Follow the Pig

A Holistic Business Perspective on Antibiotics and the Meat Production Ecosystem

Kristin B. Munksgaard, Jane Petersen, Alexandra Waluszewski, Debbie Harrison, Aino Halinen & Cæcilie Ø. Knudstorp

NOS-HS
BI Norwegian Business School
SDU
UNIVERSITY OF TURKU Turku School of Economics
UPPSALA UNIVERSITET

Table of Contents

Introduction 3

Report I

Antibiotics & Resistance, Pig Meat Production & Consumption 4

Report II

The Low Use of Antibiotics in Norway: The Case of Pigs 12

Report III

Sustainable Food Production: Innovating Future Reduction of Antibiotics in Pig Production 21

Report IV

Visioning and Shaping Sustainable Markets 30

Scientific Publications and Dissemination from the Research Group 38

Activity of NOS-HS

Layout: Katrine Engdal Vorting

Images: Colourbox

Introduction

The 'Follow the Pig' project aims to identify the challenges of reducing the use of antibiotics in pig production, thereby contributing to solving current challenges regarding food safety. Several initiatives have been launched in the Nordic countries to reduce use, avoid resistance and limit negative impact on humans and the environment. Nevertheless, statistics indicate large differences in the use of antibiotics in Denmark, Finland, Norway and Sweden. We study these differences from a holistic business and interdisciplinary perspective rather than the prevalent medical perspective, uncover learning and focus on how the pig production industry can succeed in balancing economic and sustainability goals.

The project includes four workshops exploring, mapping and comparing pig production practices across Denmark, Norway, Finland and Sweden. This report summarises findings and discussions from all four workshops:

The first workshop was organised by Professor Alexandra Waluszewski and hosted by Uppsala Antibiotic Center on 8 May 2019.

The second workshop was organised by Professor Debbie Harrison and hosted by the Department of Strategy and Entrepreneurship, BI Norwegian Business School on 4 March 2020.

The third workshop, organised by Kristin B. Munksgaard and hosted by the Department of Entrepreneurship and Relationship Management, University of Southern Denmark was held online (due to the COVID-19 pandemic), 19–20 January 2021.

The final and fourth workshop was organised by Professor Aino Halinen and hosted by Turku School of Economics, University of Turku, 24–25 May 2022.

'Follow the Pig' is a NOS-HS granted workshop project, coordinated by Kristin B. Munksgaard (PI), Prof., University of Southern Denmark, Alexandra Waluszewski, Prof., Department of Economic History/ PI at UAC, Uppsala University, Aino Halinen, Prof. University of Turku and Debbie Harrison, Prof., Norwegian Business School. The aim is to investigate differences in the Swedish, Danish, Norwegian and Finnish pig meat production settings, including contextual differences e.g. antibiotic regulations, economic logics and actor interests.

Report I

Antibiotics & Resistance, Pig Meat Production & Consumption

Uppsala Antibiotic Center

Uppsala University

8 May 2019

Kristin B. Munksgaard, Jane Petersen,

Alexandra Waluszewski, Debbie Harrison

& Aino Halinen

This report was written based on funding from NOS-HS.

Introduction

This report summarises findings and discussions from the first workshop organised by Professor Alexandra Waluszewski and hosted by Uppsala Antibiotic Center on 8 May 2019.

In her welcoming speech, Professor Waluszewski noted:

'We have known for many years that resistance is a great risk – today we take a long needed interdisciplinary perspective on antimicrobial resistance (AMR)'. Workshop speakers and discussants were invited to share knowledge, insights and perspectives regarding antibiotics and resistance as a global and multifaceted challenge.

I would like to take the opportunity to thank all the speakers for contributing – younger scholars as well as well-established professionals and researchers. A special and warm-hearted thank you to Professor Waluszewski, Uppsala University, and Eva Garmendia, Uppsala Antibiotic Center, for organising the workshop.

Professor wsr Kristin B. Munksgaard (PI), University of Southern Denmark, Denmark, August 2019.

Disposition

01 Programme

02 Participants

03 Resistance Awareness in Research and Media

04 Antibiotics & Resistance: Swedish Pig Meat Production

05 Closing Remarks and Outlook

01 Programme, 8 May 2019

9.00–9.30 a.m.	**Welcome** Alexandra Waluszewski, Uppsala University: Aim of the Day. Eva Garmendia, Uppsala Antibiotic Center: A short presentation of Uppsala Antibiotic Center.
9.30–9.45 a.m.	Coffee break
9.45 a.m.–12.00 p.m.	**Resistance Awareness in Research and Media** Chair: Alexandra Waluszewski, Uppsala University Anne Kveim Lie, University of Oslo: Resistance awareness – past and present Hedvig Gröndal, Uppsala University: Alliances between veterinary and human medicine in early Swedish AMR prevention Comments & Questions: Daniel Normark, Uppsala University Enrico Baraldi and Alexandra Waluszewski, Uppsala University: The Pharmaceutical industry: part of the problems – and the solutions...
12.00–12.45 p.m.	Lunch

12.45–2.45 p.m.	**Antibiotics & Resistance: Swedish Pig Meat Production** Chair: Aino Halinen, University of Turku Kristina Nordéus, Swedish University of Agricultural Sciences: The Swedish ban on Antibiotic Growth Promotors (AGPs) – farmers, vets, consumers and the media Marie Sjölund, National Veterinary Institute: Pig production in Sweden. Comments & Questions: Kristin B. Munksgaard, University of Southern Denmark, Debbie Harrison, Norwegian Business School BI
2.45–3.00 p.m.:	Coffee break
3.00–4.00 p.m.:	**Antibiotics & Resistance: Swedish Pig Meat Consumption** Chair: Aino Halinen, University of Turku Gunnela Ståhle, Vi Konsumenter: The role of the consumers – past and present Comments & Questions: Håkan Håkansson, Norwegian Business School BI What's next?

02 Participants

The participants were representing the following parties:

Universities: 22 participants

Commercial companies: 4 participants

Industry organisations: 15 participants

03 Resistance Awareness in Research and Media

The presentations on the morning of the workshop concentrated on resistance awareness in research and media from the early 1900s until today.

When penicillin was launched on a large scale in the 1940s, it became associated with the concept of a magic bullet That is, the idea developed by Paul Ehrlich in the early 1900s, in order to express the characteristics of a drug able to kill specific microbes without harming the body itself. However, already when penicillin was launched, the phenomenon of antibiotic resistance was known, although it was overshadowed by the great medical advances in both human and veterinary medicine that antibiotics allowed. During the first era of antibiotic development, there was also a great trust in the pharmaceutical industry's ability to respond to the resistance challenge by constantly developing new drugs.

The 1960s saw an increase in the number of health consequences of resistance outbreaks related to use of antibiotics for production animals in the UK. The government responded by initiating the Joint Committee in the United Kingdom on the Use of Antibiotics in Animal Husbandry and Veterinary Medicine, commonly known as the Swann report[1]. Until then, the use of antibiotics in farm livestock had received relatively little attention. The report concluded that 'The administration of antibiotics to farm livestock, particularly at subtherapeutic levels, poses certain hazards to human and animal health' (Swann et al., 1969) and suggested that certain antibiotics should be reserved only for human use. However, although the report inspired certain regulations in several European settings, the use of antibiotics continued to increase.

When, in the 1980s, infection specialists began to engage in efforts to reach a more restricted use of antibiotics in human medicine in order to combat antibiotic resistance or AMR, the change in the production animal setting became a source of inspiration. At the time, antibiotic resistance was considered a clinical problem confined to hospitals and primarily the concern of a small group of medical specialists. Still, the focus was on the ability to develop new pharmaceuticals to replace those that stopped working, rather than reducing use in order to combat antibiotic resistance.

1 Swann Committee. (1969). Report of the joint committee on the use of antibiotics in animal husbandry and veterinary medicine. Her Majesty's Stationary Office. London.

> *STRAMA was central to the reduction in antibiotics use on the human side in Sweden in the following years, due to its engagement in creating general awareness about antibiotic resistance as a public threat and for coordinated action in the policy setting.*

On the animal side, measures to reduce the use of antibiotics had already been initiated by pig farmers and the Swedish Farmers Association. Soon, the veterinary research setting also became involved. The measures focused on hindering antibiotics being used preventatively, under the cover of investments in animal welfare and biosecurity. The advantages made on the animal side triggered the exchange of ideas between infection specialists and veterinaries.

In the summer of 1994, a series of articles on AMR were published in Swedish in scientific and general media. Among other things, the articles reported that in the south of Sweden (Skåne), an increasing number of patients had become resistant towards penicillin. The reports increased the public attention to antibiotic resistance in the human setting and became a matter for Swedish politicians and authorities. Initiated by infection specialists and spearheaded by Otto Cars (the then Head of the Department of Infectious Diseases at Uppsala University Hospital), in 1995, the Swedish Strategic Program against Antibiotic Resistance (STRAMA) was formed. STRAMA focuses on antibiotic use in human health care but assembles actors from both human and veterinary medicine. STRAMA was central to the reduction in antibiotics use on the human side in Sweden in the following years, due to its engagement in creating general awareness about antibiotic resistance as a public threat and for coordinated action in the policy setting. Following the formation of STRAMA, a cross-sectional action plan was developed. Called the 'SPAR plan', it paved the way for the first Swedish national strategy on AMR, which was passed by the Swedish parliament in 2006. (On the animal side, use of antibiotics had been regulated since 1986.) In the strategy, AMR was considered a matter for both human and veterinarian medicine and the necessity of cooperation between the two fields was stressed. Today, the pharmaceutical industry advocate for the correct use and for more control of antibiotics, but generally not for a reduced use of antibiotics. Publicly funded research still primarily concentrates on antibiotics in human settings – such as the development of new antibiotics for human medicine or the rational use of antibiotics in hospitals – whereas relatively little public effort (and money) is put into researching the use of antibiotics for production animals.

04 Antibiotics & Resistance: Swedish Pig Meat Production

The presentations in the afternoon of the workshop

concentrated on the use of antibiotics in Swedish pig meat production.

Sweden has a minor pig production in the EU with 140,000 sows, 1,300 production sites and 2.6 million slaughtered pigs in 2018. Swedish pig production is concentrated in the southwest of Sweden. The production has been in sharp decline since the EU entrance in 1996 – both in the total number of pigs produced and in the total number of herds. The size of Swedish herds has increased substantially from 1980. Swedish pig farms are free from a number of diseases, including Porcine Epidemic Diarrhoea. This is partly due to a favourable geographic location (low pig density, surrounded by the sea and neighbouring countries with similar approaches to disease eradication). Furthermore, Swedish farmers participate in the Swedish Farmers Disease Control Program. This is a voluntary programme which strategically works to eliminate several infectious diseases. This is done by, for instance, improving diagnostics and vaccines, reducing and controlling trade with live animals and batchwise production. Should Swedish pig herds nevertheless become infected with salmonella, pig farmers are entitled to compensation from the Swedish state via the national biosecurity programmes (if they are enrolled in the programme). The sales of antimicrobials for animals have been in a steady decline since the 1980s. Antimicrobials are mainly used during the suckling period. Group treatments are the exception in Sweden. Maintaining a strong focus on animal welfare and biosecurity, there is a firm belief among Swedish pig farmers that healthy animals do not need antibiotics and that prevention is better than cure.

Conventionally, antibiotics are used in animal husbandry for a number of purposes. Antibiotics are used to treat diseases, to prevent diseases due to intense farming or as a means to enhance performance, also called Antibiotic Growth Promotors (AGP). AGP was used in farming from the early 1950s. The so-called Swedish model of prevention and reduction of AMR has been developed over a long period of time. The model consists of four elements: a healthy environment, preventive strategies, low use of antibiotics, and low resistance.

The attempts to reduce use of antibiotics were initiated already in the early 1980s by engaged pig farmers and managers in the Swedish Farmers Association. The engagement took off in the aftermath of a decade of intense public environmental debate, focusing also on agriculture and animal husbandry. The Swedish Farmers Association several of its cooperatively owned industries

and authorities engaged in reforming the Swedish use of antibiotics for animals, eventually leading up to a ban on antibiotics for growth promotion in 1986. While the main argument for the Swedish Farmers Association was to restore and develop consumer confidence in Swedish agriculture, the environmental demands were largely driven by researchers and in media, and not by the consumers. In the 1980s there was no real consumer organisation in Sweden. When Sweden entered the EU in 1995, EU demanded the establishment of a consumer organisation and in 1996, The Swedish Consumers' Organisation was established. In the following years, the Swedish Consumers' Organisation and related Swedish organisations were involved in a number of actions focusing on the use of antibiotics in farming.

05 Closing Remarks and Outlook

A vital conclusion to be drawn from the presentations and discussions on the first workshop in the 'Follow the Pig' project at Uppsala Antibiotic Center is that it is important not to limit discussions on AMR to the use versus non-use of antibiotics in pig and animal production. Instead, we need to work for and research ways to produce healthy animals – which will lead to positive side-effects, including productivity. Additional lessons are to be learned from the Swedish meat production and consumption setting.

First and foremost, the Swedish industry is characterised by a noteworthy collective interest and joint perspective across different actors on giving animal welfare pride of place. Actors across developing and producing settings advocate for a reduction of the use of antibiotics caused by increasing focus on producing healthy animals. This interplay between actors' interests and the joint ability to promote joint actions – despite inherent existing conflicts and potential misalignment of business and sustainability perspectives – warrants more research utilising a holistic ecosystem and business perspective. However, the Swedish case also underlines the importance of support from the retail setting. When Sweden entered the EU, it was followed by an influx of cheap products from settings with a significantly higher use of antibiotics. The Swedish production of pigs decreased significantly and has not yet been recovered. In recent years, the retail industry has increased its engagement for a reduced use of antibiotics and the consumers' awareness of the 'Swedish model' has increased. The different perspectives offered in the first project workshop by the presenters coming from various disciplines resulted in nuanced and extremely interesting and enlightening interdisciplinary discussions.

Report II

The Low Use of Antibiotics in Norway: The Case of Pigs

BI Norwegian Business School – Oslo,

4 March 2020

Kristin B. Munksgaard, Jane Petersen,

Debbie Harrison, Alexandra Waluszewski &

Aino Halinen

This report was written based on funding from NOS-HS.

Introduction

This report summarises findings and discussions from the second workshop, organised by Professor Debbie Harrison and hosted by the Department of Strategy and Entrepreneurship, BI Norwegian Business School on 4 March 2020.

Opening the workshop, Professor Harrison pointed to three key lessons to be learned from the Norwegian pig production industry's success with radically reducing the use of antibiotics for food animals and making resistance outbreaks among these to rare occasions: First, Norway has no live import of pigs to reduce risk. Second, the country keeps a low level of diseases among production animals. And third, the production is less intensive compared to other countries.

A huge thank you to the six industry speakers for contributing with thoughtful insights from the Norwegian setting enlightening the following discussions among the project team and other participating researcher. A warm thanks to Professor Harrison for organising the workshop.

Professor wsr Kristin B. Munksgaard (PI), University of Southern Denmark, Denmark, March 2020.

Disposition

01 Programme

02 Participants

03 Practising Minimal Use of Antibiotics in Norwegian Pig Production

04 Norway's Unique Position

05 National Strategies

06 Closing Remarks and Outlook

01 Programme, 4 March 2020

11:30 a.m.–12:00 p.m.:	Lunch
12.00–12.10 p.m.:	**Welcome and Purpose** Debbie Harrison, Bi Norwegian Business School
12.10–1.15 p.m.:	**Practising Minimal use of Antibiotics in Norwegian Pig Production** Ingrid Melkild, Nortura: Norwegian pig production – structure and key data Carl Andreas Grøntvedt, Veterinærinstituttet: Prevention is better than cure – the Norwegian Pig Health Services Elin Røssvoll, Matmerk: KSL – the Norwegian agricultural quality system
1.15–1.35 p.m.:	Coffee break
1.35–2.40 p.m.:	**Norway's Unique Position** Carl Andreas Grøntvedt, Veterinærinstituttet: Surveillance and control of LA-MRSA in Norwegian pig production Ole Nikolai Skulberg, Totalmarked: Markedsreguleringen av kjøtt og egg i Norge

2.40–3.00 p.m.:	Coffee break
3.00–3.30 p.m.:	**National Strategies** Synnøve Vatn, Animalia: The Norwegian livestock industry's joint action plan on antimicrobial resistance
3.30–4.30 p.m.:	**Reflection and Wrap-up**

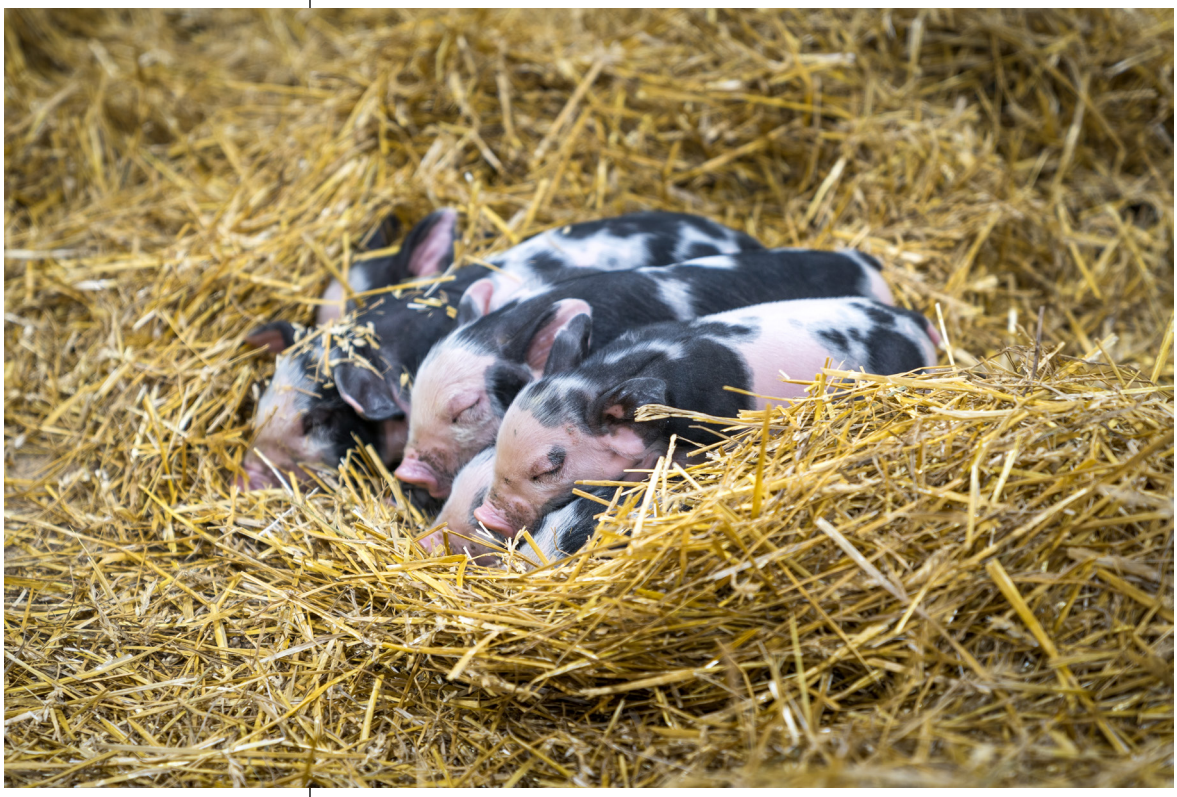
02 Participants

The participants were representing the following parties:

Universities: 5 participants

Commercial companies: 4 participants

Industry organisations: 2 participants



> ***Focus is upon securing a high level of health across levels – starting at the top of the pyramid. Norway has managed to avoid a series of swine diseases and has a low occurrence of swine diseases in general.***

03 Practising Minimal Use of Antibiotics in Norwegian Pig Production

The presentations in the morning of the workshop concentrated on the use of antibiotics in Norwegian pig production.

Norway has approximately 2,000 commercial pig herds and produces 1.6 million fattening pigs per year. Pig farms are scattered across Norway. The main pig production area is located in the southwest of Norway. There is a cap on herd sizes of 105 sows per farm and 2,100 fattening pigs produced per year.

Norwegian pig production is organised according to the breeding and health pyramid. At the top of the pyramid, 40 closed nucleus herds are located. These herds supply boars, semen and sows to the next level in the pyramid, the multiplier herds. There are 50 multiplier herds in Norway, which produce and inseminate sows for sale to breeding herds, which are at the lower level of the pyramid. All movement of pigs occurs downwards in the pyramid. Import of livestock pigs is heavily restricted in Norway and does in fact not take place.

Focus is upon securing a high level of health across levels – starting at the top of the pyramid. Norway has managed to avoid a series of swine diseases and has a low occurrence of swine diseases in general.

Norwegian legislation states that animals have an intrinsic value unrelated to their usefulness for humans. Norway has stricter regulations regarding the keeping of pigs than the EU – for example, all pigs must have a resting area, fixation of pigs is prohibited and weaning is not allowed before the piglets are minimum 28 days of age.

The health and welfare of pigs in commercial herds is monitored and supported by three services/systems in Norway:

1. The Norwegian Pig Health Service ('Helsetjenesten') is a service provided by the industry. It works at promoting pig health through the means of prevention, health and welfare surveillance, disease control, eradication programmes, counselling, support and training for farmers and veterinarians. The service works at a national, regional and local level.

2. The Norwegian Animal Health Recording System ('Helsegrisen') is a voluntary system in which veterinarians and pig producers register the health status and treatments of pigs in commercial herds. The

pig farms are visited 1-3 times a year by a veterinarian giving advice upon health, welfare and hygiene. In the system, the pig herds are assigned a status according to their health status – these are: 'Helsegris', 'Velferdsgris', 'Avlsbessetning' and 'Specific pathogen free' (SPF). Each year, approximately 123,000 registrations of antibiotic treatments are made in the system. The registrations do not match the sales statistics in pharmacies. It is estimated that about 1/3 of all antibiotic treatments are not registered in the system.

3. The Agricultural Quality System (KSL) is a system aimed at securing quality in food production and animal welfare in Norwegian agriculture. KSL is owned and administered by the Matmerk Foundation, which is an independent foundation established by the Ministry of Agriculture and Food. The system consists of checklists and guides which the farmers use in their self-monitoring of their farm. Each farm is to undertake a yearly internal audit. If the farm is in alignment with the KSL, the farm's production complies with Norwegian regulations and law. The farmers' registrations are checked by auditors from the Matmerk Foundation. In 2019, a total of 5,000 audits were carried out. These audits showed a significant increase in deviations between registrations and auditors' observations.

04 Norway's Unique Position

The presentations in the afternoon of the workshop concentrated on Norway's unique position in regulating agricultural production and eradicating livestock-MRSA.

The volume and price of agricultural products (egg, meat, milk and grain) is regulated by law in Norway. The regulation is to ensure food supplies and stable prices. The regulation system, called the 'market balancing system', aims at securing farmers high and stable prices which enable them to invest and farm in even sparsely populated areas of Norway. Import of agricultural products is heavily restricted and is at a very low level in Norway.

Farmers finance the marketing balancing system themselves through the payment of a fee, which is used to balance the agricultural production. For instance, in times of overproduction, the fee can be used to pay farmers to reduce or stop production. The fee is set and administered by 'Omsetningsrådet', which is a council with representatives from authorities, consumer organisations, farmer organisations, food industry

organisations and retail organisations. The farmer organisations have the majority of votes in the council. Furthermore, the council implements and manages market regulation measures.

The so-called 'market regulators' have the operative task of balancing supply and demand for agricultural products. Three farmer cooperatives act as market regulators: Nortura (market regulator for meat and eggs), Norske Felleskjøp (market regulator for grain) and Tine (market regulator for milk). They prepare forecasts and set prices for upcoming periods. They can ask Omsetningsrådet for permission to use the farmers' fee to balance the market. The market regulators are responsible for ensuring that the fixed prices are realised in the market. They are required to buy all farmers' agricultural products at any time and place and sell these fairly to all players in the market at equal prices.

Norway has had a very low prevalence of livestock-MRSA-positive pig herds. Since 2008, a total of 11 pig herds have been tested MRSA-positive.

In 2013/14, three separate outbreaks of livestock-MRSA were discovered in Norwegian pig herds. Following the outbreaks, a national livestock-MRSA-eradication strategy was adopted. The strategy includes restrictions on trade of live animals, standstill of production, culling of infected pig herds, cleaning and disinfection of buildings, as well as restocking with pigs from livestock-MRSA free herds. The process of eradicating livestock-MRSA in an effected pig herd takes approximately one year. Farmers receive state compensation should their pig herds become infected. The compensation is debated, as it only partly covers the cost of eradication.

In 2014, a surveillance programme to identify MRSA-infected pig herds was introduced. The main routes of introduction of livestock-MRSA in Norwegian pig production has been human beings bringing the disease into the farm, trade with live animals and MRSA-infected trucks.

The livestock eradication strategy in Norway is very costly but nevertheless prioritised by the industry and politicians alike. It is predicted that if nothing is done, 80-90% of all Norwegian pig herds will become infected with livestock-MRSA within 10 years. Livestock-MRSA has received little public attention and has primarily been discussed among authorities, politicians and actors in the industry.

From an international perspective, the overall usage of antibiotics in livestock animals in Norway was and still is very low. Nevertheless, the main goal of the action plan was to reduce the use of antimicrobials by 10% by 2020, with 2013 as a reference year.

05 National Strategies

In the last session of the workshop, the Norwegian livestock industry's joint action plan on antimicrobial resistance from 2017 was introduced.

The action plan included a number of core principles, including that healthy animals do not need antimicrobials; antimicrobials are not to be used for prevention; and treatment with antimicrobials should be based upon a diagnosis.

From an international perspective, the overall usage of antibiotics in livestock animals in Norway was and still is very low. Nevertheless, the main goal of the action plan was to reduce the use of antimicrobials by 10% by 2020, with 2013 as a reference year. This is to be achieved by enhancing prudent and correct treatment of diseases and by further improving animal health in general.

The sub-goals of the action plan were:

1. Maintain a good national biosecurity level and prevent import of disease and resistant bacteria to Norway.

    1.a A key actor in preventing import of diseases and resistant bacteria is the Norwegian Livestock Industry's Biosecurity Unit (KOORIMP). The unit works to ensure the quality of animals and breeding material imported to Norway. Furthermore, the unit works to prevent the spreading of existing diseases within Norway.

2. Improve biosecurity between animal holdings and at the farm level.

3. Reduce the occurrence of disease in Norwegian livestock.

4. Correct and documented use of antimicrobials.

5. A documented low level, and additionally, lowered levels of specific forms of antimicrobial resistance.

6. To generate new knowledge through research and development.

7. Enhanced collaboration between the authorities, R&D-institutions and other stakeholders.

The 2017 action plan on antimicrobial resistance has rapidly been implemented by Norwegian pig farms. Right from the start, farmers and farmer organisations have focused strongly on animal health and the prevention and eradication of diseases. Leaders in the industry and within politics have led the way and made no secret of the fact that the implementation of the action plan will

> *It is very much about the mindset for making such changes happen!*

be costly. Furthermore, the organisation of Norwegian pig herds in the breeding and health pyramid has spurred the implementation.

06 Closing Remarks and Outlook

A vital insight from presentations and discussions during the workshop concerning the production and monitoring regime underpinning the low use of antibiotics in Norwegian pig production is a strong national and collaborative focus by public authorities and R&D institutions on animal welfare. This determined focus seems to permeate the different parts of the industry setting, from breeding, animal husbandry, the organising of how pigs are sold, to the treatment of sick animals as well as national strategies aimed at systematically limiting the use of antibiotics.

Valuable lessons can be learned from the various activities and processes leading to a minimal use of antibiotics in Norway and the decisiveness in eradicating incidences of LA-MRSA at pig farms. Our research team considers this a continuous systemic innovation composed of related activities, use of different technologies and changes across businesses as well as political and public organisations.

What proves of particular interest is how key actors within and affiliated with the pig producing industry have driven these changes and innovations. As one of the presenters at the workshop pinpointed while finishing her presentation: It is very much about the mindset for making such changes happen!

Report III

Sustainable Food Production: Innovating Future Reduction of Antibiotics in Pig Production

University of Southern Denmark (online)

19–20 January 2021

Kristin B. Munksgaard, Jane Petersen,

Aino Halinen, Debbie Harrison &

Alexandra Waluszewski

This report was written based on funding from NOS-HS.

Introduction

Since autumn 2018, the research group coordinating the 'Follow the Pig' project has investigated the differences in the use of antibiotics in Danish, Swedish, Finnish and Norwegian pig production, including contextual differences in institutions, laws and regulations, different industry actors' attitudes towards and interests in the reducing of antibiotics, as well as the economic perspectives for a more sustainable production.

This report summaries presentations and discussions at the third of four workshops in the project. The workshop was held online (due to the COVID-19 pandemic) and hosted by the Department of Entrepreneurship and Relationship Management at the University of Southern Denmark.

During the workshop, participants were invited to learn from the latest research with different perspectives on the future of pig production, avenues for more sustainable production, consumer culture and the need for continued reduction in the use of antibiotics presented by a number of experts and guest speakers.

A special thanks to Louise Helmer for facilitating the workshop and for including opinions on the subject from industry actors through recorded statements produced specifically for and presented at the workshop.

Professor wsr Kristin B. Munksgaard (PI), University of Southern Denmark, Denmark, February 2021

Disposition

01 Programme

02 Participants

03 Shaping Future Markets for Pork

04 Alternative Futures of Innovating Use of Antibiotics

05 Perceptions in the Industry

06 Closing Remarks and Outlook

01 Programme, 19 January 2021

09.30–09.40 a.m.: **Welcome**

09.40–10.10 a.m.: **Shaping Future Markets for Pork**
Anna Schneider-Kamp, University of Southern Denmark
Consumer Resistance and Responsibilization:
The Case of Medicine Consumption

10.10–11.10 a.m.: Dannie Kjeldgaard, University of Southern Denmark
Nordic consumer culture: sustainable consumption

11.10–11.30 a.m.: Coffee break

11.30 a.m.–12.30 p.m.: Lars Esbjerg, Aarhus University
On the central role of retailers in shaping markets
(for pork)

Programme, 20 January 2021

09.00–09:10 a.m.:	**Welcome**
09.10–11.10 a.m.:	**Alternative Futures of Innovating Use of Antibiotics**
	Tuomas Kuhmonen, University of Turku
	Alternative futures of animal husbandry
10.10–11.10 a.m.:	Iben Krog Rasmussen, Frej Think Tank
	The future of sustainable food production
11.10–11.30 a.m.:	Coffee break
11.30 a.m.–12.30 p.m.:	Hans Jørn Kolmos, University of Southern Denmark
	Concerns for the future health of citizens – the case of MRSA

02 Participants

The participants were representing the following parties:

Universities: 15 participants

Commercial companies: 12 participants

Industry organisations: 3 participants

> ***However, consumer responsibilisation fails when consumers are exposed to conflicting messages regarding the responsible consumption of antibiotics, such as 'antibiotics are necessary to treat infections' versus 'antibiotics should be avoided'.***

03 Shaping Future Markets for Pork

The presentations on the first day of the workshop focused on consumer responsibilisation, Nordic consumer culture and retailers, leading to a discussion among participants on how these actors are contributing and influencing the shaping of future markets for pork.

Over the centuries, the responsibility of medical care has shifted. Today, patients take (and are expected to take) a far more active role in their treatment than previously. Health has transformed from being a question of biology to a social construct or even an individualised resource. Patients have a dual identity, as they are also consumers. Different discourses regarding the (over)use of antibiotics have contributed to both increased consumer responsibilisation and consumer resistance in the consumption of medicine. Patients have 'googled' their symptoms in advance when meeting for an appointment with their general practitioner. This essentially challenges general practitioners' expertise and authority. Patients apply different tactics when dealing with acute non-life-threatening conditions – ranging from passively receiving advice and treatment from their general practitioner ('I have to trust my GP) to resisting or questioning the decision-making of their GP ('I do not believe in antibiotics'). However, consumer responsibilisation fails when consumers are exposed to conflicting messages regarding the responsible consumption of antibiotics, such as 'antibiotics are necessary to treat infections' versus 'antibiotics should be avoided'.

Taking a broader perspective on consumers and consumer culture, studies have shown how we in the Nordic countries share a consumer culture characterised by striving for commonness, sameness, collaboration and. Generally speaking, Nordic companies mirror this narrative in their marketing and communication of products and services with emphasis on, for instance, targeting the common man, collective responsibility and equality. This understanding of Nordic consumption culture has implications for understandings of sustainable consumption. It is argued that achieving a sustainable society includes establishing sustainable consumption. Consumers' decision-making is guided by their resources, disposition and the context in which they are, as well as their ethics and locus of action. Essentially, the democratically-fuelled characteristics of commonness, sameness and consensus reflect a self-impression of the Nordic way as the (only) way to consume.

To retailers, understanding of consumers and

consumption is central. Pork consumption is declining, which is partly because younger generations consume less pork than older generations. Although consumers, retailers, processors and producers show an increasing interest in animal welfare, research shows that even though consumers are concerned with animal welfare, they are reluctant to pay a premium for animal welfare products. This is mainly due to animal welfare being a vague concept and different actors disagree on what constitutes good animal welfare, and how animal welfare should be regulated and monitored. Companies have reacted by introducing their own standards and/or employing third party certifications – but often the variety of certifications end up confusing consumers instead of guiding them. Furthermore, the sale of welfare pork is challenged by insufficient volumes, high prices, lack of innovation and lack of investments. It is claimed that legislation and regulation are no longer sufficient means to continuously improve animal welfare in Danish pork production, and consumer-driven animal welfare seems more fictional than realistic. Thus, retailers have a key role to play in promoting welfare pork. And retailers seem to be changing from being passive and predominantly market-orientated, where they simply react to consumer demand, to becoming more proactive and taking responsibility. Developing a market for welfare pork is, however, a process which demands sincere commitment from all actors involved – from producers, processors and retailers to consumers.

04 Alternative Futures of Innovating Use of Antibiotics

The presentations on the second day of the workshop focused on previous and present use of antibiotics in animal production and the possible future scenarios of animal husbandry.

Extensive use of antibiotics in pig production can lead to the development of drug-resistant organisms in animal microbiota that then migrate to other niches of animals or humans. LA-MRSA CC 398 is an example of such microbiota and today, more than 90% of industrialized pig herds in Denmark are colonised with LA-MRSA. This is a silent pandemic, as the animals are healthy carriers of the drug-resistant organisms, which, when transmitted to humans, can give rise to infections that are difficult to treat.

Antibiotic resistance poses a threat to both individuals and the healthcare system as, among other things, it

> ***Imaging the future of animal husbandry is difficult as only historical data is available and all future knowledge cannot be anything than provisional, biased, and visionary.***

means increased mortality and morbidity, increased length of hospital stays and more expensive treatments.

Various measures have been undertaken to stem the spread of drug-resistant organisms and to stall the antibiotic crisis; that is, the growing antibiotic resistance combined with a decrease in the development of new antibiotics. These measures include the implementation of 10-year targets to reduce unnecessary antibiotic use in agriculture and improving the hygiene in piggeries.

Imagining the future of animal husbandry is difficult, as only historical data is available, and all future knowledge cannot be anything than provisional, biased and visionary. Forecasting must thus be systematic, transparent and pragmatic, and a disciplined design must be applied to evaluate alternative futures. When doing so, five different futures for animal husbandry emerge:

1. A vegan future (in which commercial animal production ends).

2. An environmental future (in which animal production decreases by 67%).

3. A healthy future (where production and consumption of red meat decrease by 30%).

4. A self-sufficient future (with self-sufficiency in most agricultural products and inputs).

5. An exporter future (export demand of animal products increases and animal production doubles).

All five future scenarios are sustainable within frameworks– but the question remains which future is probable, possible and preferable. In retrospect, regime shifts have been facilitated by crises (war, draft, hunger etc.) – or adaptation to a new world model. The current shift from fossil fuels towards renewable energy and a bioeconomy may constitute such a shift.

Most people live far away from farms and have no or little knowledge of animal husbandry. Their understanding of and vision for future animal production may differ fundamentally from the visions of those working in farming or in the farming industry. Furthermore, 1/3 of all farmers in Denmark are older than 65, which is somewhat older than the population on average. A vision for future animal husbandry must bridge different understandings and it is important to establish a societal contract on when animal production can be considered 'sufficiently' sustainable.

05 Perceptions in the Industry

Prior to the workshop, recorded statements from a board representative from SEGES, the Danish Pig Research Center and a Danish farmer were gathered by Louise Helmer. At SEGES, the main objective is to ensure a sustainable pig production, both economically and socially. They need to ensure they have a 'licence to produce', and this means they must reduce antibiotics consumption and maintain good animal welfare. The fact that Denmark already has a low use of antibiotics compared to its production and is mentioned in UN and FAO reports as an example to follow is something SEGES takes pride in. SEGES also wishes for Denmark to continue being seen as a pioneer country for pig production.

The Danish pig industry is currently suffering the economic consequences of Corona and the uncertainty surrounding the spread of African Swine Fever Virus. The farmers are having a hard time selling their pigs, and they need the market back. For the Danish pig farmer, the 'licence to produce' includes getting the politicians to ensure proper conditions for a healthy business. Danish pig farmers are proud of their work as well as the low antibiotics consumption in Denmark. However, it is important to secure conditions where a given outbreak of disease can be treated with antibiotics without any restrictions.

06 Closing Remarks and Outlook

The presentations at this online workshop provided a number of different perspectives on innovating the future of pig production. Consumers, retailers, farmers, medical doctors and various industry actors all exhibit different understandings and approaches to more sustainable pork production and consumption: from farmers claiming a Licence to Produce, to consumers responsibilisation, to retailers taking a more proactive role in promoting animal welfare, to medical doctors arguing for improving transparency in antibiotics used in food animal production, to enabling consumers to make more informed purchase decisions, and NGOs calling for a societal contract on when food animal production is 'sustainable enough' to make farmers and the industry invest (or de-invest).

The challenge is monumental. Not only because of the many perspectives, but also because future images of sustainable markets are not easily framed, which leads to vague and continuously changing images. Whereas

everyone seems to agree on the importance of animal welfare and the need for sustainable production and consumption, it also seems that everyone is waiting for others to take responsibility and action.

Report IV

Visioning and Shaping Sustainable Markets

Turku School of Economics,

University of Turku (hybrid)

24–25 May 2022

Kristin B. Munksgaard, Cæcilie Ø. Knudstorp, Aino Halinen, Debbie Harrison & Alexandra Waluszewski

This report was written based on funding from NOS-HS.

Introduction

This report summarises findings and discussions from the final and fourth workshop, organised by Professor Aino Halinen and hosted by the Turku School of Economics, University of Turku, on 24–25 May 2022.

During the opening session, Professor Halinen stated that we need to build a stronger understanding of how companies consciously adopt futures thinking and how this can shape business markets that are more sustainable. This means that we need to study what kinds of markets companies predict in the future, what they envision and what they do by then. These issues produced some lively debate among speakers and participants during the workshop.

Thank you all for your insightful and interesting contributions to this important discussion.

Professor wsr Kristin B. Munksgaard (PI), University of Southern Denmark, Denmark, May 2022.

Disposition

01 Programme

02 Participants

03 Sustainable Market Shaping

04 Practices and Norms Diminishing Use of Antibiotics in Pig Husbandry in Finland

05 Closing Remarks and Outlook

01 Programme, 24 May 2022

9.00 a.m.–12.30 p.m.	**Innovation-paper workshop & Practice-paper workshop** Zoom meetings with Alexandra Waluszewski and Debbie Harrison
12.30–2.30 p.m.	Lunch
2.30–6.30 p.m.	**Seminar on Sustainable Market Shaping** Aino Halinen, University of Turku Insights from the Market Visioning Project: Conscious futures thinking to shape sustainable business markets Kristin B. Munksgaard, University of Southern Denmark Insights from the 'Follow the Pig' project: The Danish case of antibiotic free pork meat production Eini Haaja, Pan-European Institute, TSE Insights from the Sustainable Ship Building Concepts (SusCon) project: Orchestrating in a shipbuilding supplier network to foster the co-creation of eco-innovations Leena Jokinen, Finland Futures Research Centre (FFRC), TSE Creating futures images for sustainable cruise ships: Insights on collaborative foresight for sustainability enhancement
7.00 p.m.	Dinner

Programme, 25 May 2022

9.00 a.m.–12.00 p.m.	**Developing Practice-paper & preparing the afternoon** Zoom meeting with Mari Heinonen & Zoom meeting with Louise Helmer on forthcoming report on AB-free pork
12.00 p.m.	Lunch
2.00 p.m.–6.30 p.m.	**Practices and Norms Diminishing Use of Antibiotics in Pig Husbandry in Finland** Mari Heinonen, University of Helsinki Presentation on Practices and norms diminishing use of antibiotics in pig husbandry in Finland – Zoom meeting Discussion and questions
7.00 p.m.	Dinner

02 Participants

The participants were representing the following parties:

Universities: 8 participants

Commercial companies: 1 participant

Industry organisations: 3 participants

Climate change, digitalisation and radical technological innovations mean that the prevailing market systems are challenged and disrupted.

03 Sustainable Market Shaping

The presentations on the first day of the workshop focused on shaping sustainable markets through conscious futures thinking in the food-animal production industry and in the cruise and shipbuilding industry.

Climate change, digitalisation and radical technological innovations mean that the prevailing market systems are challenged and disrupted. This creates room for shaping more sustainable business markets. However, shaping a sustainable market is a slow process. The process not only involves challenging the logic of the dominant market with its focus on short-term profit and shareholder value maximisation; it involves creating systemic changes and systemic innovations with collaboration and coordination between both public and private actors. But first and foremost, the process requires envisioning a sustainable market. Visions are a requisite for the strategic actions needed to develop a sustainable market. Hence, there is an urgency for new scientific knowledge on how companies can construct images of future markets and proceed to shape markets towards more sustainable futures; for instance, by adopting conscious futures thinking.

To shape a sustainable market, producers, developers, users, NGOs, policy makers, and other industry actors need to align their interests and balance economic and sustainability goals. In the food animal production industry, a sustainable market means, among other things, reducing the use of antibiotics, as the development of antimicrobial resistance is a significant concern in terms of human health. Focusing on the intentions and actions of the heterogenous market actors (companies, industry organisations and policy makers) across the complexity of the multiple layers of the market provides a holistic picture of how the actions of these actors produce sustainable market practices over time. In the Danish case of antibiotic free pork meat production, it seems that the national policy actions, to some extent, are translated and mediated by the industry to guide the incremental shaping of existing market practices. The practices are shaped into more sustainable ones through the interplay of different norm-developing actions taken by market actors. The results are multiple and co-existing, but also contradicting practices. Reduction in use of antibiotics is achieved to some extent.

Learnings from other markets are relevant for understanding processes of market shaping. Turku, Finland is the centre for production of cruise ships. Each

new cruise ship takes years to develop. The process has many different actors involved in a business network. Initial findings have shown that the partners in the process often experience misalignments. With increasing competition and increasing demands from consumers calling for more sustainability, the cruise ship industry needs foresight and new ways of thinking, i.e., shaping a sustainable market. By considering the process from a business network perspective and combining Open Innovation, Network Orchestration, and Collective Opportunity Recognition, the aim is to give practical recommendations on how to advance and make most of the supplier network's sustainability expertise. Additionally, the aim is to give academic contributions by enlightening the mechanisms by which the hub company of an international network encourages interaction and open sharing of information among the network members; understanding how orchestration methods can be supportive towards innovation generation in such an international, project-based network setting; and insight on how collective opportunity recognition can be supported by a hub company in highly complex and international interfirm contexts that change project-by-project.

In the shipbuilding industry, certain sustainability indicators have historically been used; however, they are not clear in their definition of what constitutes sustainability. When working with collaborative interorganisational foresight, it is possible to gather different groups on different project levels and get them to share their visions for the future. That is constructing preferable future images for sustainability enhancement in the shipbuilding context. Four recurring future images in the industry are:

1. 'Money rules', which stresses that every decision on sustainability development must make economic sense.

2. 'The customer is always right', which puts emphasis on meeting customer demands and expectations and how each network member strives to meet the requirements.

3. The local economy focus image, which emphasises the employee perspective, as employee safety and wellbeing are key components in sustainability enhancement.

4. The most sustainable ships in the world, an overall strategy.

For market actors, the challenge is to critically consider and eventually change the market practices related to production, marketing and consumption.

04 Practices and Norms Diminishing Use of Antibiotics in Pig Husbandry in Finland

The presentation on the second day of the seminar focused on the use of antibiotics in Finnish pig production.

In Finland, there is a long tradition for producing healthy pigs and lowering usage of antimicrobials. The Finnish pork production is mainly located in the western and southwestern parts of the country. The 1980s saw an increase in pneumonia registered in slaughterhouses and this, combined with the herd specialisations at the end of the 1990s, led to an increase in the use of antibiotics – for instance due to an increase in use of group treatment to eliminate infections. The increase resulted in limitations on sows per herd, an increased cooperation with the slaughterhouses, strong veterinary involvement and eradications of herds with mycoplasma hyopneumoniae (M. Hyo).

These precautions, plus a better price for meat given to M. Hyo negative herds, has helped keep the disease under control, with only a few cases after 2010 and no new cases found in 2017-2018.

In general, Finland is strict when it comes to keeping the pig herds healthy. By importing few live pigs (no import before joining the EU), having multiple strict controls and eradication of diseases, they succeeded. Veterinarian research plays a key role in the development of healthy herds, such as for diagnosing, controlling and health classifications. Furthermore, there is a long and strong collaboration between farmers, vets and slaughterhouses. The online SIKAVA system is used to register pig health issues and is based on health classification of all pig farms (97%) in Finland. The system is financed by the slaughterhouses. Medical companies are developing vaccines against viruses, and the vaccines are used in the Finnish production to fight diseases. Vaccines are costly but demanded by the slaughterhouses. These joint efforts to keep Finnish pig herds free from many of the infectious diseases with a low and controlled prevalence of the rest of the pig diseases have resulted in reducing the need for antimicrobials in Finland.

05 Closing Remarks and Outlook

The interesting discussions during this fourth and final workshop focused on the grand-scale challenge of shaping business markets toward more sustainable futures. Relevant learnings can be drawn from different industries on how market actors perceive and envision

futures and markets, and how they engage and collaborate with others based on their images of these markets.

Insights were put forward on market actors' collective and central role in taking the lead in bridging business and society and thus creating sustainability value. Engaging in sustainability requires active choices for altering existing and/or developing new and more sustainable business market offerings – choices that necessitate a transformation of market actors' existing practices. For market actors, the challenge is to critically consider and eventually change the market practices related to production, marketing and consumption.

In Finnish pig production, the various actors approach such challenges by constantly discussing the use of antibiotics, castration of male pigs and animal welfare in general. The discussion is fuelled by vegetarian and vegan trends; whether we should produce pigs at all.

During the discussion among the workshop participants it became clear that the focus in pig meat production should not be on reducing the use of antibiotics but rather reducing the need to use them. It seems that investments in animal welfare and the prevention of diseases is a common strategy to Nordic countries in their efforts to develop a more sustainable pork market for the future.

Scientific publications from the research group

This section lists work in progress and published research resulting from and related to the project.

Cinti, A., Perna, A., & Waluszewski, A. (2020). Resistance to change and Antimicrobial resistance. Antibiotics as a value adding resource in animalbased food industry network: experiences from Italy (Marche Region) and Sweden. In The 36th IMP Conference.

Halinen, A. & Munksgaard, K.B. (2022). Shaping Sustainable Markets: Reducing Use of Antibiotics in Meat Production. Market Shaping Workshop, Linköping University, Sweden, September 15-16, 2022.

Halinen, A., Munksgaard, K.B., Harrison, D. & Waluszewski, A. (2022). Shaping Sustainable Business Markets: Reducing Use of Antibiotics in Pig Meat Production. Paper accepted for the IMP Asia Conference, Okinawa, Japan, December 4-7, 2022

Munksgaard, K. B. (2019). Business interests shaping networking boundaries: the case of reducing use of antibiotics in Danish pig production. The 35th IMP Conference 2019, IÉSEG Paris, France.

Waluszewski, A. (2019). Antibiotic resistance and the animal-based food industry – Antibiotics as a value adding resource in three interdependent industrial settings. The 35th IMP Conference 2019, IÉSEG Paris, France.

Waluszewski, A. (2020). Matproduktion med eller utan antibiotika: Om en systeminnovation. In Humanimalt: Oss djur emellan i medicin och samhälle förr och nu (1st ed., pp. 127–135).

Waluszewski, A., Harrison, D., Halinen, A., & Munksgaard, K. B. (2020). The "what's" and "how's" of some Nordic system innovations: compensating for routine group input of antibiotics in animal-based food production. The 36th IMP Conference, Örebro, Sweden.

Waluszewski, A., Cinti, A. & Perna, A. (2021). Antibiotics in pig meat production: restrictions as the odd case and overuse as normality? Experiences from Sweden and Italy. Humanit Soc Sci Commun 8, 172.

Waluszewski, A. (2019). More research? Or more use of research and practical experiences? On a system innovation compensating for (over) use of antibiotics in Swedish pig meat production. In 'Animal husbandry in 20th Century Europe: Policies, trade, animal and public health, breeding and production systems', SLU June 26-28 2019.

Waluszewski, A., Cinti, A., Perna, A. (2022). Food industry, policy and the use of antibiotics for animals. The Italian or Swedish way? Proceedings of the 38th IMP Conference, Florence. September 1-3 2022.

Waluszewski, A., (2022). More research? Or more use of research and practical experiences? On a system innovation compensating for regular use of antibiotics in Swedish pig meat production. Forthcoming. From Breeding & Feeding to Medicalization. Animal farming, veterinarization and consumers in the 20th c. Western Europe. Laurent Herment, Carin Martiin, Lourenzo Prieto and Daniel Lanero. Turnhout: Brepols Publishers.

Dissemination

Insights from project workshop have been disseminated in talks, presentations and the media.

Munksgaard K. B. (2019). Barrierer og motivationer for bæredygtig forretning (Barriers and motivations for sustainable business). Presentation at SDU First Mover Meetings, University of Southern Denmark, Department of Entrepreneurship and Relationship Management, 2019-11-22

Munksgaard K. B. (2019). En bæredygtig forretning? (How to build a sustainable business). Presentation at Presidents Institute, Denmark, 2019-11-18

Munksgaard K. B. (2019). Forretningsgørelse af Fødevarespild (Making business from food waste). Presentation at Agro Food Park, Danmark, 2019-08-27

Munksgaard, K. B. (2022). Follow the Pig. Keynote at 26th Nordic Workshop on Interorganizational Research, April 22. – 24. 2022, SDU Kolding, Denmark.

Waluszewski, A. (2018). Antibiotika och resistens: vetenskap, media, mat och handel. Presentation vid Kungliga Vetenskapssamhället i Uppsala, 2018-03-05.

Waluszewski, A. (2019). Antibiotika till djur är den största faran. Svenska Dagbladet. Publiced in Svenska Dagbladet 2019-07-14.

Waluszewski, A. (2019). Att hänvisa till 'EU:s ledarskap' är en grov förenkling. Publiced in Dagens Nyheter 2019-05-20

Waluszewski, A. (2019). Health innovation – the impact from economic resources in place. Seminar at a master course in Innovation Management, arranged at Uppsala University, 2019-03-20.

Waluszewski, A. (2019). More research? Or more use of research and practical experiences? On a system innovation compensating for (over)use of antibiotics in Swedish pig meat production. Presented at the workshop: Animal husbandry in 20th Century Europe: Policies, trade, animal and public health, breeding and production systems, University of Agriculture, Uppsala, Sweden, 2019-06-27.

Waluszewski, A. (2020). Den billiga produktionen kan ha ett högt pris. Göteborgsposten, 2020. No 5 maj

Waluszewski, A. (2021). Antibiotics & Animals. Interviewed in the AMR studio, UAC, Uppsala Antibiotic Centre, 2021-10-13.

Waluszewski, A. (2021). Antibiotics and pig meat production: restrictions as the odd case and overuse as normality? Experiences from Sweden and Italy. Presentation at the STS seminar, Uppsala Science & Technology Studies Centre, Uppsala University, 2021-11-30.

Waluszewski, A. (2021). Antibiotika - i tjänst och otjänst hos djur och människor. Presentation arrangerad av Senioruniversitet, Uppsala. 2021-03-09.

Waluszewski, A. (2021). Antibiotika för djur – välsignelse eller vansinne? Presentation arrangerad av Alma Löv Museum of Unexpected Art, Sunne 2021-11-21.

Waluszewski, A. (2022). Combatting overuse of antibiotics - but what's included in the plead for 'new economic models'? Presentation at a one-day seminar at BI, Norwegian Business School, Oslo 2022-08-23.

Waluszewski, A. (2022). Den tysta pandemin pågår ständigt. Göteborgsposten, 2022. No 8 feb.

Waluszewski, A. (2022). Under the same EU regulation – but why is restricted use of antibiotics for food animals is still a rare case? Presentation at a seminar at UAC, Uppsala Antibiotic Centre, Uppsala University, 2022-03-06.