gebaseerd op "utilities" en "belangrijkheids" scores uit de conjoint-analyse.

Abbreviations

CBS	Centraal Bureau voor de Statistiek (Central institution for statistics)
DON	Deoxynivelanol
DUS/DOS	Database Unwanted Substances Database Ongewenste Stoffen
DRV	Databank Risicobeoordelingen Voedermiddelen (Database risk analysis for feed ingredients)
EWS	Early Warning System
FSRA	Food Safety Risk Assessment
GMO	Genetically Modified Organism
GMP+	Good Manufacturing Practice
HACCP	Hazard Analysis Critical Control Points
LEI	Landbouw Economisch Instituut (Agriculture Economic Research Institute)
ISO	International Organization for Standardization
OPNV	Overleggroep Producenten Natte Veevoeders (Organization for wet feed producers)
PBA	Public Board Animal feed
QS	Qualität und Sicherheit fur Lebensmittel vom Erzeuger bis zum Verbraucher (Quality certificate in Germany)
RASFF	Rapid Alert System for Food and Feed
VWA	Voedsel en Waren Autoriteit (Public organization to secure food safety)

1. Introduction

1.1 Background

Due to several contamination crisis, there is growing attention for food and feed safety in the Netherlands. Feed contaminations can potentially cause enormous losses in food supply chains. For instance, losses of the MPA crisis (2002) were estimated to be 107-132 million euros (European Commission, 2002). The cause of this contamination was a waste stream of Irish glucose syrup. This waste stream was delivered to both compound feed companies as well as primary producers (pig farms). At the time the contamination was discovered producers had already distributed the contaminated products through the supply chain (Product Board, 2002). Recalling all contaminated products caused the largest part of the losses (Eindhovens dagblad, 2004).

The MPA crisis and earlier crisis raised the issue of increasing the coverage of product liability insurance for animal feed producers. In 2007, processing companies required animal feed companies to extend their product liability insurance to cover 75 million per crisis. TrusQ, which was founded by 6 large feed producers, acquired a collective insurance (a so-called “sur-plus insurance”), which covers losses up to 75 million euro per incident (Beekman, 2007). However, it is almost impossible to get this coverage for many individual animal feeding companies.

Earlier research indicates that the losses at farm level are expected to be 5.3 million per crisis, ranging from 0.2 million euros to 18 million euros in respectively 5% and 95% percentiles (Asseldonk et al., 2006). A research of Andel (2008), which focused on the supply chain losses due to animal feed contaminations, showed in the best likely scenario an expected loss for the processing industry of 30 million per crisis (aggregated average losses). These studies consider the animal feed companies as a group. However, the group consists of many different individual companies. Does every individual company need an insurance of 30 million? Risk classification can be used for insurance schemes to differentiate between individual compound feed companies. Besides this, they can be used to improve the food safety because a lower premium can be an incentive for risk prevention.

1.2 Research goal

Objectives

The two objectives in this research are:

1) To analyze current practices of risk classifications in the food- and agribusiness; and

2) To design a risk classification tool for individual compound feed companies with respect to food safety risks.

These objectives lead to the following research questions:

- What are important food safety risks in the feed sector?
- Which risk prevention strategies already exist in the feed sector?
- On which attributes are companies in other agribusiness sectors classified (size, kind of ingredients, kind of product)?
- Which attributes are important to classify individual compound feed companies?
- How can individual companies be classified into different categories?

This research focuses on food safety risks in *compound* feed. In the Netherlands there are approximately 132 compound feed companies[1] that produce 12,5 million tons of feed (PBA, 2004b).

1.3 Outline of the research

The report consists of two phases and it is organized as follows:

- 1: Chapter 2 presents a literature review on the compound feed sector, critical areas in the compound feed sector and risk prevention strategies. Chapter 3 covers a literature review of risk classification and examples of risk classification in the agri- and food business. Thereafter, paragraph 3.3 describes the current practice of ABN AMRO.
- 2: Phase two consists of two chapters as well. First, the materials and methods used in this research are discussed (chapter 4). Scanning available data sources (paragraph 4.1), the conjoint analysis (paragraph 4.2), selection of attributes (paragraph 4.3), designing the questionnaire (paragraph 4.4) and data collection (paragraph 4.5) are reviewed in this chapter. Chapter 5 covers the results of the conjoint analysis and several ways of risk classification.

After these two phases, chapter 6 presents the conclusion and discussion.

[1] The exact number of compound feed companies that produce compound feed is unclear. The PBA confirms the 132 producing companies, but literature (e.g. Thelosen (2007) and several experts find this questionable.

2. Food safety risks and prevention strategies in the compound feed sector

2.1 Compound feed

Feed can be divided into wet feed, semi-wet feed, dry feed (compound feed) and raw feed. Compound and wet feed are produced the most, respectively 12.5 million (PBA, 2004b) ton and 5,15 million ton (OPNV, 2006) for livestock farms. Compound feed consists of natural ingredients like corn, wheat, coco, soy and rest flows from different industrial, chemical and pharmaceutical production processes. The main ingredients are manioc/tapioca (1.5 million ton), soybean flour (1.4 million ton) and maize gluten flour (0.8 million ton) (Roest et al., 2004b). The rest flows could exist of waste from the preparation of other types of food (recall product, recycled fat). Fat is another important ingredient for animal feed. In the Netherlands there are 7 fat melters, which are monitored by the government. Compound feed can be divided in different types of feed: pigs (43%), poultry (25%), cattle (25%) and remains (dogs, cats, horses, total 7%) (LEI, 2005). The ingredients of compound feed have different origins. A report of Aert (2002) described that 75% of the feed ingredients are bought in the USA, Thailand and Malaysia.

2.2 The compound feed sector

The animal feed sector consists of all companies which produce animal feed: compound feed companies, pet animal feed producers, producers of wet feed, traders in feed ingredients and food producers, which produce waste streams for animal feed. In the Netherlands there are about 1800 companies, with 9000 employees and a common sale of 4 billion euro (PBA, 2008b). 132 companies are compound feed companies; together they produce approximately 12.5 million ton feed (PBA, 2004b). 10 companies, in the compound feed sector, produce 90% of the production in total (Q-Point, 2003). The supply chain of compound feed companies is very complex. Figure 2.1 gives an overview of the supply chain of a compound feed company that produces pig feed.

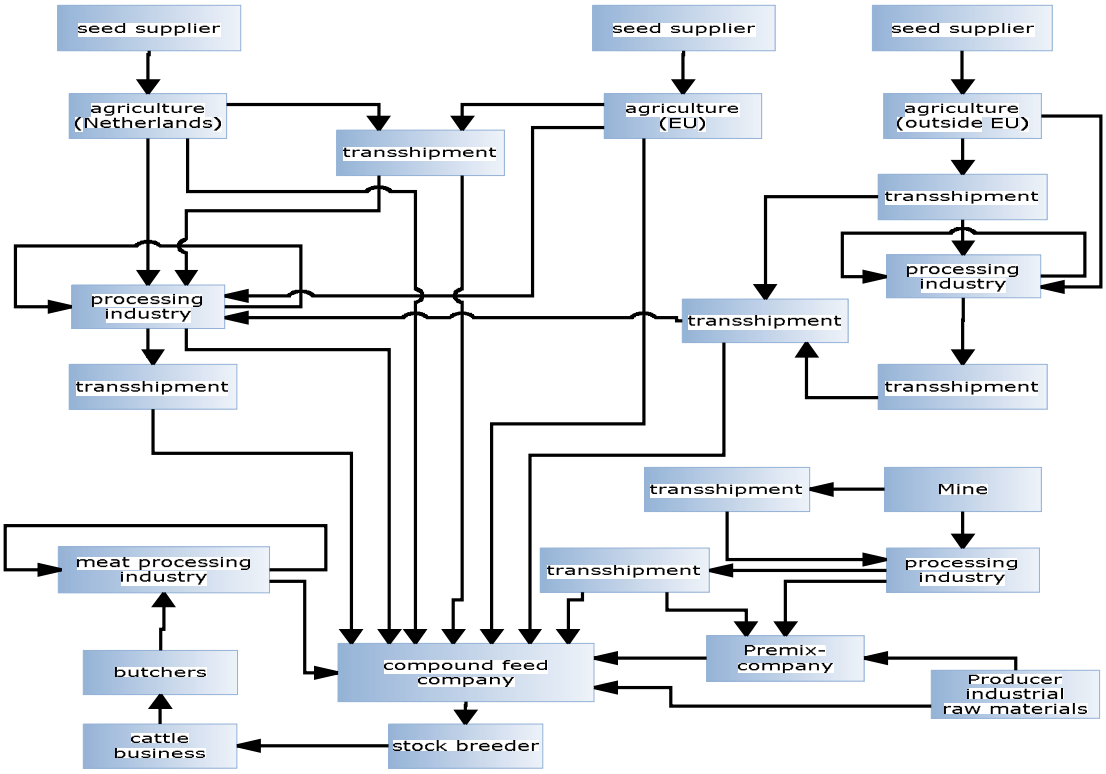


Figure 2.1 Logistic chain of ingredients of pig compound feed (Wagenberg, 2002).

2.3 Critical food safety areas in the compound feed sector

As described above, many kinds of ingredients with different origins are used for different kinds of feed. It is a very complicated sector with different types of risks. Product attributes, which can cause a risk for the food safety, are indicated as risk factors (Wagenberg et al., 2002). Risk factors can arise during the growth process, the harvest, the process, the storage or they can appear from substances in the environment. The risk factors in the compound feed sector can be divided into three main groups (Wagenberg et al., 2002), i.e.:

- Physical dangers: These are dangers related to substances, which do not belong in the feed, like wood, metal and glass. This danger can be controlled through a good production process, by using sieves or metal detection that removes these substances.
- Microbiological dangers: Microbiological dangers are contaminations through bacteria, viruses, mould and yeast. It can be very harmful if the feed is contaminated by these microbiological dangers. For instance the enormous losses during previous crisis (BSE, MPA, dioxin).
- Chemical dangers: The group chemical dangers consist of mycotoxins (an example is aflatoxine, DON, zearaleone or orchatoxine A), additives (like dye, conservative), environment pollution (dioxin, heavy metals (lead, cadmium, mercury or arsenic)) and residues of suppression resources. The residues of pesticides can be divided into five groups; herbicides, fungicides, insecticides, rodenticides, nematicides.

For every process in the production process of a compound feed company, the chance and the impact of the above risk factors are considered. This is consistent with literature, because from a scientific point of view, risks are traditionally characterized by the probability of occurrence (chance) and the extent of damage (impact) (Luning et al., 2006).

Although the production processes are analyzed on the above dangers, the fact remains that five critical points in the animal feed sector will still exist (Roest et al., 2004a). The assumption is made that four out of five points are applicable for the compound feed sector. Table 2.1 represents the top 5 of these five critical points (the cursive text is not applicable for the compound feed sector).

Table 2.1 Critical points in the animal feed sector (Roest et al., 2004a).

Critical area (top 5)	Critical point
Import of the ingredients for feed	The risks of the circumstances in pre-accession countries are unknown (environmental contaminations)
Waste stream food supply chains	There is no tracing system and there are no measures for disapproved and damaged companies.
Import of the ingredients for feed	Insufficient pre information, more physical control needed.
Non certificated companies	*Purchase and supply of wet feed is unknown*
Waste stream food supply chains	Destination waste stream of non-GMP+ companies is unknown.

In practice this leads to two main attention points for risk control (Roest et al., 2004b):

- Unwanted additives who are allowed for a few animals, but not for the feed of all animals.
- Unwanted pollution (microbiologic: aflatoxin and mycotoxin; chemical: pesticides and heavy metals).

To reduce the chance of unwanted additives or pollutions in the feed, companies apply prevention strategies. For example, if an ingredients is analyzed with every batch (risk prevention) the chance on a contamination will be reduced. The following paragraph will further elaborate on different kind of prevention strategies.

2.4 Risk prevention strategies

The critical points shown in table 2.1 were established in 2004. During this time, the compound feed sector enhanced risk prevention by several measures. Since 2004, risk prevention has been improved due to new developments in the sector, industry and through new legislation. Table 2.2 mentions various examples of enhancing risk prevention during the period between 1997 to 2006.

Table 2.2 Examples of developments enhancing risk prevention of animal feed (1997/2006). Retrieved from Meuwissen et al., (2007).

	1997/ 2001	2002	2003	2004	2005	2006	2007
Legislation							
Regulation 178/2002/EC: General Food Law[1]		X					
▪ Traceability law implemented					X		
Directive 2002/32/EC: Undesirable substances in animal feed		X					
▪ Extended requirements for lead, fluorine and cadmium					X		
▪ Idem, for dioxins and dioxin-like PCBs						X	
Regulation 178/2003/EC: Genetically modified food and feed			X				
Comm. Decision 2004/217: Prohibited materials for animal nutrition				X			
Directive 183/2005/EC: Requirements for feed hygiene					X		
Directive 623/2007/EC: Requirements for transport of feed							X
Sector initiatives							
Good Manufacturing practices (GMP)	< 97						
GMP plus HACCP (GMP+)		X				X[2]	X[3]
Only accredited products based on risk assessment			X				
Procedures for recall, early warning and tracking and tracing			X				
Industry initiatives							
TrusQ[4]			X				
SafeFeed[4]					X		

[1] 178/2002/EC laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.
[2] New version of GMP+, among others to fully include requirements set by directive 183/2005/EC and to better respond to foreign companies' needs.
[3] GMP+ is extended with standard B6; feed originated from arable farming and B3; Storage and trade in animal feed.
[4] The aim of Safe Feed and TrusQ is to enhance and deepen GMP+. Table 2.3 elaborates on both organizations.

As can been seen in table 2.2, several initiatives, from the legislation, the sector and the industry itself, were not taken into account when the report of Roest et al. (2004) was written. Especially the new version of GMP+ (2006) is important, because this version is extended with procedures of HACCP and ISO 22000. Table 2.3 presents more detailed information on the existing prevention measures for risks.

Table 2.3: Detailed information of risk prevention measures.

Prevention measure	Short description	Remarks
GMP (Good Manufacturing Practice)	- Focuses on hygienic producing (Agriholland, 2008). - Is especially applicable for production companies in the feed, food, pharmaceutical and health sector. (Agriholland, 2008). - Almost 100% of the Dutch animal feed companies uses this regulation (Berg and Thielen, 2004).	- The certificate does not say anything about the behaviour of the entrepreneur (Nevedi, 2004).
GMP+	- Is applicable for producers and traders of compound feed, pre mix, wet feed and feed ingredients (Agriholland, 2008). - The HACCP systematic and the ISO 9001/ 22000 is integrated (Agriholland, 2008). - The ingredients are bought in a) the Netherlands or b) in another country. If a, the supplier need to be GMP+ certificated. If the supplier has to satisfy the GMP+ certificate scheme (PBA, 2006b). - Besides the obligated monitoring scheme (analyzing the products on parameters), the feed producers have their own monitoring scheme (PBA, 2006b). - The quality system is audited at least once a year (PBA, 2006b). - Since 2004, companies with GMP+ can only use ingredients that have had a risk assessment of the PBA. These assessments are stored in the database of the PBA (PBA, 2003).	- The chance on faults or fraud (in earlier stages of the chain) exists (Nevedi, 2004). - GMP+ requires analysis of ingredients. However this can be done at a minimum level (Nevedi, 2004). - It is a standard with minimum requirements for quality control, because not all worldwide suppliers of feed materials (already) apply an extensive and comprehensive quality management system (PBA, 2006b). - The origin of the ingredients is often unclear (Nevedi, 2004).
HACCP	- The principles are related to identifying and checking potential dangers for the hygiene in the company process and of the critical controls or mastering points in that process the dangers master as much as possible (Nevedi, 2004).	- If a potential danger is not acknowledged there are no prevention measures (Nevedi, 2004).
ISO 9001	- A norm that gives requirements to the quality system of an organization and the way in which the organization deals with the quality policy. - Not specific for food companies (Agriholland, 2008).	- Is not a quality system with prevention measures (Lighter, 2008).
ISO 22000	- Follows the requirements of ISO 9001 and incorporates these with food safety rules on the basis of HACCP (Berg and Thielen, 2004).	- If a potential danger is not acknowledged there are no prevention measures (Nevedi, 2004).

Continuation of table 2.3: Detailed information of risk prevention measures.

Prevention measure	Short description	Remarks
ISO 22000	- The goal is to integrate other quality systems in order to reduce the number of different certifications (Berg and Thielen, 2004). - Is a norm to manage food safety at the whole food chain (Ligther, 2008). - Introduced in 2005 (Berg and Thielen, 2004). - Specific for food companies (Agriholland, 2008).	- GMP+ has additional procedures related to monitoring, use of ingredients and suppliers (Berg and Thielen 2004).
QS (Qualität und Sicherheit fur Lebensmittel vom Erzeuger bis zum Verbraucher)	- Quality control in the whole supply chain, from birth to slaughter (Agriholland, 2008). - Partly consists of protecting the animal. - Several Dutch animal feed companies have QS (Roest, 2004b). - Traceability of ingredients and transparency are important building blocks. (Agriholland, 2008).	- There are differences with GMP+ on the following aspects: HACCP, purchase, final product control.
Tracking & tracing	- To track down (in real- time or off-line) the logistical route of (composed) products (Goor et al., 1996). - Within four hours the product must be tracked (General Food Law). - Incorporate in the General Food Law and in GMP+. - Since 2005, traceability is obliged in the EU (General Food Law).	- The administration is for some of the companies too complicated (Voedingscentrum, 2008). - Sometimes the ingredients are not traceable (e.g.grain from different farmers) (Voedingscentrum, 2008).
Product board Animal Feed (PBA)	- They have a common database (DRV), which give risk analysis for several ingredients of feed products (PBA, 2008c). - They have a common database (DUS), which archive the analyses of feed (in 2006: 250.000 monsters, 400.000 analyses) (PBA, 2006b). - In the GMP+ certificate scheme animal feed 2006 (PBA, 2006b), parameters with their accepted table levels for different kind of feed are described. - Gives an overview of all companies with GMP+ (PBA, 2008d).	- Only 43% use the database for purchasing ingredients (PBA, 2007). - The DUS is used on a voluntarily basis (PBA, 2007).
Early warning system	- An aspect of the quality program of the PBA (PBA, 2008a). - A warning system, to signal potential dangers that prevail themselves despite the preventive quality systems (PBA, 2008a). - Started 2001, 2003 incorporated in GMP (PBA, 2008a).	- Dependent on information of individual companies. An individual company has to acknowledge the danger (PBA, 2008a).

Continuation of table 2.3: Detailed information of risk prevention measures.

Prevention measure	Short description	Remarks
TrusQ	- Initiative of 6 companies. Together they consist of 65% of the animal feed production sector (Nutreco, 2008)[1]. - The aim of TrusQ is to use systematic screening of suppliers and raw materials to significantly reduce the risk of animal feeds being mixed with unwanted constituents (Meuwissen et al., 2007). - TrusQ is setting stringent requirements for logistic and production processes of raw materials. These are based on the combined knowledge and experience of quality control in six compound feed producing companies (Meuwissen et al., 2007). - Assess the product of the supplier as the supplier itself (TrusQ, 2008). - The aim of TrusQ is that contaminants are not being mixed with the ingredients (TrusQ, 2008). - Collaboration with VWA (TrusQ, 2008).	- TrusQ might be seen as a further deepening of GMP+" (Meuwissen et al., 2007). - They acquired a collective insurance (the so called surplus insurance) (Beekman, 2007).
Safe Feed	- Safe feed consists of 70 companies and is established in 2005. Together they count for 50% of this sector (Safe Feed, 2008)[1]. - The objective is to acquire safe ingredients, products and services (Safe Feed, 2008). - The suppliers are assed on a transparency and uniform way. Important aspects in this assessment are: detailed specifications, certificates and recognition, perform audits, monitoring program and complaints and deviations (Safe Feed, 2008). - Safe feed members can only buy ingredients of companies, which are allowed by safe feed (Safe Feed, 2008). - Safe feed has its own monitoring program (Safe Feed, 2008). - Assess the product of the supplier as the supplier itself (Safe Feed, 2008).	- Since 2007, also wet feed companies can become a member (Meuwissen et al., 2007).

[1] The market share of TrusQ and Safe Feed are together not 100 %. The reason for this can be a) Safe feed incorporates wet feed producers too, b) it is a dynamic market with several mergers and acquisitions and c) the information of the Safe Feed website could be outdated.

Paragraph 2.3 presented critical and control points in the compound feed sector. Risk prevention strategies can reduce the number of product failures, because the chance on occurrence and the impact can be smaller (e.g. the early warning system can lead to a reduced impact). However, prevention measures are no guarantee for safe products.

3. Risk classification; current practices

3.1 Risk classification

Risk classification is defined as "the process of sorting insurance applicants into categories believed to correspond to differences in expected risk. Common examples include sorting life insurance applicants by age or health insurance applicants by health status" (Baker 2001). This definition of risk classification is applicable for this research, because insurance applicants (compound feed companies) have to be sorted into categories.

Risk classification has three general effects: "a redistribution of wealth (one company will benefit (pay less) and the other will detriment – so they will have to pay more), a change in behaviour and the introduction of classification cost" (Harrington and Niehaus, 1999). The change in behaviour can have a positive influence on society as a whole, because companies would rather like to be in a category where they have to pay fewer premiums. To accomplish this, they have to improve on food safety aspects (in this research).

Besides these general effects, risk classification can also be used as a competitive tool in the insurance sector. This is because the insurer can offer a lower price to their client and, possibly obtain a greater profit. The lower price is obtained because the risk bearing companies can be eliminated from an insurance pool and this measure will reduce the average cost of insuring the members of the pool (Baker, 2001).

3.2 Examples of risk classifications

In this paragraph four examples of risk classification are described. The first three examples focus on classifying companies and the last one focuses on classifying products. A summary is given in table 3.1.

Classify suppliers into categories

Individual companies can judge their own suppliers on different ways and make their own risk categories. Supplier rating is a review on suppliers and is done by a lot of industries. It is a critical process that is obligated to do in most of the quality systems. Based on periodic reviews before and after, the quality of the suppliers and their products are controlled. There are three main approaches:

- *Product review*: before the delivery they look into the general information, price, and earlier experiences with the supplier, a test example, etcetera. While and afterwards the delivery they look at the product quality and service.
- *Process review* (in particular the car and the electronical sector): before the process they look into the statistic process control (SPC) and afterwards at the statistic analysis (SQC).
- *System review*: First they look at the ISO standards and questionnaires and afterwards they do a Vendor Rating. This is the evaluation of the customers on the quality of the organization and the quality aspects of the delivery (in a particular period).

Suppliers can be classified into different categories (e.g. A,B,C,D status or 1,2,3,4). Every status have their own consequence, e.g. a supplier with status A will be re-audit in three years or a supplier with status C will be re-audit the next year. The method of classification and the consequences each category can bring will be different for every individual company.

Classifying for crop insurance

Asseldonk et al. (2000) conducted a research related to crop insurances due to bad weather conditions. This insurance consists of a standard tariff and an amount that can be added up or can be discounted. The standard tariff depends upon policy conditions and the insurance construction. The differentiation of the premium can be based upon three criteria (attributes): region of rates (the risk at a region for some bad weather circumstances), the type of ground and the type of crop. Every level of each attribute gets a score. This can be: the basic tariff, a number of +++ or a number of ---. Every + indicates a higher premium with 12,5% and every – indicates a discount of 12,5%. For instance, the basic tariff is *f*10 for a *f* 1000 insurance amount, an arable farm; -- (crop), with clay; - (ground) and located in Northeast polder; basic premium (region) have to pay a premium of *f*6,25 for every *f*1000 insurance amount (10-1.25-2.5) (Asseldonk et al., 2000). In this example companies are not classified into specific categories, because every company has different characteristics. However, it is possible that companies have the same premium.

Classifying pig farms for animal health fund

Are there transparent criteria (attributes) to differentiate health fees for pig farms based on the risk for animal diseases? This was the research question of a research by Meuwissen et al. (2002). Five attributes were analyzed: location, hygiene, farm type, import of pigs and number of contacts. Every attribute is judged on the related risk (chance and impact) and thereafter the relative importance of every attribute is presented. This research concluded that current knowledge and data is not sufficient to differentiate between companies.

Classifying different types of food related to microbiological hazards

Every company with a food quality system has to accomplish a risk assessment. The risk assessment for different types of food is associated with a time and expense consuming process (Ellerbroek, 2007). The research of Ellerbroek represents a reliable model of risk classification, related to microbiological hazards, for different types of food.“The classification is based on the food group of origin, the hazards, steps available to minimize the risk, consumption pattern of the food and the number of health relevant complaints”. The products are classified in category one, two or three (most dangerous). For instance, milk products are classified in category 3 and ice cream in category 1.

Table 3.1: Examples of risk classifications.

	Related to company			Related to product
	Suppliers	Animal health fund	Crop insurance	Microbiological hazards
Goal	To differentiate between suppliers	Differentiating pig fees for an animal health fund	Premium calculation for an insurance that covers the damage due to bad weather conditions	To distinguish different types of food on their microbiological risk
Used for	Quality system	Animal health fund (calculate the pig fee)	Crop insurance	Quality system
Category based on	Various aspects	- Location - Hygiene - Farm Type - Import of pigs - Number of contacts	- Region - Type of soil - Type of crop	- Food groups - The hazard - Consumption Pattern - Number of relevant complaints - Steps available to minimize the risk
Categories	Depends on individually company. e.g. A, B, C,D or 1,2,3,4	No rating possible	Based on + (every + is 12,5% more premium than the basic tariff) and - (discount of 12,5%)	1,2,3
Conclusion	E.g. frequency of supplier audits	No differentiation possible	Premium differentiation possible	Less time and money invested for risk assessments

3.3 Current practices with ABN AMRO

ABN AMRO Risk & Insurance Management

ABN AMRO Risk & Insurance Management is a part of the ABN AMRO Bank N.V. They advise clients on risk management issues and act as an insurance broker. This means that they identify and analyze the risks of a company and make a risk-financing plan based on a company's situation. As insurance broker they compile a package of the best insurance products available in alignment with the company's needs and thereafter purchase this package on the national and international markets. Besides this they offer, as insurance broker, a specialized support in the claim settlement process. They also make an active effort to ensure that a claim is paid as quickly as possible (ABN AMRO, 2008).

Product liability insurance

Because of the crisis in the sixties with Planta (skin infections) and Softenon (negative effects on unborn children and nerve damage for adults), there was an increased attention on the consequences of producing dangerous products. At 25 July 1985 the guideline product liability was established. The guideline is established to create a harmonious situation between the laws of different member states. These are related to the liability of a producer when losses occur as a consequence of producers' products. The main rule of product liability comes forward in article 6:185 BW: "the producer is liable for a deficiency in his product". There are four requirements (Heeres, 2007):

- The harmed person has to have damage.
- There has to be one or more liable persons or producers.
- The product must be deficient.
- There has to be a casual relation between product and damage.

Acquiring product liability insurance in the compound feed sector

In the compound feed sector the product liability insurance is very complicated. This has to do with the calculation of the expected amount of losses (due to a feed contamination) in the supply chain. As described in the introduction, a feed contamination can cause enormous losses in the supply chain. Recently, there is a lot of discussion with insurers, processing companies and compound feed companies on the amount of the insurances. Besides the individual product liability insurances (various amounts) of TrusQ and Safe feed members, a collective insurance (a so-called "sur-plus insurance") is acquired by TrusQ. This insurance covers losses up to 75 million euro per event, with a maximum of 150 million euro per year (Beekman, 2007). Safe feed is currently negotiating about a collective insurance as well.

In the compound feed sector the acquiring process starts with completing a questionnaire individually or with help of an expert. Thereafter the questionnaire and additional information is sent to insurance companies. They make an extra visit or they request additional information. The premium is calculated based on objective and subjective attributes. The "feeling" with the company, is a typically subjective attribute and the kind of quality certificate is an objective attribute. When there is consensus between the ABN AMRO and the insurance company the animal feed company receives an offer. The insurance companies will try to sell a part of these insurances to other insurers to reduce the underlying risks (reinsuring: the purchase of insurance by an insurer) (Harrington and Nieuhaus, 1999). Figure 3.1 shows the process graphically for the compound feed sector.

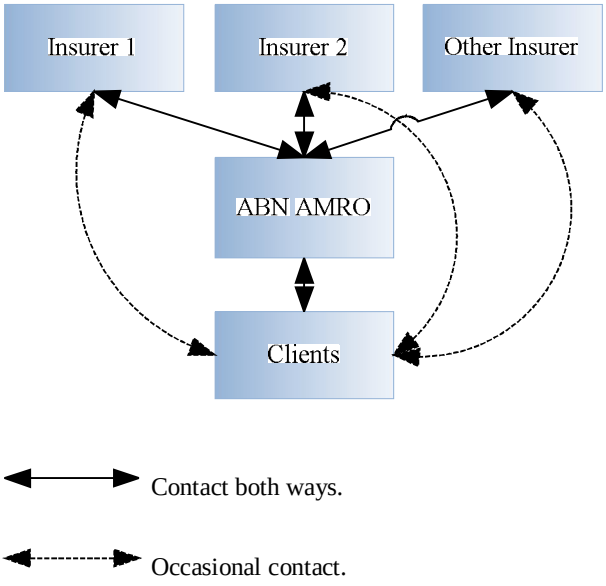


Figure 3.1: Acquiring a product liability insurance.

The premium

The insurance premium consists of different parts: operational costs, broker cost (ABN AMRO), costs of claims, reservations (for future claims) and a part for the profit. Besides these components, the premium can fluctuate because of three important aspects: amount of deductible, the insured amount (a higher insured amount leads to a higher premium) and the concurrency (more competitiveness in the market can lead to lower premiums). If the deductible of a company is high, the insurance company does not pay out every small incident. Thus, a high deductible can lead to a lower premium.

Current way of classification

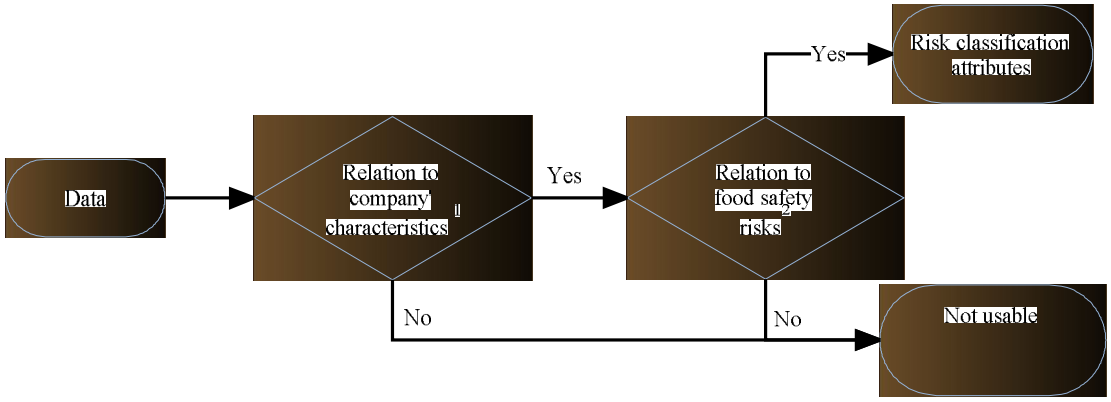
The described process is the current way of acquiring insurances. As described above, insurances classify compound feed companies based on objective and subjective attributes.

Two problems arise when calculating the premium in this way: subjective attributes are difficult to measure and every objective attribute needs a weight factor (which objective is more important than another?). Besides these two difficulties, every insurer has different weight factors and use different attributes. Thus, no strong basis for differentiating companies exists.

4. Material and methods

4.1 Scanning available data sources for designing categories

The purpose of scanning available data is to find attributes that can be used to classify companies into categories. The selected characteristics have to fulfill two aspects: they need to have a relation to the risk (e.g. companies with only GMP+ are expected to have more risks than companies with GMP+ and ISO9000) and they have to be related to characteristics of companies, which can distinguish individual companies from each other (e.g. companies can be differentiated based on type of certificate). Figure 4.1 shows the relation between the data and the attributes.



1 Which can be used to differentiate between companies.
2 Risk (chance or impact).

Figure 4.1: The relation between data and selected attributes.

Data of the Product Board Animal Feed

The Product Board of Animal feed has two databases with information: the Early Warning System (EWS) and the Database Unwanted Substances (DUS) (table 2.3). The annual reports of EWS represent the annual notifications of unwanted substances in the feed. For example, in 2003 EWS gave six notifications related to unwanted substances (e.g. salmonella) in ingredients (e.g. rye, grey, fish flour, palm fatty acid) and 1 notification of unwanted substances in compound feed (PBA, 2004a). In the Database Unwanted Substances results of different types of analysis (e.g. dioxin, salmonella, heavy metals, pesticides) are archived (PBA, 2006a). The GMP+ members can use this database for extra information regarding ingredients of compound feed.

Despite of the extensive information, which the annual reports offer, the link to companies' characteristics (the characteristics, which can distinguish companies from each other) is not provided. Therefore these databases cannot be used to classify companies into categories.

Data of the Voedsel en Waren Authoriteit (Dutch public organization).

Directive (EG) nr. 882/2004 of the European Union contains laws for public organizations, which are responsible for official checkups on animal feed (VWA, is the public organization in the Netherlands). Every year the VWA conducts a monitoring plan that contains a number of samples, type of the samples and the place where the sample has to be taken. For example in 2007:

Table 4.1 Examples of monitoring program VWA 2008.

Research on	Product	Place	Type	Number
Animal protein	Mays gluten flour	Harbor	A select	20
Pesticides	Feed ingredients, like soy.	Compound feed companies	A select	100
Dioxin	Fish flour/meal	Where possible	A select	50
Dioxin	Fat/oils	Compound feed companies	A select	50
Mycotoxin	Compound feed for dairy cattle	Compound feed companies	A select	100

Again the information which is given is very broad, but this information does not help any further in creating attributes because there is no link to company's characteristics.

Data of the Rapid Alert System for Food and Feed

The Rapid Alert System for Food and Feed (RASFF) was established in 1979. "The purpose of the RASFF is to provide the controlling authorities with an effective tool for exchange of information on measures taken to ensure food safety" (RASFF, 2008). The Commission publishes a weekly and annual overview of alert notifications, information notifications and border rejections of all the international members. The annual report consists of a summary of food safety alerts related to different categories, among other feed. The information contains alerts related to different hazards and their variables (e.g. heavy metals: lead and cadmium, mycotoxins: aflatoxin and ochratoxin, pathogenic micro-organism: salmonella and listeria). This information is also very broad, but again the relation to companies' characteristics is missing.

Historical data of ABN AMRO

ABN AMRO has a database with historical claims of every client. These claims are related to many different insurances and one of them is product liability. This data is the only data that could have give information about a possible relation of data related to both risks and companies' characteristics. However, this data is too less to make conclusions because very few claims were related to product liability (food safety related). From recent crisis, 4 dioxin contaminations (1999, 2003, 2004, 2006), 1 bone fragments (2004) and one MPA crisis (2002), only the financial consequences of the MPA crisis is partially paid out to the clients of the ABN AMRO.

The current available data is not adequate for classifying companies into categories. Databases fail to show a relation in both risks and company characteristics. Consequently, it is not possible to create attributes for classifying companies. Because the current data is not sufficient, the perception of experts is used. This is done in two stages; first the literature is reviewed on attributes that can be used to differentiate companies from each other. Thereafter a conjoint analysis is carried out. This analysis shows the relative importance and the utility of each attribute. In the following paragraph the conjoint analysis is elaborated further.

4.2 Conjoint analysis

Conjoint analysis is a multivariate technique developed specifically to understand how respondents develop preferences for any type of object (products, services, or ideas). It is based on the simple premise that consumers evaluate the value of an object (real or hypothetical) by combining the separate amount of value provided by each attribute (Hair et al., 2006). For example, a phone (the object) is valued by measuring the preference of different characteristics (attributes), e.g. color, price, camera, size. The attributes, with their own levels (e.g. color: black or silver), are presented to a number of respondents as a package of attributes (e.g. price: 100 and color: black). An advantage of this method is that respondents do not have to judge every product attribute individually. After the survey, the individual's utility for a multi-attributed product concept, U, can be expressed in a simple way:

$U_i = \sum u_{ij}$

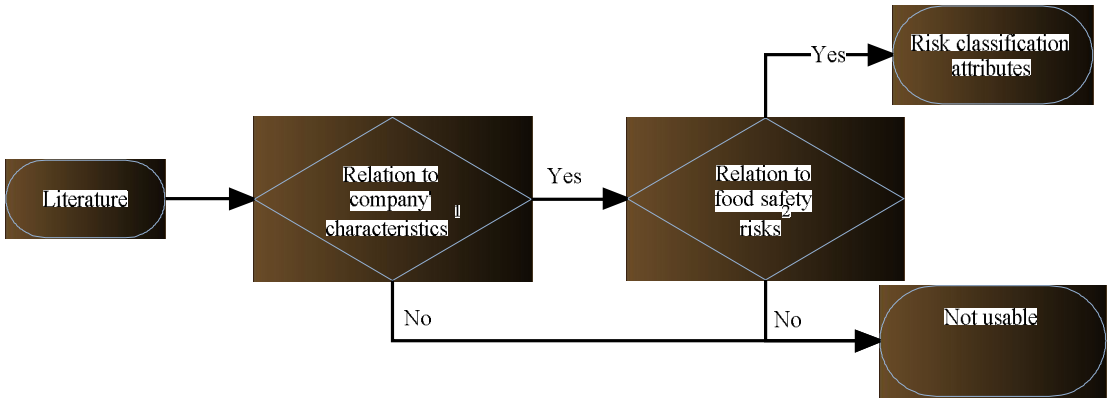
Where U_i is the utility for the ith brand and u_{ij} the utility of the jth attribute possessed by brand i. The u_{ij} are usually called part-worths. They reflect a part of the total worth of the brand contributed by the jth attribute" (Roa and Steckel, 1998).

The conjoint analysis estimates the utility for each single attribute level, which is then used to determine the relative importance of each product attribute. This is done with computer program SPSS. Originally a conjoint analysis was used to examine consumer preferences for multi-attributed products (Green and Srinivasan, 1990). In this research the conjoint analysis is used in a different way because in a questionnaire experts do not have to give their preference for a product with attributes, but for companies with different characteristics (company A; 100.000 ton production and separate production lines).

The conjoint analysis consists of five steps. First, in paragraph 4.3 the attributes and their levels are selected. Thereafter a questionnaire is designed (paragraph 4.4), experts are chosen and data is collected (paragraph 4.5). The fifth step is described in chapter five; analyzing the results.

4.3 Selection of attributes

This paragraph describes the selection of attributes for the conjoint analysis. Figure 4.1 shows the relation of data and risk classification attributes. Part of this figure is also applicable in the selection of attributes from literature, because attributes need a relation to companies' characteristics and the expected risk.



1 Which can be used to differentiate between companies.
2 Risk (chance or impact).

Figure 4.2: The relation between literature and selected attributes.

Types of compound feed

The compound feed industry produces different types of animal feed (pig, chicken, cattle, horse feed, pet feed). The produced compound feed goes to three main consumers: pigs (43%), hogs (25%) and poultry (25%). The other 7% goes to a variety of animals, like horses, cats and dogs (Pierinck and Bolhuis, 2005). Literature does not provide for evidence of differences, related to the expected risk in types of feed. The annual reports of databases on unwanted substances (DUS) and the early warning system (EWS) confirm this. Table 4.2 presents positive tested analysis (for different unwanted substances, like salmonella or cadmium) of different types of feed.

Table 4.2 Unwanted substances in different types of animal feed.

Data source	2003 (1/2 year)	2004 (1/2 year)	2005	2006
EWS	Pig feed Cattle feed	Cattle feed	Rabbit feed Poultry feed Sheep feed Cattle feed	Silage Dog feed
DUS (2004 and 2005)		Poultry feed Pig feed Cattle feed	Poultry feed Cattle feed Pig feed Horse feed	

Poultry-, cattle- and pig feed are in total 97% of the total production of feed. As can been seen in table 4.2, unwanted substances can be found in all three main types of feed. Therefore this table confirms the absence of literature on differences in risks that different types of feed can bring. Thus, although companies can be differentiated based on types of feed, the link to an expected risk is missing. For that reason this attribute is not used.

Compound feed ingredients

Chapter two describes three critical areas in the animal feed sector, which are associated to ingredients of feed (table 2.1, Roest et al., 2004). These factors were related to the origin (next attribute) and the type of ingredient (this attribute). It can be suggested to distinguish companies based on types of ingredients. After all, every ingredient has a different risk and has their own risk analysis, which can be found in the risk assessment database of the Product board Animal Feed. However, this risk analysis consists of an analysis of every hazard in the production process no general 'grade' for every ingredient exists. Even if this was available, distinguishing companies based on types of ingredients is too complicated, because there are too many different kinds of hazards (the RASFF used 23 types of hazards in their report of 2006) and this will result in many risk-bearing ingredients. For example:

- Salmonella is an unwanted substance, which regularly can be found in ingredients of the feed. The following ingredients have more risk regarding salmonella: sunflower seed scrap, sunflower seed products, soy scrap, soy broad beans, corn gluten fodder, animal flours, vegetable oil; soybean oil, rapeseed oil and palm oil (RASFF report, 2006).
- Attention for mycotoxin is necessary for maize, maize gluten feed, rye, soy crap, wheat, wheat gluten flour, triticale and sunflower seed flour (PBA, 2007).

This example shows only two types of hazards (salmonella and mycotoxin) and already a lot of risk bearing ingredients. If we continue analyzing every hazard, there will be an enormous list of risk bearing ingredients. Because of this enormous list, every company will use one of the ingredients mentioned in the list (compound feed consists of many ingredients). Consequently, companies cannot be distinguished based on the used ingredients.

Country of origin

As described above, two critical areas were related to the import (origin) of the ingredients. It can be suggested to look at the origin of the ingredients for conducting attributes (e.g. one country produces more risk bearing ingredients than another country). However, in practice this way of differentiating between companies is very difficult. This because, no research shows that one country produces more risk bearing feed ingredients than another. Only the report of RASFF (2006) shows a higher risk in Asian countries (since 1997), because they had the most total notifications. Although these notifications are not only related to feed, it can give an idea about the risks in Asian countries. Nevertheless, most companies import compound feed ingredients from Asian countries (Aert, 2002) and thus companies cannot be differentiated based on the import out of Asian countries.

Besides the fact that no research shows the most risk bearing countries, most compound feed companies will buy their ingredients from the same countries. This is due to the fact that there is a lack in ingredients, and because 75% of the compound feed ingredients is bought from USA, Thailand and Malaysia (Aert, 2002). Consequently, the attribute "Country of origin" cannot be used because it does not differentiate companies and it does not provide a link to the amount of risk.

Type of feed

There are different types of feed: compound feed, premix, additives, concentrate and wet feed. In terms of volume, livestock farms mostly use compound feed and wet feed, i.e. 12.5 million ton and 5.15 million ton respectively. This research focuses on compound feed companies, but these companies can sell wet feed too. Table 4.3 gives an overview of different characteristics of both types of feed, the history of crisis (chance) and the expected losses during a contamination (impact).

Table 4.3 Risk related to compound feed and wet feed.

	Compound feed	Wet feed
Produced feed (million ton kg)	12.5 [1]	5.15[2]
Recent Crisis (1999-2006) [3]	4 per 7 years	4 per 7 years
Estimated probability of occurrence[4]	1 per 5 years	1 per 5 years
Expected losses during a contamination (mln)	5.3[3]	-[5]
Size of 'sector'	10 companies produces 90% of compound feed[6]	3 companies have 45% market share[5]

[1] PBA, 2004b.

[2] OPNV, 2006.

[3] One crisis can be in compound feed and in wet feed. Retrieved from Andel (2008).

[4] Asseldonk et al., 2006.

[5] Confidential.

[6] Q-point, 2003.

Although this table does not show a difference in a chance of a contamination, confidential research shows significantly lower expected losses for wet feed. This is because a contamination of wet feed is likely to affect less livestock farms than a contamination of compound feed.

The attribute "Product" is used in the conjoint analyses, because a) it shows a relation to the amount of risk (impact is higher during a contamination of compound feed) and b) companies can be differentiated based on this aspect.

Monitoring ingredients

In the Netherlands public organizations and companies analyze ingredients on many different parameters (e.g. dioxin, aflatoxin). The goal of monitoring ingredients is to verify the ingredients on these parameters and to reduce the impact of product contaminations (the sooner a contamination is discovered, the smaller the impact will be).

There are a number of obligatory monitoring programs:

- Based on new developments in the sector and their databases, the product board makes a monitoring program every year. This monitoring program is obligatory for GMP+ members.
- Besides the monitoring program of the PBA, GMP+ certificated companies have their own monitoring scheme to reduce the chance on unwanted substances in the feed.
- The national plan on animal feed is published every year by VWA. This plan incorporates the number of analysis (done by the VWA) for every parameter for every product group (table 4.1).

Even though these prevention measures exist, it is still possible that something is wrong with the feed. This is due to the fact that not all feed is analyzed and feed is not tested on every parameter. However, a company that analyzes every batch of ingredients can have less risk than a company that analyzes only the obligatory minimum. The number of extra analysis could be used as an attribute, but defining the attribute levels is too difficult. How many and what kind of analysis is necessary to reduce the risk?

Claims in the past

Historical claims related to food safety can give an idea on the risks of a certain company.
The historical claims of the ABN AMRO clients are stored in the ABN AMRO database. This database is the same as described in paragraph 4.1. Therefore this attribute cannot be used for the same reason; the claims are too few to make conclusions related to the amount of risk of a certain company. Consequently, companies cannot be differentiated based on this attribute.

Member of TrusQ or Safe Feed

Food safety is an essential item in the organizations TrusQ and Safe feed. Both organizations enhance and deepen GMP+ and therefore the chance on product failure can be reduced. Table 2.3 (risk prevention strategies) describes these organizations more in depth. Because 99% of the compound feed producers are member of Safe Feed or Trusq (Thelosen, 2007), the difference between being a member and a non-member is insignificant. Thus the link to the amount of risk is available, but it does not distinguish companies from each other.

Traceability system

Traceability can be defined as “to track down (in real- time or off-line) the logistical route of (composed) products” (Goor et al., 1996). It can be divided in tracking (tracking the actual product, forward in the chain) and tracing (backwards, were does the product come from) (Wagenberg, 2002).

The tracing system of waste stream was considered as a critical point in the report of van Roest et al. (2004) (table 2.1). In recent years the regulation (in the general food law and in GMP+) related to tracking and tracing is further elaborated. Tracing the product within four hours was one of the changes. Because legislation and the supply chain requires an efficient traceability system it is too complicated to differentiate companies based on their traceability system; how can companies be distinguished if everyone needs an efficient traceability system? Thus, this attribute does incorporate the risk (an efficient traceability system can decrease the risk), but it fails in distinguishing between companies.

Size of the company (total production)

Table 4.4 presents the differences in size within the animal feed sector.

Table 4.4 Members of Nevedi categorized by amount of production.

Production (ton)	<50.000]	[50.000, 100.000]	[100.000, 500.000]	[500.000, 1.000.000]	[1.000.000, ->	Total
Number of members	63	6	19	0	5	93
Total	1575000	450000	4750000	0	6250000	13025000
Cumulative Percentage	0.12	0.16	0.52	0.52	100	100

Source: Nevedi.

A research of Asseldonk et al. (2006) shows that compound feed companies with a production of 1 million ton have a higher expected risk with a factor of 1,75 than companies with a production of 0,1 million ton (a company that produces 10 times more has a higher expected risk with factor 1.75). This factor is a median of the scores of ten individual experts, the lowest score was 1 and highest 5. In contrary with this research, larger companies will argue that they have better quality control departments than smaller ones and therefore the expected risk can be reduced.

Although it is arguable what the impact of “Size” is on the expected risk of the company, table 4.4 shows that companies can be distinguished based on size, expressed in amount of production. To use “Size” as an attribute the amount of production has to be divided in two levels. If the number of members and the cumulative percentage are combined, the attribute levels will be <100.000 ton and > 100.000 ton. Although the cumulative percentage is only 16%, the cumulative percentage of members is this category is 75% (69).

GMP+ or more

The quality system that is mostly used in the compound feed industry is GMP+. Almost 100% of the Dutch animal feed companies uses this regulation (Berg and Thielen, 2004). Other quality systems used in this sector are for example ISO 9001, ISO 22000 and QS (Germany). Table 2.3 gives more details on these quality systems.

Table 4.5 presents the difference between ISO 9001, HACCP, ISO 22000 and GMP+. Especially the double + of the purchase and design process is an advantage of ISO 9000, because these processes are very important to reduce the risk (risks related to ingredients were critical points in the animal feed sector (table 2.1). This is related to the purchase process).

Table 4.5 Differences in quality systems.

Aspect	ISO 9001[1]	HACCP[1]	ISO 22000[1]	GMP+[2]
Improvement management	+	-	+	-
Purchase process	++	-	+/-	+
Design process	++	-	+/-	-
Traceability	+/-	+/-	+	+
Pre/requisite program	-	+	+/-	+
Use of HACCP principles	-	+	+	+
Guidance for quality system layout	+	-	+	-

[1] Lighter (2008), Good4Food consultancy.
[2] PBA (2005 and 2006b).

As can been seen in the table not every certificate is the same. If a company has another certificate besides GMP+, some processes will be further elaborated. In this way the risk of a certain company can be reduced. Thus, attribute "Certificate" can show a relation to the expected risk and it can distinguish companies from each other. For that reason this attribute is used in the conjoint analysis, the attribute levels are: GMP+ or GMP+ and more.

Separate production lines

A company can reduce the risk on cross contamination by having different production lines. Cross contamination, direct or indirect transfer of a pathogen from one medium (food or water) to another (FSRA, 2008) can increase the impact if a product is contaminated. For example, there are two production lines, one for 'GMO' feed and one for 'non-GMO' feed. If the feed is produced at the same line, there is a chance of cross contamination (non-GMO feed can be contaminated with GMO feed). During a contamination only the feed of one production line has to be recalled and not the other line. Another example where the impact could have been reduced was during the MPA crisis (2002); the molasses producer delivered contaminated molasses through *cross contamination* (PBA, 2002).

The research of Valeeva (2005) shows a conjoint analysis where control measures are related to food safety in the dairy chain. Separate production lines for feed with critical additives and veterinary medicines have a coefficient of 1.38 and the same production line for different types of feed has a coefficient of 0. In this research a coefficient means "the relative contribution of a control measure to improve food safety compared to the minimum food safety level"(Valeeva, 2005). Thus, separate production lines have an advantage. Although this research was conducted for the dairy industry, it shows the importance of separate production lines in order to improve food safety in the feed sector. Besides the link to the expected amount of risk, this attribute can distinguish companies based on the availability of

separate production lines. This attribute ("Separate production lines") is used in the conjoint analysis, the attribute levels are: yes or no.

Supplies to types of farms

Compound feed companies can deliver their feed to production farms (dairy cattle, sow), meat farms (hogs) or both. Table 4.6 presents the characteristics of the two main groups.

Table 4.6 Characteristics of production and meat farms.

	Gross margin (Euro per animal per year)	Value of animal	Cost of feed/100 kg	Number of farms	Total used feed (mln/kg) [1]
Production farms					
Dairy cattle	1925	1000[2]	14,3	19186	1860
Laying hens	4.3	2.07	18,8[3]	1533	1880
Sows	344	415.6	18,5	3658	1460
Total				24377[4]	5200
Meat farms					
Bulls	41	915	18.4	5365	11
Veal, rose	76	250	18,5	1392	235
Pigs	66	70.5	18,3	7576	1360
Broilers	0.17	0.07	22,8	748	1560
Total				15081[3]	3166

Source: CBS, KWIN 2008.

[1] Number of animals x amount of feed used by one animal.

[2] Value is based on expert opinion.

[3] Price without the price of biologic feed.

[4] No correlation for mixed farms.

If something is wrong with the feed there are several financial consequences at farm level. Financial consequences can be subdivided into 1) losses arising from growth disruption/downgraded quality and other losses associated with the standstill period and 2) culling and destruction of livestock (Asseldonk et al., 2006). Especially the second category is different between the two types of farms. This is because during a contamination, meat companies slaughter the animals (e.g. during the MPA crisis in 2002, 50.000 pigs were culled (Asseldonk et al., 2006)) and the production companies stop producing. The impact is therefore expected to be higher at meat farms. A part of table 4.6 shows the consequences of a contamination; the value of the animals (slaughtering by meat farms during a contamination) and the missing income. Besides the differences in impact, the table shows the differences in number of companies (more production farms) and the amount of feed that is delivered (more feed to production farms).

The attribute, “Supplied to”, can be used as an attribute because companies can be distinguished on this aspect and there is a difference in impact (risk). The attribute levels are “only meat farms” or “only production farms”. This is done to investigate the perceived differences in risk between these two types of farms.

Distribution to USA

Animal feed producers can deliver their products on national or international level. In total 90% is used in the Netherlands and 10% is exported. There is no research that gives details about the export countries or the risks of exporting compound feed. However, the United States is well known for their extreme claim culture. This vision is confirmed by the Dutch Authorities (Faire and Hartlief, 2002) and two insurance companies. The experts of the insurance companies both emphasized that compound feed companies, which are exporting to the USA, have a higher expected risk because the impact can be higher due to higher claims of the USA. It does not matter *what* they are exporting, but it matters *if* they are exporting. Thus, this attribute includes not only the export of compound feed but also other products that are exported by compound feed companies (e.g. cooperations are not only producing compound feed). Table 4.7 shows the available sector and export information.

Table 4.7 Sector information 2004/2005.

	Pigs	Poultry	Cattle	Remains	Total
Part of the sector	43%	25%	25%	7%	100%
Production (million ton)	5.1	3.1	3.3	0.83	12.33
% Export	10	12.9	6	15.66	10[1]
Export (million ton)	0.5	0.4	0.2	0.13	1.23
Export to USA	na	na	na	na	na
Export to other countries	na	na	na	na	na

Source: Lei (2004), na= not available.

[1] Pierick and Bolhuis (2005).

As can been seen in the table, the amount of export to the USA is unknown and the number of companies that export to the USA is unknown either. Because experts emphasized importance of exporting to the USA when considering a premium, this attribute is used in the conjoint analysis.

Table 4.8 gives an overview on the different attributes and table 4.9 shows the attribute levels of the selected attributes.

Table 4.8 Overview of described attributes and whether they are used or not.

Attribute	Related to amount of risk	Related to company' characteristics	Used
Types of compound feed	no	yes	no
Ingredients of the feed	yes	no	no
Origin of the ingredients	no	no	no
Type of feed	yes	yes	yes
Monitoring ingredients	yes	no	no
Claims in the past	no	no	no
Member of TrusQ or Safe Feed	yes	no	no
Traceability system	yes	no	no
Total production	yes	yes	yes
GMP+ or more	yes	yes	yes
Separate production lines	yes	yes	yes
Supply type of farm/ Clients	yes	yes	yes
Distribution to USA	yes	yes	yes

Table 4.9 Selected attributes and attribute levels.

Attributes	Attribute levels
Type of product	1. Only compound feed
	2. Only wet feed (single feed)
Production compound feed	1. More than 100.000 ton kg
(total company per year) [1]	2. Less than 100.000 ton kg
GMP+ or more[1]	1. GMP+
	2. GMP+ and more (e.g. ISO 9001)
Separate production lines[1]	1. Yes
	2. No
Supplied to (type of farm) [1]	1. Only production companies
	2. Only meat companies
Distribution to USA[1]	1. Yes
	2. No

[1] Only for compound feed companies (not wet feed companies).

4.4 Designing the questionnaire

The goal of the questionnaire is to investigate the clients' perception on the risk of the selected attributes. This will lead to the utility of each attribute level and the relative importance of every attribute. As can been seen in table 4.9, six attributes with each two attribute levels are used in the conjoint analysis. If all the selected attributes with their levels are combined, many different cases (2x2x2x2x2x2= 64) are accessible. In this questionnaire a case consists of one level of each of the six attributes. It is a company with six characteristics (the attribute levels). The process of selecting a subset of all possible cases must be done in a manner to preserve the *orthogonality:* "ability to measure the effect of changing each attribute level and to separate it from the effects of changing other attribute levels and experimental error" (Hair et al., 2006). This means: "no correlation among the levels of an attribute" (Hair et al., 2006). The SPSS function orthoplan constructed 10 cases of the selected attributes.

The questionnaire consists of three parts (Appendix A). First the cover letter describes the purpose of this research and questionnaire: to classify individual compound feed companies for insurances on product liability. Secondly, the 10 different cases (companies) have to be judged. The experts have to imagine that they have to invest in a 'fictive' company based on the food safety risk. For every case (i.e. company) the preference is measured with a scale from 1 to 7. The assumption is made that the experts will give a high score if the case (company) has a low risk. Thus, the experts are no 'risk searchers" (invest in high risk companies to acquire more profit). Consequently, the assumption for the score is: a company with a high score has a high preference and therefore less risk. The last part of the questionnaire consists of questions related to the attribute levels for their own company.

4.5 Data collection and sample

Compound feed companies, which are clients of the ABN AMRO, are consulted by means of a questionnaire on risk classification. They are considered to be experts on risks related to food safety. The consulted companies have different characteristics and at least one common characteristic: they have product liability insurance. Twenty-eight contact persons of the ABN AMRO were consulted by mail at the end of March. After this, they got a telephone call and they got the possibility to get a digital version of the questionnaire. Finally, when necessarily, they got a phone call again. Of the twenty-eight experts that were contacted, sixteen returned the questionnaire (response of 57%). Four questionnaires were originated from two compound feed companies (two employees filled in the questionnaire).

The sixteen questionnaires are used as a sample for the conjoint analysis. The computer program SPSS is used for analyzing the results. This program can carry out the conjoint analysis, which is used to estimate the utility of the attribute levels and importance scores of the attributes. The attributes, which are used in the conjoint analysis (table 4.9), are considered to be discrete variables. This means that no assumption is made about the relationship between the attributes and the scores.

5. Results

5.1 Importance and utility scores of the attributes

The utility of each attribute level and the importance of each attribute are presented in table 5.1. In our case, a positive utility means a higher preference to invest in a certain company and therefore the risk is expected to be lower (referring to the assumption that experts are no "risk seekers", paragraph 4.4). Thus, an attribute level with a positive score will have a lower perceived risk. An attribute level with negative score will have a higher perceived risk.

Table 5.1 Utilities & importance values (n=16).

Attribute	Importance (%)	Attribute levels	Utility
Product	32.03	Compound feed	0.78
		Wet feed	-0.78
Distribution to USA	30.35	Distribution to USA	-0.80
		No distribution to USA	0.80
Certificate	11.23	GMP+	-0.31
		GMP+ or more	0.31
Separate production lines	11.42	Separate production lines	0.19
		No separate production lines	-0.19
Size (ton kg)	8.07	> 100.000	-0.11
		< 100.000	0.11
Supplied to	6.91	Production farm	0.13
		Meat farm	-0.13
Total	100		

The attributes "Product" and "Distribution to USA" have the highest importance value followed by attributes "Certificate" and "Production lines" (i.e. 32.03% and 30.35% respectively). The percentages on importance show the importance of every attribute related to the perceived risk of a company. Thus, the total perceived risk of a company is more dependent on attribute "Product" and the "Distribution to the USA" than the dependency on attribute "Size" or "Supplied to".

Remarkable is the lower risk for compound feed than for wet feed. This because the impact during a crisis is expected to be higher for compound feed than wet feed (paragraph 4.3). Furthermore, the relative importance of attribute "Size" (8%) is lower than expected (the insurers both emphasized the importance of "Size"). Although the result of this attribute is in line with literature (a company with a production of >100.000 ton kg has a higher expected risk with factor 1.75 (paragraph 4.3)), the difference between the attribute levels in these results is very low.

5.2 Attribute levels of individual companies

The next table presents the results of the attribute levels of individual companies (where experts work). Compared to table 5.1, the attribute level "both" is incorporated. This because individual companies can have both attribute levels of one attribute (e.g. a company can deliver to production and meat farms).

Table 5.2 Attributes of individual compound feed companies (n=14)[1].

Attribute	Attribute level	Number of companies (n=14)
Product	Compound feed	12
	Wet feed	-
	Both	2
Distribution to USA	Distribution to USA	-
	No distribution to USA	14
Certificate	GMP+	3
	GMP+ or more	11
Separate production lines	Separate production lines	6
	No separate production lines	8
Size (ton kg)	> 100.000	12
	<100.000	2
Supplied to	Production farm	-
	Meat farm	-
	Both	14

[1] Two companies answered twice (different persons), n is not 16 as in table 5.1, but 14.

Table 5.2 shows several interesting aspects: only two companies sell wet feed and compound feed, non of the 14 companies are distributing to the USA, only two firms have a production of less than <100.000 ton (kg) and just three companies have "only GMP+".

5.3 Risk classification in the compound feed sector

As described in chapter three, different ways can be used for risk classification. For example; the categories can be divided in a A,B,C/1,2,3 status, or every attribute that is used for classifying gets a number of + or -. It is important to have a strong case for designing these categories.

To establish risk profiles the importance of each attribute is multiplied with the utility. As a result, every attribute level gets a separate score (table 5.3).

Table 5.3 Scores of every attribute (n=16).

Attribute	Importance	Attribute levels	Utility	Weighted utility [1]
Product	0.32	Compound feed	0.78	0.25
		Wet feed	-0.78	-0.25
Distribution to USA	0.30	Distribution to USA	-0.80	-0.24
		No distribution to USA	0.80	0.24
Certificate	0.11	GMP+	-0.31	-0.03
		GMP+ or more	0.31	0.03
Separate production lines	0.11	Separate production lines	0.19	0.02
		No separate production lines	-0.19	-0.02
Size (ton kg)	0.08	> 100.000	-0.11	-0.01
		<100.000	0.11	0.01
Supplied to	0.07	Production farm	0.13	0.01
		Meat farm	-0.13	-0.01
Total	1			

[1] Weighted utility: importance x utility.

With the scores of each attribute level, the individual total scores of companies can be calculated (table 5.4). Theoretically, the individual scores of each company are based on six attributes. However, as can be seen in table 5.2, no respondent distributes to the USA and they all deliver to meat and production farms. Therefore four attributes will influence the differences in the individual scores. These are: “Product”, “Certificate”, “Separate production lines” and “Size”.

Table 5.4 Scores of individual companies (n=14)[1].

Scores, all attributes [2,3]	0.24	0.43	0.44	0.45	0.49	0.54	0.55
Number of companies	2	1	1	2	2	5	1
Scores, without attribute “Product" [2]	0.18	0.19	0.2	0.24	0.29	0.3	
Number of companies	1	2	1	4	5	1	

[1] Because two companies answered twice (different persons), n is 14 instead of 16 (table 5.1).
[2] If the company sells to production and meat farms, the score of this attribute is 0.
[3] Every company uses compound feed. If a company also sells wet feed, the score of attribute product will be 0 (0.13-0.13=0).

The first row in table 5.4 shows two scores far below the average (outliers, 0.24). These low scores are caused by the attribute “Product”; companies that are trading in wet feed acquire a lower score, because the high score of compound feed (0.25, table 5.3) is reduced with the minus score of wet feed (-0.25, table 5.3). Thus, two companies with wet feed are causing these outliers. Because the results of attribute “Product” is in contrary with literature and it results in two outliers, the second row with scores presents the scores of individual companies without attribute “Product”.

After calculating the individual scores, there are several possibilities of classification. Four classification methods, which are related to the above results, are presented in table 5.5.

These methods are based on a) all attributes and b) all attributes but without attribute "Product". Two categories are established: a "high" and a "low" risk group. A "high" risk is related to a low score and a "low" risk is related to a high score. Again, the assumption is made, that experts are no "risk seekers".

Table 5.5 Classification methods.

Classification methods	Classification of sample	
	"Low risk"	"High risk"
All attributes		
1a. Median risk score (0,40)	12	2
2a. Average (0.45) [1]	10	4
3a. Weighted average risk score (0,46) [2]	8	6
4a. Score were 50% of the companies belong to [3,4]	≤ 0,49	>0,49
Without attribute "Product" [5]		
1b. Median risk score (0.24) [6]	10	4
2b. Average (0.23) risk score	10	4
3b. Weighted average risk score (0.25) [2, 7]	6	8
4b. Score were 50% of the companies belong [3,4]	≤ 0,24	> 0,24

[1] The average score is incorporated in the "low risk" group.
[2] Calculation of weighted average: score (table 5.4) x number of companies in the score "category"/n (14).
[3] With this score, 50% of the companies are in the "low risk" group and 50% in the "high risk" group.
[4] The 50% scores (i.e. 0.49 and 0.24 respectively) are incorporated in the "low risk" group.
[5] Two outliers in the results of the overall scores are not used in this calculation. These outliers were caused by the attribute product. Therefore this attribute is not taken into account in this calculation.
[6] The median score is incorporated in the "low risk" group.
[7] The weighted average score is incorporated in the "low risk" group.

In classification method 1a. two companies belong to the "high risk" category. These two companies are the companies with the attribute level wet feed (attribute "Product"). The attribute "Product" is incorporated in classification method 1a,2a,3a and 4a. Thus, these methods are based on four attributes:"Product", "Certificate", "Separate production lines" and "Size". Attributes "Distribution to USA" and "Supplied to" are not of importance because all fourteen companies have the same scores on these attributes. Methods 1b,2b,3b and 4b are based on three attributes: "Certificate", "Separate production lines" and "Size".

6. Conclusions and discussion

6.1 Conclusions

Risk classification in the food and agribusiness

Risk classification is defined as the process of sorting insurance applicants into categories based on their expected risk (Baker, 2001). Although it is widely applied by insurers, examples in the food and agribusiness are very scares. Four examples are found in literature. Three of them have the purpose to classify companies; these classification methods are used for an animal health fund, crop insurance and for classifying suppliers of individual compound feed companies. The fourth one is used to classify products based on their microbiological hazards (table 3.1). Categories can be based on a number of criteria (in the examples 3 to 5 criteria), like location, type of crop, farm type and types of hazards.

Risk classification for compound feed companies

Because the current available data was not adequate for classifying companies into categories, the perception of experts was used. Experts had to give their judgments on different attributes (in this research company characteristics). Thirteen attributes were reviewed, but only six were suitable for use. This because these attributes provided a link to the amount of risk and they are suitable to distinguish companies from each other. The other seven failed in providing one of these links. The used attributes and attribute levels are: "Product" (compound or wet feed), "Distribution to USA" (yes or no), "Certificate" (GMP+ or GMP+ and more), "Separate production lines" (yes or no), "Supplied to" (production or meat farm) and "Size" (production of >100.000 ton kg or <100.000 ton kg).

The importance and the utility score of every attribute is calculated with a conjoint analysis by computer program SPSS. The attributes "Product" and "Distribution to USA" have the highest importance value (i.e. 32.02%, 30.35 respectively) followed by "Certificate" and "Production lines" ((i.e. 11.23%, 11.42% respectively) and "Size" and "Supplied to" (8%, 7% respectively).

After analyzing the results, four possible methods of classifying were established. These methods are based on the median, average, weighted average and the score where 50% of the companies belong. These methods are applied on the individual scores of the compound feed companies (which filled in the questionnaire). Based on one of the four methods, companies are classified in category "high risk" or "low risk". The results of the attribute "Product" were not in line with literature and caused two outliers in the results. Therefore the four methods are also applied without this attribute. Attribute "Distribution to USA" and "Supplied to" are not used in this classification, because all companies (that filled in the questionnaire) are not distributing to the USA and all companies deliver to meat- and production farms. The differences between the "high" and "low" risk category are caused by four attributes: "Product" (only by the calculation with this attribute), "Certificate", "Separate production lines" and "Size".

6.2 Discussion

Attributes

"Member of TrusQ or Safe Feed"

This attribute was not used in the conjoint analyses because 99% of the compound feed producers was supposed to be member of Safe Feed or TrusQ (Theloson, 2007). This statement was confirmed by experts and the literature about the market shares of Safe Feed and TrusQ (together more than 100% (footnote, table 2.3)). However, the total number of members of Safe Feed or TrusQ (+- 76) are not equal with the total number of compound feed companies (132). It might be possible that a number of compound feed companies are not a member of Safe feed or TrusQ. Therefore this attribute could be used to distinguish companies from each other and be used in the conjoint analysis after all.

"Product"

Attribute "Product" is used because the assumption was made that compound feed companies can be distinguished on selling wet feed and compound feed or only compound feed. However, after analyzing the results of the questionnaire, it seems that only two of the fourteen compound feed companies are selling compound and wet feed. This raise the discussion if this attribute is chosen well; can compound feed companies been distinguished on this aspect?

"Distribution to USA"

Both insurers gave the impression that attribute "Distribution to USA" was important when calculating the premium. It didn't matter what they were exporting, but it matters if they are exporting. However, non of the compound feed companies were exporting to the USA. This raise the question, how often compound feed companies are exporting to the USA and if this attribute can be used to differentiate between companies.

"Certificate"

Attribute "Certificate" consisted of the attribute levels "GMP+" and "GMP+ and more". In the questionnaire, examples were given on the last attribute level. However it can be interpreted differently by experts, like choosing this attribute level based on a certificate that has nothing to do with food safety. Besides this, several experts believe it is questionable if a company with more certificates have lower risks.

"Separate production lines" and "Size"

There are no discussion points for these attributes.

"Supplied to"

Attribute "Supplied to" is chosen because literature shows a difference between the risk of supplying to a meat or production farm. However, the utility scores of the conjoint analysis (related to this attribute) do not confirm this. Besides this, table 5.1 shows a very low importance score (7%). This raises the question if this attribute is chosen well.

Representativeness of sample

Knowledge of experts

The questionnaire was sent to twenty-eight clients of the ABN AMRO. These clients were considered to be experts on food safety related risks. For the largest part this was correct, because the clients were mostly operational directors or owners of the company and therefore they have a lot of knowledge on the involved risks. However, in some cases the experts were only working in on part of the company (e.g. finances) and therefore they did not have an overall view of the companies' risks.

Presence of the attributes

The attribute "Distribution to the USA", which was considered to be of importance by experts (paragraph 4.3 and table 5.1), and attribute "Supplied to", which was considered to be of importance by literature are not represented in the sample. Besides the absence of these attributes, the attribute level "< 100.000 ton kg" (attribute "Size") is represented only twice.

Size of sample

Fourteen compound feed companies returned the questionnaire. Because two attributes ("Distribution to the USA" and "Supplied to") are not represented in the sample and attribute level "< 100.000 ton kg" is only represented twice, it is questionable if the size of the sample is not too small.

Risk classification

Utility and importance scores of attribute "Product"

When filling in the questionnaire with a client, the attribute "Product" was judged differently than the others. The expert said "currently I only have compound feed, thus I do not invest in a company with wet feed". This can be the reason that the utility scores of the attribute levels are in contrary with literature.

Two categories

Within the classification methods, the sample of the questionnaire is categorized in two categories: "high" and "low" risk category. It is possible to establish more categories, like a category in between.

Larger sample

No respondent delivers to the USA and all respondents deliver to meat and production farms. Therefore these attributes are not used in the classification methods. If the sample was larger, these attributes could change the results of the classification methods. Besides this, the attribute "Size" can change the results because in a larger sample compound feed companies with a production of <100.000 ton kg would be more representative.

6.3 Recommendations and further research

Recommendations for insurance companies

This research provides different attributes and different methods, which are used for risk classification. It is not recommended to immediately apply these risk classification methods because the methods are based on only three attributes and the differences between the scores are very low.

Further research

Because paragraph 6.2 presents many discussion points related to the representativeness of the sample, the conjoint analysis can be carried out on a larger scale. This may lead to different results and different classification methods.

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Appendix A Questionnaire conjoint analysis

Wageningen, 28 maart 2008

Geachte XXX,

Vanuit de keten is de laatste jaren veel aandacht besteed aan het verzekeren van de productaansprakelijkheid van diervoederbedrijven. Bij het afsluiten van een verzekering is goed inzicht in de risico's van groot belang. Niet elk bedrijf heeft hetzelfde risico. Hier zouden verzekeringsmaatschappijen op aan kunnen sluiten door middel van zogenaamde risicoprofielen.

Momenteel ben ik bezig met mijn afstudeeronderzoek dat betrekking heeft op het creëren van risicoprofielen binnen de diervoedersector. Een belangrijk onderdeel in dit onderzoek is de bijgevoegde vragenlijst. Deze vragenlijst is kort en duurt maximaal 15 minuten.

Graag zou ik u willen vragen om deze vragenlijst in te vullen en te retourneren voor 9 april a.s. Mocht u nog vragen hebben, hulp nodig hebben bij het invullen of meer informatie wensen, neem dan gerust contact met mij op. U kunt uw vragenlijst retourneren via email, fax of u kunt de vragenlijst opsturen naar onderstaand contactadres.
Na afronding van dit onderzoek stel ik u graag op de hoogte van de resultaten. Hiertoe kunt u desgewenst aan het eind van de vragenlijst uw adresgegevens invullen. Uiteraard wordt over dit onderzoek alleen op geaggregeerd niveau gepubliceerd.
Alvast bedankt voor uw medewerking, mede namens mijn afstudeerbegeleidster.

Met vriendelijke groet,

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Deel 1 Risicoprofielen in de diervoeder sector

Middels de vragen wil ik graag inzicht krijgen in uw persoonlijke voorkeur omtrent bedrijven met verschillende eigenschappen. De vragenlijst is opgebouwd uit een lijst met 10 fictieve veevoerbedrijven, elk bedrijf heeft zijn eigen profiel. Dit profiel bestaat uit 6 bedrijfseigenschappen welke allemaal een invloed hebben op het bedrijfsrisico met betrekking tot de voedselveiligheid. De volgende eigenschappen zijn mogelijk:

Hoofdeigenschap	**Variabelen**
Soort diervoeder	1. Alleen mengvoer 2. Alleen vochtrijk voer (enkelvoudig)
Productie mengvoer, totale bedrijf per jaar	1. minder 100.000 ton 2. meer dan 100.000 ton
Certificaat	1. GMP+ 2. GMP+ en meer (b.v QS, ISO 9001, ISO 22000)
Strikt gescheiden productielijnen*	1. Ja 2. Nee
Beleverde veehouderijen	1. Alleen productiebedrijven (melkvee, leghennen, zeugen) 2. Alleen vleesbedrijven (vleesvee, vleeskuikens vleesvarkens)
Distributie naar VS	1. Ja 2. Nee
* Verschillende productielijnen om kruisbesmetting te voorkomen (bv GMO en niet GMO voer)	

Stel u voor dat u een bedrijf kunt overnemen. Rekening houdend met de risico`s kunt u uw voorkeur aangeven, deze voorkeur heeft een schaal van 1 (heel weinig voorkeur) tot 7 (heel veel voorkeur).

Bij het invullen van de vragen gelden geen goede of foute antwoorden. Het gaat om uw persoonlijke voorkeur.

Omcirkel of markeer bij elk bedrijf uw voorkeur.

Bedrijf:	Heel weinig voorkeur			Gemid-delde voorkeur			Heel veel voorkeur
Bedrijf 1 - Alleen mengvoer - GMP+ en meer - Geen strikt gescheiden productielijnen - Geen distributie naar VS - Minder dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7
Bedrijf 2 - Alleen vochtrijke voeder - GMP+ en meer - Geen strikt gescheiden productielijnen - Distributie naar VS - Meer dan 100.000 ton - Alleen belvering van vleesbedrijven	1	2	3	4	5	6	7
Bedrijf 3 - Alleen vochtrijke voeder - GMP+ en meer - Strikt gescheiden productielijnen - Distributie naar VS - Minder dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7
Bedrijf 4 - Alleen mengvoer - GMP+ - Strikt gescheiden productielijnen - Distributie naar VS - Meer dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7
Bedrijf 5 - Alleen vochtrijke voeder - GMP+ - Strikt gescheiden productielijnen - Geen distributie naar VS - Minder dan 100.000 ton - Alleen belvering van vleesbedrijven	1	2	3	4	5	6	7

Bedrijf:	Heel weinig voorkeur			Gemid-delde voorkeur			Heel veel voorkeur
Bedrijf 6 - Alleen mengvoer - GMP+ en meer - Strikt gescheiden productielijnen - Geen distributie naar VS - Meer dan 100.000 ton - Alleen belvering van vleesbedrijven	1	2	3	4	5	6	7
Bedrijf 7 - Alleen mengvoer - GMP+ - Geen strikt gescheiden productielijnen - Distributie naar VS - Minder dan 100.000 ton - Alleen belvering van vleesbedrijven	1	2	3	4	5	6	7
Bedrijf 8 - Alleen vochtrijke voeder - GMP+ - Geen strikt gescheiden productielijnen - Geen distributie naar VS - Meer dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7
Bedrijf 9 - Alleen vochtrijke voeder - GMP+ - Strikt gescheiden productielijnen - Geen distributie naar VS - Minder dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7
Bedrijf 10 - Alleen mengvoer - GMP+ - Geen strikt gescheiden productielijnen - Distributie naar VS - Meer dan 100.000 ton - Alleen belevering van productiebedrijven	1	2	3	4	5	6	7

Deel 2 Uw eigen bedrijf

Kruis aan wat voor uw bedrijf van toepassing is:

Soort diervoeder:	☐ Alleen mengvoer ☐ Alleen vochtrijke (enkelvoudig) voeder. ☐ Beide
Productie mengvoer, totale bedrijf per jaar:	☐ Minder dan 100.000 ton ☐ Meer dan 100.000 ton
Certificaat:	☐ Alleen GMP+ ☐ GMP+ en meer (QS, ISO 9001, ISO 22000, AIC , OVOCOM)
Strikt gescheiden productielijnen:	☐ Ja, strikt gescheiden ☐ Nee, niet strikt gescheiden.
Beleverde veehouderijen:	☐ Alleen productiebedrijven ☐ Alleen vleesbedrijven ☐ Zowel productiebedrijven als vleesbedrijven.
Distributie naar VS:	☐ Ja ☐ Nee

Graag stellen we u na afronding van ons onderzoek op de hoogte van de resultaten. Hiertoe kunt u uw adresgegevens invullen.

Uw naam: _____
Firma:
_____
Adres:
_____
_____
Functie: _____

Dit is het einde van de vragenlijst. Nogmaals hartelijk dank voor uw medewerking!