

IMPLICATIONS OF CHANGING GENERAL MARKET CONDITIONS ON PRODUCT QUALITY AND QUALITY ASSURANCE IN THE GERMAN PORK PRODUCTION

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Abstract

The purpose of this paper is to derive suggestions for product quality and quality assurance in German pig production from general market conditions. It is argued that developments in trade, the EU agricultural policy and legislation increase the already existing disadvantages in competitiveness of German pork producers. The German consumers, food retailers, meat processors, and large-scale consumers mainly demand low priced pork and special hygienic quality whereas process quality characteristics such as regional production or animal welfare are of lower importance. Against this background, low priced meat and special hygienic quality must be the quality characteristics to be assured. In order to achieve a sustainable animal production in Germany, a closer co-operation between the participants of the food production chain and the increase in average pig stock size to gain profit from cost depressions is required.

1 Introduction

The production value of DM 7 billion in the financial year 1998/99 underlines the importance of the German pig production for the agricultural sector.² However, the German pork producing sector has lost market share in the EU. It is regarded as not being prepared for the increasing competition mainly because of the following reasons:

- High production costs. The main competitors on the European market profit by lower production costs due to advantages in farm structure and the organisational degree of production and marketing.³
- Low product and process quality. By now, warranted elements of the Danish national quality assurance system are traceability and assurance of origin. Germany is still occupied with establishing the basic conditions.⁴
- Lack of organisation in production and marketing. The atomistic supply structure of the German agriculture is confronted with the market power of highly concentrated retailers. Higher degree of integration among the participants of the production chain are necessary for the co-ordination and the implementation of new standards.

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² BMELF (2000).

³ E.g., feed costs and expenditures for buildings in the Netherlands and Denmark are lower than those in Germany. Compare: BRILL (1996). - N.N._A (1999), p.1 – SCHULZE (1995). - USDA (1999), p. 34. - WOLFFRAM (1998), p. 39.

⁴ Danske Slagterier, p. 2. - N.N._E (1998), p. 29 – N.N._B (1999), p. 15.

These disadvantages have to be overcome. Therefore, the aim of this study is to derive suggestions for product quality and quality assurance in German pig production from general market conditions. The following questions have to be answered:

1. How will German pig and pork production be influenced by EU legislation in the future?
2. What kind of product characteristics are demanded by German consumers, retailers and the meat processors?
3. Which measures are capable to improve the standards of a sustainable animal production according to product quality and quality assurance in Germany with special regard to the economic impact?

2 Implications of changes in the general framework of the German pork market

Changes in legal market conditions comprise developments of agricultural policy in international trade and within the European Union as well as aspects of food safety and animal welfare. They influence the competitiveness of the German pork production sector.

2.1 Changes in trade regulations, EU agricultural policy and EU enlargement

The following factors will increase the excess supply of pork in the EU and lead to price pressure:

- Cutback of subsidised exports. In the range of the ongoing WTO- negotiations, the EU already conceded a cutback of subsidised exports. However, this restriction becomes less binding in the face of the support price reduction for cereals which lowers the feed costs and increases the competitiveness of pork on the world markets.
- Increase of minimum market access.
- A reduction of pork consumption. Although the Agenda 2000 does not imply changes in the market organisation for pork, the reduction of the market support price for beef results in a shift from pork to beef consumption, especially in the processing industry.

A decrease in supply of pigs and pork in the present EU countries owing to the EU enlargement is not expected in the short- or medium-term.⁵

The changes of these general market conditions can be summarised as follows. The changes in trade regulations, EU agricultural policy and the EU enlargement will have significant impact on the German pork market. Additional supply weakens the competitiveness of European exports on the world export markets⁶ and leads to increasing price pressure on the EU market. Marginal suppliers will be forced out of production. This especially affects structurally weak regions in Germany where cost disadvantages already exist.

2.2 Food Safety

The following product damages are related to the production of meat:

⁵ WINDHORST (1999), p. 80.

⁶ Different studies emphasise that the production costs, e.g. in Canada and the USA, are overall lower than in the EU. Compare: BREWER, KLIEBENSTEIN, HAYENGA (1998). - HAYENGA et al. (1998). - ABN AMRO-BANK N.V. (1997).

- Contamination with micro-organisms. It is estimated that about 20 % of human cases of salmonellosis are caused by consumption of pork.⁷
- Other contaminants and residues.
- Foreign bodies, e.g. broken injection needles.

The EU's goal is to protect the consumers' health by increasing the standards of food safety to the highest level possible. This shall be achieved mainly through⁸

- control of food in every step of production. The planned General Food Law requires the implementation of elements of hazard analysis control principles, and the observance of hygiene rules in the whole food production chain. The adaptation to the pig farmers' situation is put up for discussion. The proposal contains explicit principles for good practice in agriculture.
- traceability. To improve traceability also for disease prevention and assurance of origin, each EU country has to implement a central database where every pig movement has to be registered. The database requires electronic labelling and identification systems that do not exist in Germany by now.
- including the agricultural production into the product liability.⁹ In the past, it has been difficult to trace back product deficiencies to the farmers because it was not possible to differentiate between the single products. Agricultural products are often mixed up in the process of united storage, transportation, cleansing, processing, and marketing. Additionally, agricultural products are usually distributed without any individualising packaging and labelling.

The German Ministry of Agriculture objects to the establishment of a database because of difficulties in realisation and already sufficient existing rules.¹⁰ German measures to improve product safety support the reduction of pig transports and of mixing up different origins as an indirect prevention. The fees for pest insurance, e.g. in North Rhine-Westphalia, are lowered when fatteners receive piglets from only up to 3 farms.¹¹ In addition, the German government started a national eradication and disease control programme against salmonellosis in pork where participation was voluntary. It was abandoned by the end of last year because of a lack of interest. At the moment, the ministry plans to introduce a directive. Fatteners will be legally forced to control the slaughter pigs concerning salmonella. Samples have to be taken and controlled at the slaughterhouse.¹²

It is obvious that the German pork sector only follows the EU legislation without own initiative. The implementation of higher standards in food safety causes additional expenses but this is valid for all producers in the EU. As quality assuring measures are subject to cost de-

⁷ STEINBACH, HARTUNG (1999), p. 299.

⁸ Commission of European Communities (2000).

⁹ Directive 1999/34/EC.

¹⁰ INGWERSEN (2000), p. 8. - Council Directive 97/12/EC. - Verordnung zum Schutz gegen die Verschleppung von Tierseuchen im Viehverkehr (Viehverkehrsverordnung).

¹¹ BOWINKELMANN (1999), p. 30.

¹² BMELF (1998). - N.N.c (2000), p. 20.

gression, the competitiveness of large scale producers increases even more. Marginal producers will be forced out of production.

2.3 Animal Welfare

Animal welfare is supported because of ethical aspects and concerns about product quality. It is directly connected with performance measurements and with the application of veterinary medicine. It also affects the quality of meat. Proper animal keeping reduces the susceptibility for diseases. The two main tendencies are

- the EU wide prohibition of (fully) slatted floors. Slatted floors are widespread in the EU and also in Germany because of advantages in labour productivity.¹³
- intensification of the German animal welfare legislation. The Federal Constitutional Court is likely to check the conformity of the German regulations of pig housing with the German law about animal protection as it was the case with laying hens. If it is found not to be conform, the German legislation may be forced to improve the pig welfare standards to a level above those of the EU. This unilaterally increases the production costs with the consequence of reduction in German production.¹⁴

Although the standards for pig keeping are raised in the EU in general, especially German producers suffer from additional production costs because measures in animal welfare are also subject to cost degression. The marginal producers in Germany will have to give up production.

3 Requirements of the demand side for pork

The demand side consists of consumers, retailers, meat processors, large-scale consumers, gastronomy and catering. These groups request different quality items according to their goals.

3.1 German consumers

When asked to rank quality characteristics of meat according to the importance in buying decisions, the consumers mention elements of product quality, measurable at the product itself, and of process quality not measurable at the product.¹⁵

- Product quality comprises flavour and taste, appearance, health aspects (e.g., low fat), packaging, juiciness, and frying characteristics.
- Process quality includes elements of animal welfare, product safety, regional origin, ecology, and labelling.

¹³ ZDS (1999), p. 7. - RATSCHOW (1999). - FRANKE (1999). - ZDS (1998), p. 140. – Scientific Veterinary Committee (1997), p. 137.

¹⁴ Tierschutzgesetz. - Bundesverfassungsgericht (1999). - Verordnung zum Schutz von Schweinen bei Stallhaltung (Schweinehaltungsverordnung). - Council Directive 91/630/EEC.

¹⁵ v. ALVENSLEBEN (1999). - BECKER, GLITSCH, HOLZAPFEL (1995). - OVERHOFF. - WIRZ (1996).

Since consumers more and more buy cheap offers, their behaviour is inconsistent with their statements. Although items like animal welfare, traceability and assurance of origin are discussed in public, the main criterion in meat purchasing remains the price.¹⁶

At least, two facts indicate that the price is the main buying criterion for the consumer:

- The growing importance of discounters.¹⁷
- The small market share of pork produced under special regulations.¹⁸

Only few and limited market segments are left for products with special process quality items.

General trends in pork consumption are¹⁹

- the rise in demand for processed meat. At present (1999), pork consumption is at 57.5 kg again, with 41 kg of human consumption. Generally, the human consumption of meat consists of 50 % fresh meat and 50 % meat products. From 1980 to 1998, a steady decline in fresh meat consumption can be observed. It was replaced mainly by sausages, the most important meat products.
- more pre-packed meat. The still growing share of pre-packed meat and meat products including sausages accounted for nearly 40% (1998/99) of the private purchases.
- the increase in out-of-home consumption. The number of meals taken outside is steadily increasing. About one third of those meals contains meat.

Furthermore, processed meat, pre-packed meat and consumption out-of-home belong to the overall convenience trend.

3.2 Food retailers

The following trends emphasise the requirements of the food retailers:

- The food market is highly concentrated. In 1998, the top 5 in German food retail had a 64 % share in total sales volume. Most of the meat and meat products are sold through food retailers. A steady increase in price competition which is caused by the consumers' demand also affects the meat prices. Additionally, meat is often used as a special offer. The consumer prices for pork have been declining in 1998 and the first half of 1999 with a trend to stabilise in the second half.²⁰
- Retailers stated their expectations towards their suppliers in the so-called "Frankfurter Deklaration". They demand, among other things, ISO certificates, a special status of hygiene, a HACCP concept, proper keeping and transportation of the animals, and a certifi-

¹⁶ Compare: Problem of social desirability at consumer interviews. BORTZ, DÖRING (1995), p. 212.

¹⁷ DFV.

¹⁸ E.g., the market share of "Prüfsiegel" labelled pork, produced under guidelines of the CMA, was only 5 %. The Danish initiative to label a guaranteed proper pig keeping has failed up to now because of the consumers' unwillingness to pay a higher price for it. - CMA (1999). - ZMP. - N.N._D (2000), p. 28- VERSEPUT (2000).

¹⁹ DFV. - ZMP (1999).

²⁰ M+M EUROdATA (2000). - DFV. - ZMP.

cate of origin.²¹ Although products produced under these regulations would be available, the retailers follow the consumers wish of low prices.

- Butchers lose market share. They concentrate on the high quality segment combined with consumer confidence and consumer orientation. Sensorial characteristics (tenderness, juiciness, taste/flavour, smell), hygienic factors and other features (German origin, produced by taking care of the environment, freshness) are important buying criteria for the butchers. The price is of lower importance. The microbiological guarantees and certificates lose significance because the consumers heat and cook most of the meat from the butcher's shop and thereby destroy pathogens. The consumers rely more upon a personal relationship, e.g. with a butcher, than on a quality label.²²

3.3 Meat processors

The meat processing industry is interested more explicitly in special quality characteristics because some elements directly influence the processing. Therefore, the meat processors demand

- a technological applicability determined by a defined protein, fat and water content, and a defined pH value.²³
- good microbiological condition. High demands towards the hygienic level result from the fact that many meat products such as raw salted meat, raw sausages, minced meat (contributing to more than one third of the consumption of meat products) are not cooked at all, neither in processing nor in the household and bear the risk of containing not destroyed infectious pathogens. Additionally, there are meat products only heated in processing, such as cooked salted meat, boiled sausages, cooked sausages, and aspic products. They also account for more than one third of the meat products' consumption.²⁴ In addition to the health risk for the consumers, undesirable micro-organisms can disturb the processing.
- no residues. The products have to be free from residues such as environmental chemicals, veterinary medicine, growth promoters and foreign bodies,²⁵ because they also can negatively influence the production process.
- uniformity of the supply. Meat processors demand uniform supply and a standardisation of raw material²⁶ in order to better control the production process.

Other features concerning the agricultural production are of less importance. Instead of labelling the origin of the raw materials, the regional specialities in processing should be stressed. In addition, the brand of the processor is more important than the labelling of the region.²⁷ The regional origin might be interesting for special segments but the processing industry that distributes nationally would need a great amount of meat which is not available in one region.

²¹ PETERS (1996), p. 59.

²² DFV. - PETERS (1996), p. 74. - WIRZ (1996), p. 57. - v. ALVENSLEBEN (1995), p. 56.

²³ SCHMALHOFER (1999), p. 51. - TIMM, HERRMANN (1996), p. 112.

²⁴ DFV.

²⁵ VOGELSANG (1997). - SCHMALHOFER (1999), p. 45.

²⁶ POTTEBAUM (1996), p. 120. - VOGELSANG (1997).

²⁷ POTTEBAUM (1996), p. 39.

Although not explicitly mentioned, the price is also of importance for meat processors because of the consumers' wish to buy cheap products. Additional value cannot be conveyed for most of the products by the meat processor. This is caused by the distance to the animal and the fact that meat often only remains a small part in a composed end product.

3.4 Large-scale consumers, gastronomy, and catering

The increasing importance of large-scale consumers, the gastronomy and catering is closely related to a reduction in household size, the greying population and the convenience trend. Just as meat processors, this group has difficulties to convey additional process qualities to their customers. Especially large-scale consumers are forced to buy cheap meat because of a limited budget. Additionally, gastronomy and catering services depend on good taste but less on process quality.

3.5 Conclusions

The demand side mainly concentrates on low prices and the hygienic quality. The consumer is not willing to pay more for further quality elements. The segments with special guarantees for process quality characteristics are small.

4 Implications

The development of strategies for adequate quality assurance and product safety requires the consideration of legal aspects and demand of consumers. The mentioned aspects show that quality is defined differently by every market participant but still the main criterion remains the low price, followed by hygienic aspects and a sufficient amount of standardised meat. To participate in the different market segments, the German producers have to fulfil certain requirements. Those are described for the following demanded product and process qualities:

- **Low prices.** In general, the German producers are badly prepared to meet this issue because of already existing disadvantages in production costs. Developments in trade, the EU agricultural policy and legislation in addition to the consumers' demand will increase the disadvantages. Furthermore, the importance of the price for buying decisions is heightened because the possibilities of quality differentiation are reduced by the intensification of legal requirements. Increasing price pressure implies the reduction of production volume especially in structurally weak regions. Other countries such as Denmark or Spain are going to fill the gap until they are forced to stop their expansion in production. The German producers must lower their production costs mainly through improvements in structure to gain profits from in economies of scale.
- **Hygienic quality.** This issue is mainly fostered through legislation. In addition, the market segment of meat and meat products which are hygienically sensitive is growing in importance. Again, the German producers are badly prepared to fulfil the requirements in comparison to their main competitors because of the low organisational degree in German production. The industry hardly benefits from existing relationships. It forces the pig producers to become part of an uninterrupted system to trace back products from the store to the farm in case of product deviations. Another advantage would be an improved adaptability of the pork sector on changing general market conditions. The starting point has to be the protection of animal health. Therefore, basic elements have to be a standardised registration process, which starts with the registration of all animals and animal movements on every farm and obligatory regular veterinary care and advice. Due to the large

variety of specific operational characteristics, a general framework has to be built up with concepts adjustable to every farm's situation. It has to be considered that means of quality assurance are subject to degression of costs.²⁸ Due to already existing disadvantages, the efforts of German producers should be restricted to fulfil the legal requirements. Additional measures to take are improvements in structure, namely the increase in the average stock size, and a higher organisational degree.

- Large uniform pork cuts. Prerequisites for large uniform pork cuts standardised according to customers requirements are the production on large-scale farms or the co-ordinated production in organisations using the same genetics and production methods and combining the animals to larger units. Due to the special situation in Germany with mainly small scale farms and unorganised production, an intensified co-operation and increases in the average pig stock size are necessary to achieve the goal. Firstly, regional co-ordination should take precedence of national co-ordination due to regional characteristics. When established, national measures can more easily be implemented, respectively the pooling of desired qualities and co-ordination of the sales-volume.
- Process quality characteristics. Only a small market segment values process quality characteristics, such as regional production and animal welfare. Additional supply would lower the price and displace the marginal suppliers. Although consumers express their willingness to pay higher prices for food from the region or for animal welfare, these higher prices cannot be achieved because the supply with qualitatively equal products is bigger than the demand for higher priced products.²⁹ So, it does not make sense for most of the producers to invest in these market segments. Animal welfare has to be improved mainly in accordance with increasing standards in the hygienic quality. Controls of housing systems have to be adjusted and tailored to individual operational conditions and special forms of housing. In order to prevent product damages caused by exhausting transportation, a regional co-ordination is required through a well-balanced relation between places for sows and fattening pigs. Again, larger farms profit from cost degression effects so that German producers should increase their stock size.

In order to achieve a sustainable pig production in Germany, the main qualities that have to be assured are a low pork price and a high hygienic quality based on legal requirements. This goal must be supported by reductions in production costs mainly through increases in the average pig stock size and a higher organisational degree.

²⁸ SIMONS (1999).

²⁹ WOLFFRAM (1997), p. 89.

References:

- ABN AMRO-BANK N.V. (1997): De Varkenshouderij in de Europese Unie vergeleken met Noord-Amerika. Amsterdam.
- v. ALVENSLEBEN, R. (1995): Den Imageverlust von Fleisch bremsen. DLG-Mitteilungen, No. 3, pp. 55-57.
- v. ALVENSLEBEN, R. (1999): Verbraucherpräferenzen für regionale Produkte: Konsumtheoretische Grundlagen. Lecture/ Vortrag auf der Wissenschaftlichen Arbeitstagung "Regionale Vermarktungssysteme in der Land-, Ernährungs- und Forstwirtschaft - Chancen, Probleme und Bewertung" des Dachverbandes wissenschaftlicher Gesellschaften der Agrar-, Forst-, Ernährungs-, Veterinär- und Umweltforschung e.V. am 25./26.11.1999 in Bonn.
- BECKER, T., GLITSCH, K., HOLZAPFEL, R. (1995): Neue Organisationsformen der Qualitätssicherung bei Fleisch und Fleischprodukten. Schriftenreihe der Landwirtschaftlichen Rentenbank, Vol. 9. Frankfurt am Main, pp. 113-164.
- BMELF (1998): Bekanntmachung der Leitlinien für ein Programm zur Reduzierung des Eintrags von Salmonellen durch Schlachtschweine in der Fleischgewinnung. Bundesanzeiger No. 44/98, 5.3.98, p. 2905.
- BMELF (2000): Agrarbericht der Bundesregierung 2000. <http://www.bml.de/landwirtschaft/ab-2000/ab00/material/tab009.htm> (29.03.00).
- BORTZ, J., DÖRING, N. (1995): Forschungsmethoden und Evaluation. 2., vollst. überarb. und aktualisierte Auflage, Berlin, Heidelberg.
- BOWINKELMANN, H. (1999): Was die Tierseuchenkasse 2000 kassiert. Landwirtschaftliches Wochenblatt Westfalen-Lippe, No. 48, pp. 30-31.
- BREWER, C., KLIEBENSTEIN, J., HAYENGA, M. (1998): Pork Production Costs: A Comparison of Major Pork Exporting Countries. Department of Economics, Iowa State University (ed.), Staff Paper Series, No. 302, Ames.
- BRILL, M. (1996): Der Einfluß der vertikalen Integration auf die regionale Wettbewerbsstellung der Schlachtschweineproduktion und -vermarktung. Diss., Bonn.
- Bundesverfassungsgericht (1999): Entscheidung des Bundesverfassungsgerichts zur Hennenhaltungsverordnung vom 12.8.1999 (Az. 2 BvF 3/90). BGBl. I, Nr. 45 vom 13.9.1999.
- CMA (1999): Charts aus der Präsentation. http://www.cma.de/d/a/pruefsiegel/stat_charts.asp (23.04.99).
- Commission of the European Communities (2000): White Paper on Food Safety. Brussels, 12.01.2000. http://europa.eu.int/comm/dg24/library/pub/pub06_en.pdf (13.01.00).
- Council Directive 97/12/EC of 17 March 1997 amending and updating Directive 64/432/EEC on health problems affecting intra-Community trade in bovine animals and swine. Official Journal L 109, 25/01/1999 pp.0001-0037.
- Council Directive 91/630/EEC of 19 November 1991 laying down minimum standards for the protection of pigs.
- Danske Slagterier: Rückverfolgbarkeit und Herkunft in der dänischen Schweineproduktion. Kopenhagen.
- DFV: Geschäftsberichte. Frankfurt/Main, various years.
- Directive 1999/34/EC of the European Parliament and of the Council of 10 May 1999 amending Council Directive 85/374/EEC on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products. Official Journal L141, 04.06.99.
- FRANKE, W. (1999): Moderne Haltungsverfahren zur Verbesserung der Tiergerechtigkeit und Akzeptanz. Vortrag auf der DLG-Fachtagung "Schweineproduktion unter neuen Rahmenbedingungen" am 27.10.1999 in Güstrow-Bockhorst.
- HAYENGA, M. ET AL. (1998): Global Competitiveness of the U.S. Pork Sector. Department of Economics, Iowa State University (ed.), Staff Paper Series, No. 301, Ames.
- INGWERSEN, J. (2000): Mit zunehmender Gesetzesdichte ins neue Jahrtausend. SUS, No. 1, pp. 6-9.
- M+M EUROdata (2000): Konzentration im deutschen Lebensmittelhandel. <http://mm-eurodata.de/presse/99112301.htm> (18.02.00).
- N.N._A (1999): Anhaltender Trend zu größeren Viehbeständen. Agra-Europe, No. 35, Markt + Meinung, pp. 1-7.
- N.N._B (1999): Auf die Veredlungs- folgt die Qualitätsoffensive. Agra-Europe, No. 6, Länderberichte, p. 15.
- N.N._C (2000): Behörden nehmen Listerien ins Visier, Lebensmittelzeitung, No. 11, p. 20.
- N.N._D (2000): Qualitätsoffensive für Schweinefleisch. Agra-Europe, No. 12, Länderberichte, pp. 28-29.
- N.N._E (1998): Zentrale Datenbank für die Schweineproduktion praxisreif. Agra-Europe, No. 43, Länderberichte.
- OVERHOFF, C.: Die Nachfrage nach Wurstwaren in der BRD - Marketingkonzept für Putenwurst der Firma Bernard Matthews Oldenburg. Diplomarbeit, Bonn, forthcoming.

- PETERS, W. (1996): Wie wichtig sind ISO-Zertifizierungen für den Handel? DLG (ed.), Reicht die ISO-Zertifizierung?. Frankfurt am Main, pp. 55-77.
- POTTEBAUM, P. (1996): Die künftigen Marktchancen der nordrhein-westfälischen Landwirtschaft. Münster, Gutachten im Auftrag der Stiftung Westfälische Landschaft in Münster.
- RATSCHOW, J.-P. (1999): Umweltschonende Tierproduktion. Leiter des Referates Tierhaltung, Bauen und Technik an der Landwirtschaftskammer Westfalen-Lippe in Münster. Lecture/ Vortrag am 15.12.1999 im Rahmen des Tierzüchterischen Kolloquiums an der Uni Bonn.
- SCHMALHOFER, O. (1999): Wachsende Ansprüche der Industrie an die Rohware. Deutscher Raiffeisenverband e.V. (ed.), Lahnsteiner Tagung, Zwölfte Fachtagung für bäuerliche Führungskräfte aus dem genossenschaftlichen Vieh- und Fleischbereich am 15./16. Nov. 1999, Bonn, p. 51.
- SCHULZE, U. (1995): Analyse der Wettbewerbsfähigkeit der Schweineproduktion in Niedersachsen, den Niederlanden und Dänemark und Vorschläge zu ihrer Verbesserung. Bonn.
- Scientific Veterinary Committee (1997): The welfare of intensively kept pigs. Brussels 1997.
- SIMONS, J. (1999): Ökonomische Bewertung regionaler Vermarktungssysteme bei Fleisch. Lecture/ Vortrag auf der Wissenschaftlichen Arbeitstagung "Regionale Vermarktungssysteme in der Land-, Ernährungs- und Forstwirtschaft - Chancen, Probleme und Bewertung" des Dachverbandes wissenschaftlicher Gesellschaften der Agrar-, Forst-, Ernährungs-, Veterinär- und Umweltforschung e.V. am 25./26.11.1999 in Bonn.
- STEINBACH, G., HARTUNG, M. (1999): Versuch einer Schätzung des Anteils menschlicher Salmonellaerkrankungen, die auf vom Schwein stammende Salmonellen zurückzuführen sind. Berl. Münch. Tierärztl. Wschr., No. 112, pp. 296-300.
- Tierschutzgesetz vom 25.5.1998. BGBl. I, S. 1105.
- TIMM, F., HERRMANN, K. (1996): Tiefgefrorene Lebensmittel. 2., völlig neu bearbeitete Auflage, Berlin.
- USDA (1999): 1997 Census of Agriculture. United States Summary and State Data. Washington 1999, Volume 1, Geographic Area Series Part 51, AC97-A-51.
- Verordnung zum Schutz gegen die Verschleppung von Tierseuchen im Viehverkehr (Viehverkehrsverordnung) vom 9.6.1998. BGBl. I, No. 32, p. 1194.
- Verordnung zum Schutz von Schweinen bei Stallhaltung (Schweinehaltungsverordnung) in der Fassung der Bekanntmachung vom 18. Februar 1994 (BGBl. I, S.311), geändert durch die Verordnung vom 2. August 1995 (BGBl. I S. 1016).
- VERSEPUT, W. (2000): Dänische Initiative für Fleischlogo scheitert am Preis. Ernährungsdienst, Agrarzeitung, Forum Vermarktung, p. III.
- VOGELANG, T. (1997): Industrieller Fleischeinkauf im Wandel. Danske Slagterier (ed.), Qualität einkaufen - mit System/ Handbuch des Einkaufs von Verarbeitungsfleisch, Kopenhagen.
- WINDHORST, H.-W. (1999): Ein neues Leitbild für die Fleischproduktion. DLG (ed.), Landwirtschaft 2010, Frankfurt a.M., pp. 75-89.
- WIRZ, S. (1996): Imageanalyse für deutsches Schweinefleisch. Diplomarbeit, Bonn.
- WOLFFRAM, R. (1997): Konzepte zum Aufbau regionaler Vermarktungsstrukturen in Nordrhein-Westfalen. Landwirtschaftliche Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn (ed.), Vorträge der 49. Hochschultagung, Münster, pp. 85-104.
- WOLFFRAM, R. (1998): Zukunft des Veredelungsstandortes Nordrhein-Westfalen. Landwirtschaftliche Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn (ed.), Vorträge der 50. Hochschultagung, Münster, pp. 23-46.
- ZDS (1999): Mitgliederrundschreiben (MR) 7/99. Bonn.
- ZDS (1998): Schweineproduzenten in Deutschland 1997. Bonn.
- ZMP (1999): Nachrichten von den Agrarmärkten Online, No. 97 vom 07.12.1999. <http://www.zmp.de/presse/nachrichten/zmpnac97.htm> (23.12.99).
- ZMP (ed.): ZMP-Bilanz Vieh und Fleisch. Bonn, various years.