

The rear side of regulation

Purchasing power of sustainable antibiotic use in livestock farming

Nora Slotman

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Nora Charlotte Slotman
S4185773
noraslotman@gmail.com

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Supervisor Radboud University: Dr. M.A. Wiering

Supervisors Radboudumc: Prof. dr. H.F.L. Heiman Wertheim & H. Laurijsen

Radboud University



Radboudumc
university medical center

Executive summary

Antibiotic resistance is one of the biggest global health problems today. The abundant treatment of antibiotics to animals and humans causes bacteria to survive and become unaffected by common medical treatments. Hospitals are making efforts to decrease antibiotic use in-house, while governmental actors are monitoring the use of antibiotics in the livestock sector through laws and regulations. The current types of governance, regulated by the state and corrected through the market, led to a decrease in antibiotic resistance in livestock farming. In the Netherlands livestock antibiotic use is considered as relatively responsible and sustainable. However, the decrease in livestock antibiotic use came to a stand-still and now requires alternative methods. At the same time a new form of governance is emerging. Purchasers and consumers are gaining increasingly more power to influence the supply chain by demanding high standards for the quality of their food. This research has explored purchaser policies that are able to guarantee sustainable antibiotic use for the purchased meat. The policies were composed in light of the strategies of Hart and Milstein (2003); Sustainability Vision and Product Stewardship. Radboudumc is interested to explore their purchasing power to minimize antibiotic resistance. In a case-study the supply chain of fresh pig meat of the Radboudumc was examined for its implementation of these strategies, in order to create sustainable value and enable sustainable antibiotic use by the concerned livestock farmers. Farmers are not supported in their environmental (knowledge), social (acknowledgement) and financial needs by the supply chain and often have limited resources to address these themselves. Moreover, transparency, connectivity and collaboration with civil society organisations to guarantee sustainable livestock antibiotic use are not yet optimized in the supply chain. However, purchasers are able to meet the described needs and improve strategies. During interviews experts shed light on how best to perform such strategies as a purchaser and hereby guarantee sustainable antibiotic use. The findings are extensive: The hospital could increase the demand by collaborating with partners in a long supply chain. Or enlarge the impact of their current demand in a short local supply chain with long term guarantees creating involvement and encouraging the responsibility of farmers to improve. The hospital could support farmers with in-house knowledge on antibiotic resistance and create awareness in the supply chain. In the procurement policy the purchaser could integrate livestock antibiotic use as a sustainability condition, could specify quality marks that incorporate sustainable livestock antibiotic use (i.e. KDV, Beter Leven Keurmerk, 'free range'), could demand transparency of the suppliers (by all means a Dutch origin) and a fair distribution of the price in the supply chain, and could reduce regular meat supply (e.g. veal that has the lowest performance regarding to reducing antibiotics) and replace it with sustainable alternatives. Purchasers are thus able influence the supply chain and guarantee responsible and sustainable livestock antibiotic use through their demands. They could facilitate the creation of environmental, social and financial values in an integral system change.

Keywords: sustainable livestock antibiotic use, purchasers, strategies, Radboudumc, supply chain

Preface

'In tijden dat de richting duidelijk is, hebben we aan efficiëntie een sterke bondgenoot, maar zodra die richting onduidelijk wordt, is ze haar kracht kwijt.'
(Murakami, 2003, p677)

The idea for the research originated as a result of the interest in the impact of antibiotic resistance today in society and the motivation to make a (small) contribution to improving the sustainability of the issue. The Radboudumc proposed this case as an opportunity to view the topic from a practical orientation and with the ability to implement the outcomes. It is an interesting yet complex topic as it integrates research fields on medicine, environment, society and management. In the following chapters I hope to show the tip of the iceberg and provide guidance in positioning oneself as a purchaser when aiming for sustainability and responsibility of antibiotic use in the livestock farming sector.

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1: Introduction

The discovery of antibiotics contributed substantially to human and animal healthcare. It helped to treat, prevent and control bacterial infections, which otherwise would lead to serious illness or even death. Over the years society has become increasingly dependent on this miracle medicine and started producing it for a multitude of purposes mostly in the health and livestock sector. However, a lack of proper prescription standards and poor alternative strategies for prevention and control of infectious diseases has led to a misuse and overuse of antibiotics (WHO, 2018). The abundant use of antibiotics now poses a serious global threat to the environment and public health at large. The UN reported it as a global health crisis as infectious diseases are becoming increasingly resistant to antibiotics. To make matters even worse, 'there are hardly any new antibiotics in the pipeline' to overcome the problem of resistance (Silver, 2011). When antibiotics become less effective due to resistance, infections are more difficult to treat. 'This is a major concern because a resistant infection may kill, can spread to others, and imposes huge costs to individuals and society.' (WHO, 2017). The livestock and healthcare sector have to critically review and change their current policies to meet the needs of present and future generations. The use of antibiotics should therefore be limited (Centers for Disease Control and Prevention, 2013).

The course of antibiotic resistance

The use of antibiotics creates resistance and subsequently resistant bacteria can spread to other environments, animals and humans (Centers for Disease Control and Prevention, 2013). Antibiotic resistance is a consequence of bacteria that experience stress (e.g. through antibiotic use; see *fig. 1.2.*). Stress can cause natural selection of antibiotic resistance bacteria (see *fig. 1.3.*), can cause bacteria to share their DNA and interchange the resistance mechanism (see *fig. 1.4.*) and can cause mutations in bacteria. Consequently, mechanisms start that renders antibiotic resistance; bacteria change their target (transferring resistance), produce enzymes that inactivate antibiotics (enriching the pool of resistant genes) or excrete antibiotics from their cells in the environment. When animals or humans get antibiotics, they develop resistant bacteria in their gut. These antibiotic resistant bacteria can directly or indirectly spread via for instance hands or surfaces. They can spread through the meat from animals when not prepared properly, or they spread through the organic fertilizer or polluted groundwater used on food crops ending up in the next human gut (see *fig. 2.*; Sarmah, Meyer & Boxall, 2006).

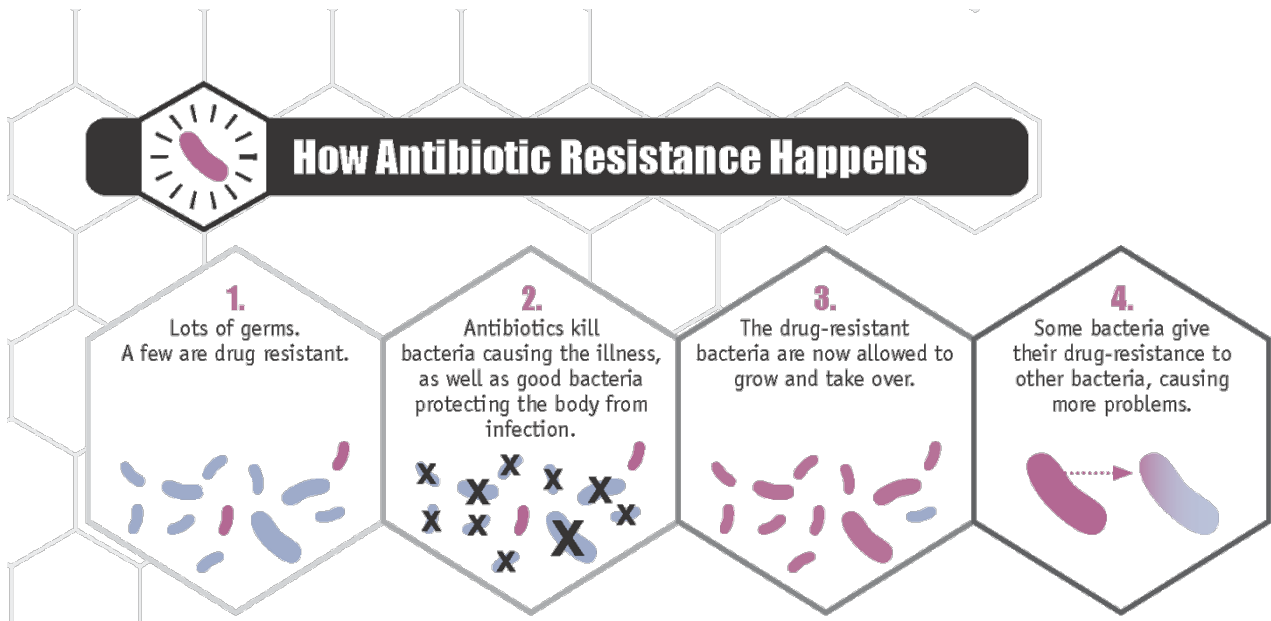


Figure 1: How antibiotic resistance happens Source: Centers for Disease Control and Prevention, 2013

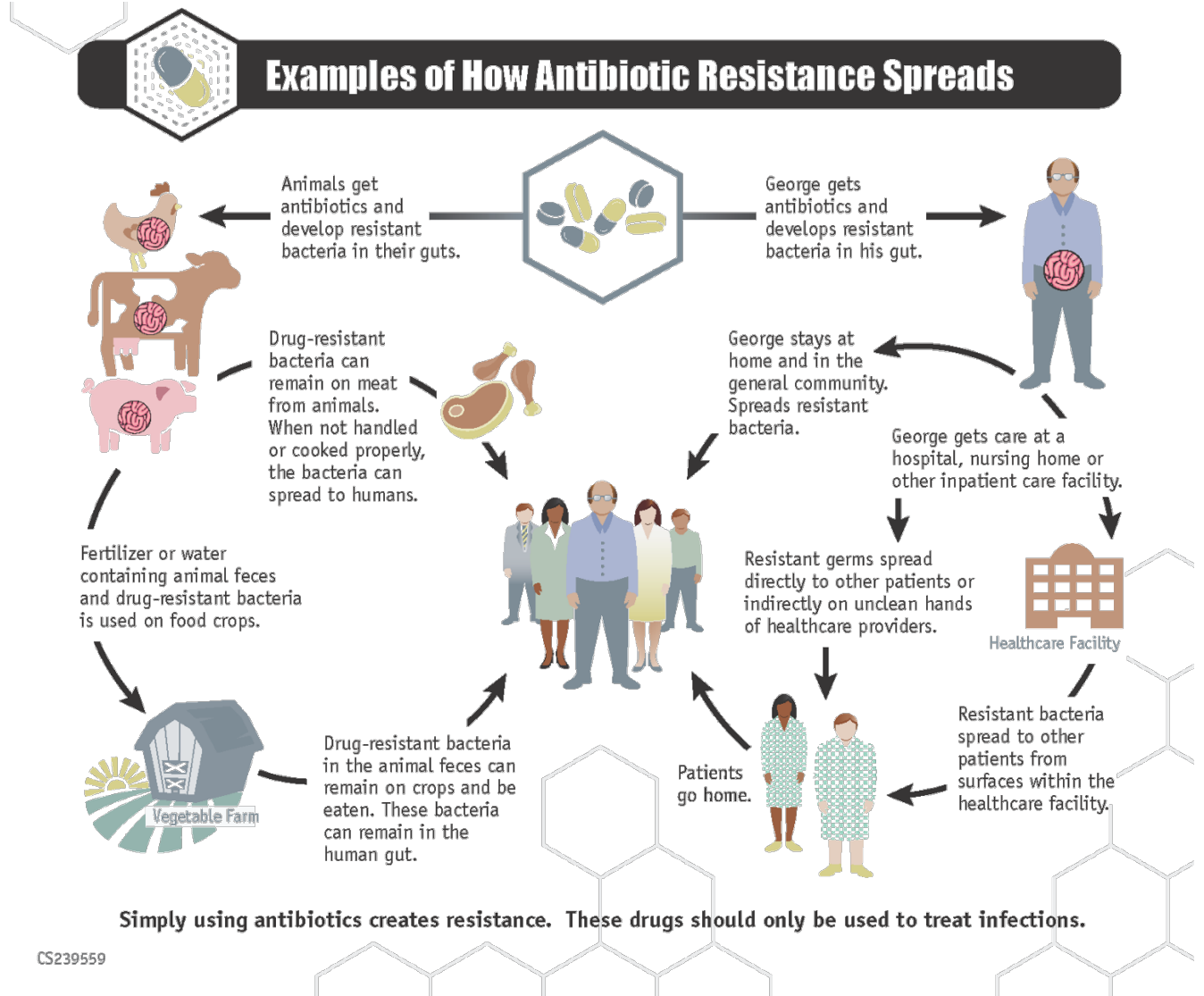


Figure 2: The spread of antibiotic resistance Source: Centers for Disease Control and Prevention, 2013

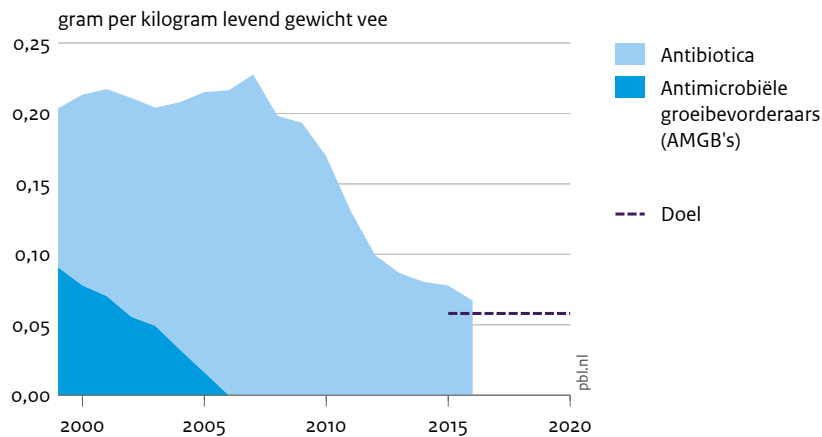
The impact of antibiotic use in livestock farming

As most antibiotics are used in the livestock sector there is still much to be gained as it is globally often over- and misused in healthy animals to stimulate growth or to prevent diseases in order to improve profits (Kim et al., 2011; Martinez, 2009; Mayhew, 2005; Sarmah et al., 2006). Note that in the Netherlands a waiting time after treatment is obligated by law before an animal can be processed. This to prevent that meat products could actually still contain antibiotics when consumed (Voedingscentrum, n.d.). However, resistance already originates in the environment when antibiotics are administered in livestock farming. In the Netherlands the amount of antibiotic resistant genes has increased in the soil (Knapp et al., 2010), causing pollution in groundwater and terrestrial grounds (Martinez, 2009). Around 90% of antibiotics remains unchanged when they pass through animals and ends up in the surface and groundwater through their urine and feces (Kemper, 2008; Kumar, Gupta, Chander & Singh, 2005; Sarmah et al., 2006). Excreted antibiotics then spread to the terrestrial environment. Plants and microflora and -fauna are not directly affected due to the low concentrations of antibiotics in manure, however there are possible indirect toxic effects on the food chain (Kumar et al., 2005). Manure containing antibiotics is spread on fields, affecting streams and reservoirs and hereby increasing the amount of antibiotics absorbed in crops (Kumar et al., 2005; Mayhew, 2005). Intestinal bacteria are possibly being contaminated as bacteria expressing a high resistance to multiple antibiotics are now even found on chicken meat and in ordinary organic crops for human consumption (Reuland, 2017; Ruimy et al., 2010). The studied ecological and agricultural consequences of veterinary antibiotics on the quality of water and ecosystem health are yet inconclusive (Williams-Nguyen et al., 2016). Potentially antibiotic pollution does affect the resilience of the global activity of the micro-biosphere (Martinez, 2009).

The Dutch case

Fortunately, in the Netherlands we have proven to be frontrunners in limiting our use of antibiotics since the maturation of our national guidelines. Among others those guidelines included clear targets monitored by an independent institute (Ceccarelli, 2017). The government places the responsibility to ensure antibiotic reductions at the market (PBL, 2017). Currently the sales of antibiotics are reduced up to 63,4% in mass active substance relative to the (government chosen) reference year of 2009. Moreover, the use of critical antibiotics for human health in livestock farming is decreased (see fig. 3; SDa, 2018). However, the decline has come to a stand-still and the policy goal of 70% reduction is not yet achieved (PBL, 2017). In 2019 new benchmark values per livestock sector therefore will apply that are compiled by the Autoriteit Diergeneesmiddelen (SDa) (SDa a, n.d.). Farms are already benchmarked according to a target value (green), signalling value (orange) and action value (red). Whereas green is considered as a responsible use of antibiotics, a value for farmers to strive to. The new benchmark values only incorporate a target value and an action value that is oftentimes stricter than the current signalling value (SDa, 2018)

Antibioticagebruik veehouderij



Bron: FIDIN, MARAN-2017

Figure 3: The decrease of antibiotic used in Dutch livestock farming over the last years (PBL, 2017)

Table 4: Distribution of farms over the different benchmark categories in 2017 (SDa, 2018; edited).

Species	Category	Target area		Signalling area		Action area	
		N	%	N	%	N	%
Poultry	Broilers	646	76	138	16	68	8
	Turkeys	29	64	7	16	9	20
Pigs	Sows	1,717	93	119	6	17	1
	Weaned piglets	1,397	69	332	16	308	15
	Meat pigs	4,141	90	130	3	309	7
Meat calves	White meat	459	55	346	41	33	4
	Rosé meat	58	24	145	61	35	15
	Fattening rosé meat	244	42	248	43	88	15
Cattle	Dairy cattle	17.027	99	78	0	16	0
	Rearing	474	91	40	8	6	1
	Suckler cows	8.572	92	761	8	18	0
	Meat bulls	2.599	89	172	6	148	5

Although Dutch livestock antibiotic use has reduced substantially over the years (SDa, 2018), as a precautionary principle both doctors and farmers should be encouraged by policies to reduce unnecessary antibiotic use even further, create awareness in the involved stakeholders and explore prevention efforts with sustainable livestock production practices (Ceccarelli, 2017; Gezondheidsraad, 2015). Since, altering our environment through the abundant use of antibiotics will create opportunities for infectious diseases (Geerling, 2016). 'The epidemiology of infectious diseases are dynamic and outbreaks can occur suddenly. [...] In our highly connected world, no country is an island - disease can potentially reach any country, rich or poor, nearby or far away' (Wertheim, 2017). However, it is a wicked problem as human health and the health of the broader environment are intertwined and sectors are dependent on antibiotics. To slow-down or lower the spread of antibiotic resistance and limit the impact of antibiotics on the environment joint action should be taken at all levels of society through collaboration and the formation of networks (Wertheim, 2016). It is crucial to examine opportunities in behavioural change along the chain that alter values and ensures sustainable livestock antibiotic use.

Research problem statement

There is still to be gained as not yet all farmers meet the national green target value. To fulfil this Dutch interest and prevent unnecessary livestock antibiotic use, the purchaser of meat could contribute. The role of the purchaser on the market that is able to demand sustainable antibiotic use in meat production is yet unknown. The supply chain from livestock farmer to purchaser is long and not transparent for all parties (Kilkens, 2018). Consequently, the influential power of purchasers on the amount of antibiotic used for their meat is rather limited. Partly because the actual amount of antibiotics that has been used in production (the benchmarked value of the SDa) is unclear for purchasers (Kilkens, 2018). This leads to an increased interest to expand the influence of purchasers on the content of their food and hereby changing the behaviour of the producers (Linnemann et al., 2006).

The Radboudumc is interested in expanding their influence on the supply chain and sharpen their procurement policies to ensure responsible and sustainable meat products. This corresponds with their green deal in which they strive for minimizing their impact on the environment (Radboudumc a, n.d.). Although the current contract of the Radboudumc with their food suppliers consist of certain demands on the quality of food, it does not entail demands on the antibiotics used in the production of it. This creates a lack of insight for the purchaser. The Radboudumc is therefore interested in exploring the origin of the meat they serve and the possible policies that can ensure a sustainable and responsible livestock antibiotic use of that meat (e.g. procuring a green target value).

Research aim and research questions

The aim of the research is to examine possible policies for purchasers to ensure responsible and sustainable antibiotic use in livestock farming. The aim is to enable a guarantee on the sustainable production of the purchased meat according the green target value of the SDa. To reach this aim the roles and bottlenecks of the entire supply chain from purchaser to producer will be researched. Analysis will be done through interviews along the supply chain and its stakeholders. Additionally, in-depth interviews with experts will be conducted to shed light on suiting purchaser strategies. These sources provide clarification of the stakeholders and their interests, and allow to subtract a model which helps to value possible policy strategies in its context. The central question of this research is therefore:

How can purchasers influence the chain towards responsible and sustainable antibiotic use by livestock farmers?

The central question will be answered through six sub-questions. The first sub-question will be answered through a thorough theoretical research and will describe the institutional processes and policies regarding antibiotics in livestock farming that are at play over time. The second, third and fourth sub-question will serve to describe the incentives and practices of the entire supply chain and will be answered through interviews with its stakeholders. The fifth sub-question is explained

through the expert interviews. In the last sub-question the outcomes will be integrated according to the performance of policy strategies in the supply chain supplemented with the information derived from the experts. The answers will be translated into concrete recommendations to ensure the responsible and sustainable use of antibiotics in livestock farming in purchased meat products.

Sub-questions

1. How is antibiotic use in livestock farming currently governed by the institutions of market, state and civil society?
2. What are the current practices and incentives of livestock farmers in antibiotic use?
3. Who are the stakeholders within the chain and what are their interests?
4. What is the current role of the purchaser in the procurement of responsible and sustainable antibiotic use?
5. How can the governing role of the purchaser be strengthened within the chain?
6. What are effective policy measures for the Radboudumc to ensure sustainable and responsible antibiotic use by livestock farmers?

Scientific and societal relevance

The proposed research investigates new roles in contemporary forms of governance. Governance of antibiotic use in livestock farming is currently focussed on the joint responsibility of market actors (PBL, 2017). The research then scientifically contributes on how new roles could be shaped that adhere to the demands of proper governance in this context. Specifically this research explores the emerging role of purchasers expressing co-responsibility through stakeholder management. Considering that the scope of influence of purchasers on the quality and content of food products is increasing (Linnemann et al., 2006), purchasers attain more possibilities to exert pressure on producers ensuring sustainability. Since every stakeholder in the supply chain fulfils their role according to their own abilities, this new role enables purchasers to target effective strategies. The opportunities of this emerging role are not investigated profoundly. The chain approach in this study therefore researches the proper and most effective actions for purchasers to ensure sustainable meat production concerning antibiotics. The study then contributes to scientific literature on governance of antibiotic use in livestock farming (O'Neill, 2015) and hereby fills the scientific gap of the purchaser's role therein. Moreover, self-governance through voluntary agreements in the market is studied as the hospital aims to improve transparency of the supply chain and research the role of the purchaser in supply chain management. The research then re-enforces theory on market-based governance and contribution to the theory of voluntary-governance in grassroots innovations (Seyfang & Haxeltine, 2012).

The study contributes also significantly to societal relevance. As one of the biggest global health problems of today, counteracting antibiotic resistance is of major public interest (WHO, 2018). There has been made elaborate efforts to reduce the use of antibiotics in hospital and livestock setting, however up until now the role of civil society generally took a back seat to governance. Exploring

the role of purchasers in the governance of sustainable antibiotic use then provides another perspective in solving the problem. As the influence of purchasers might be great it is important to address it. In anyway the research augments transparency in the practices of stakeholders and the incentives underlying antibiotic use in livestock farming. This transparency will create societal awareness on the state of the problem and improves network collaboration between the public health, ecological and development knowledge domains (Geerling, 2016). Lastly, societal relevance is attained on a smaller scale as the research implicates the exploration of new purchasing policies that can be implemented by the Radboudumc on the basis of its corresponding results. However as large exemplary employers, executed policy measures could create sufficient support to make a substantial difference in sustainable antibiotic use in livestock farming. The outcomes of the research might provide implications for other institutions on a macro level hereby enabling a system change, benefiting human health and the environment.

2: Transitions in the institutional landscape

‘Op het einde van de twintigste eeuw beleefden we de laatste jaren van een cultuur zoals we die eeuwenlang kenden, maar die nu binnen enkele decennia tussen onze vingers wegglipte’ (Mak, 2001, p42).

First it is of value to dive into the historical and political context in order to provide information on the institutional processes and developments that led to the current state. In this chapter a historical background is painted on how the livestock sector is governed over time and why certain changes in governance occurred. The current governance concerning the use of antibiotics in livestock farming will then be explained. An understanding of the policy background may provide a prelude in sustainable strategies and solutions. This chapter hereby has the aim to answer the first sub-question ‘How is the use of antibiotics in livestock farming governed by the institutions of market, state and civil society?’ Later on in the research this evaluation of the current governance context will also serve to substantiate the methods and contribute to the formulation of recommendations for the sixth sub-question.

Historical background

When examining governance of the agricultural sector it is important to realize that farmers are difficult to mobilize towards new pathways. Farmers are generally conservative and warily for novelties, since a farm is rather inflexible. For farmers are exposed to a multitude of uncontrollable circumstances, like the weather and diseases, and they are stuck to a certain period of production (Veerman in PBL, 2018, p74). Governing the agricultural sector towards sustainability is therefore difficult because of those limits and the path dependency farmers are subjected to. The agricultural sector is locked-in a linear economic model driven by competition in scale, cost and export-production (PBL, 2018, p70). Dependent on the path laid out by the European Union and the state post-war, they are not in a position to readily change.

In 1962 Europeanization resulted in ‘a partnership between agriculture and society, and between Europe and its farmers’ (European Commission, n.d.) called the Common Agricultural Policy (CAP). The CAP had a multilevel character of agricultural policy aimed to support farmers and consumers (European Commission, n.d.). Laws and regulations were made on the European level and implemented nationally. While at the same time decentralized governmental bodies had the possibility to act within European policies and mould them to their needs. After the second world war the Dutch state had a great influence on the structure of the livestock sector. The state wanted to protect farmers and consumers through supporting a stable production of affordable food. The state and market collaborated and set up their own arrangements to ensure their common interest in improving the livestock productivity. Under the guidance of Dutch minister Sicco Mansholt, pre-

war small-scale mixed livestock farms transformed through a modernized path of upscaling, intensification and specialization (Kromhout, 2001). Antibiotics were used to improve productivity as they promoted growth in livestock (Martinez, 2009). Farmers could focus on production and received reasonable incomes, while low prices, trade surplus, food security and job opportunities benefited the Dutch economy (PBL, 2018, p76). The livestock sector became dependent on the support that the state offered in cognitive, material, financial and regulative resources (PBL, 2018, p90).

Later on, in the eighties and nineties, tradesurplusses were the cause for the formation of butter mountains and milk lakes. Around that time also the impact of antibiotics in livestock farming on resistance was alleviated (Martinez, 2009). The negative impact of the livestock sector on the environment became visible for society, and the state reacted by phasing out their support. Consequently, the interests of the market and state grew apart (PBL, 2018, p76). The state began to regulate and control the livestock sector from a distance pursuing the limits and values society set. Also on an European level measures were employed to limit production and to phase out price support. Moreover, the European Union required the livestock sector to provide ecosystem services. Subsequently, in 1988 the European Union banned feeding livestock for growth promotion of those antibiotics that are valuable in human medicine. In 2006 this ban was expanded to all antibiotics and related medicines (Martinez, 2009). Only up until then the Netherlands acted accordingly and banned antibiotics for growth promotion (O'Neill, 2015). Although farmers themselves cooperated for a long time to counteract overproduction in the common grounds, they were not fit to neutralize all negative externalities of livestock farming on the environment and are today often shattered, losing their governing power (PBL, 2018, p72). Obtained with a new role the state was to keep the collateral damage of livestock farming as low as possible (PBL, 2018, p72).

However, the liberalization of safety nets, and hereby phasing out the supporting resources, caused farmers to be subjected to the competitive rules of world trade. Governance began to change and big individual private players within the private sector gained more influence taking over the supporting role of the state. Resources and information were regulated throughout the supply chain in order to increase food safety and quality. Stakeholders within the supply chain could influence other parties by requiring high standards and pressuring farmers to improve the efficiency of their business operations (PBL, 2018, p72-75).

A recent policy paper of the Ministry of Agriculture, Nature and Food Quality published 8 september 2018 promotes circular agriculture on every scale for reasonable prices and through a revalue of food. Farmers will be rewarded for their investments in sustainable, safe and high quality products through the financial support of banks, the food industry, supermarkets and the consumer (MVO a, 2018). The state and civil society now have to make plans how to reach these goals, how the goals will be measured, and what the input is that is required from everyone. Willem Lageweg, president of the "Transitiecoalitie Voedsel", reacted by stating that to ensure a structural transition the price of food will incorporate the high societal costs of the livestock sector. He argues that the state has to take a strong governing role in order to change the rules of the game, which is not incorporated in the vision (MVO b, 2018). Lageweg continues that policies should not only be aimed at the producers, but should also entail measures that activate food-service distributors to support the

demand for healthy and sustainable products (MVO b, 2018). Ambitions of parties within the supply chains and drastic measures of the state are necessary.

Today's political context, an institutional analysis

Changes in the governance of institutional domains reflect the tendencies towards addressing the environmental issues of antibiotic resistance. The market, state and civil society all play different roles in environmental governance. The variety of institutional roles can best be displayed by the figure of Steurer (2013) as it shows the different forms of regulations (see fig. 4). Efficiency and effectivity in governance is elevated when networked institutions pursue common means and ends. Performance is thus influenced by the institutional design, political issues and societal context (Sørensen & Torfing, 2009). In the following paragraphs 'the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes' (Lemos & Agrawal, 2006) therefore will be discussed in light of a political and societal context.

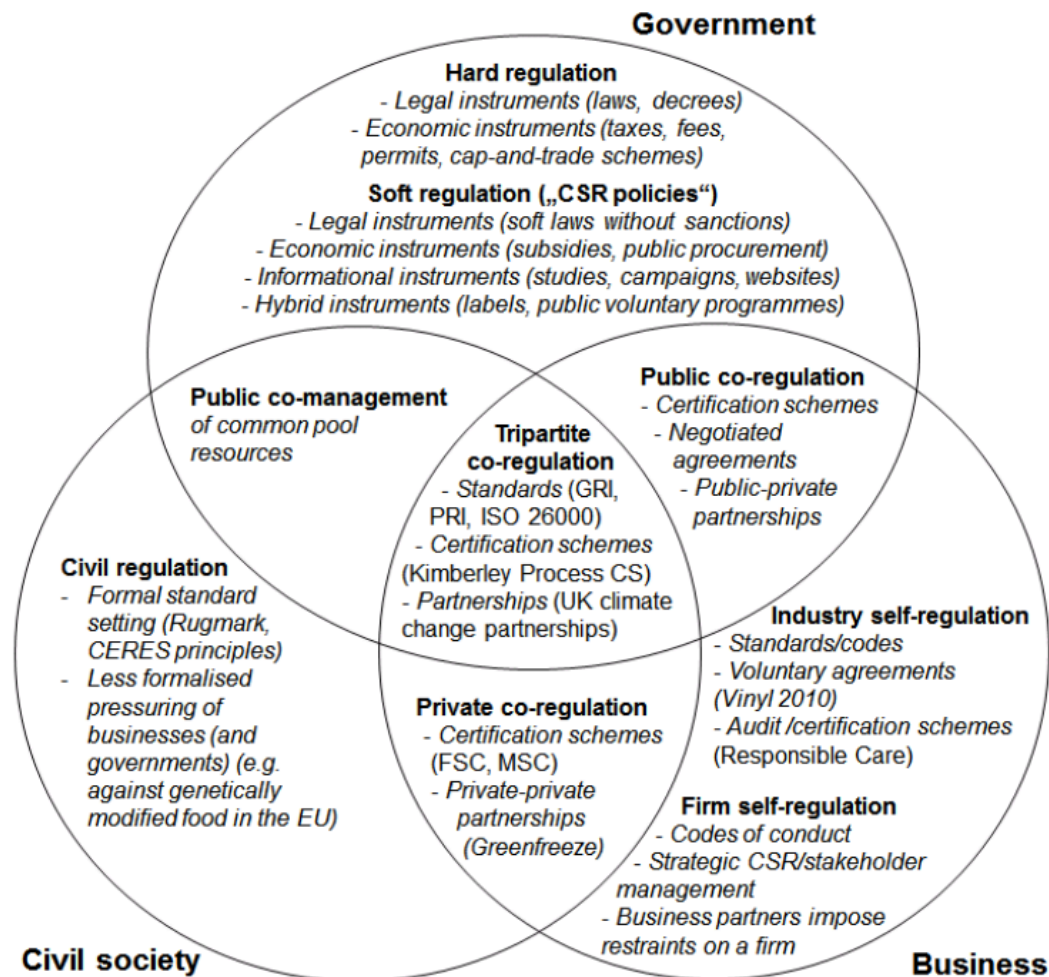


Figure 4: Regulative roles by government, business and civil society (Steurer, 2013)

The market

The concerned market consists a supply chain of stakeholders that generally includes caterers, food-service providers, retailers, meat processors, butchers and of course livestock farmers. Today livestock farmers are governed through procurement and chain approaches of other stakeholders within the supply chain. As the demanding stakeholders provide the technology, knowledge and market access for farmers, these stakeholders determine the material, financial and cognitive path dependency of livestock development. The choices of farmers in their investments are then dependent on the demand of the supply chain. Although the acts of livestock farmers (also concerning antibiotic use) are shaped through the pricing mechanisms of the market, the sector is unable to govern themselves as industry according the 'Business' roles proposed by Steurer (2013). Farmers are in regulation subjected to the organization of the supply chain and trade, where stakeholders impose restraints on their practices. Farmers are therefore part of the market, but (separately) also distanced from its governing power and often even represented by civil society. At the same time, the supply chain is not a coordinating center for the livestock sector (PBL, 2018, p 84). For instance in specialized pig farming there are a lot of links within the chain of production and without coordinated governance all parties within the chain as suppliers, retailers and purchasers have relatively influential regulating roles (Berkhout et al. in PBL, 2018, p89). Although 90% of pig holders are united through the Producenten Organisatie Varkenshouderij (POV), the industry lacks the capacity to govern itself. Together with the public-private collaboration ('public co-regulation' see *fig 4*; Steurer, 2013) Coalitie Vitalisering Varkenshouderij, entailing Uri Rosenthal, POV, Rabobank and the Ministry of Agriculture, Nature and Food Quality (LNV), they now aim to restructure the pig holdery through chain approaches (PBL, 2018 p89).

The state expects these chain approaches from the market, as they hold the entire market sector responsible for the prevention of antibiotic resistance (NVWA a, n.d.). This is in line with Steurers' 'business self-regulation' (2013) that insinuates businesses themselves to monitor, enforce compliance, set-up rules without tampering from the other institutional actors. They expect a joint approach where all the links in the production chain combine their knowledge and insights. According to the state the market should thus focus on the quality of the feed, better housing, measures to prevent infections and alternative business models. The structural reduction of antibiotic use should go hand in hand with the transition towards sustainable production chains (NVWA a, n.d.).

Private parties therefore collaborate in arrangements, where non-governmental organizations (NGOs) co-regulate ('private co-regulation' see *fig. 4*). Together they monitor and regulate if their rules on for instance food security and quality are maintained in the livestock sector (PBL, 2018, p83=84). One of these initiatives is GLOBALG.A.P. formed by European retail companies. They provide voluntary, extra-legal standards for farmers certified by a third party. Together with the Dutch Food Retail Association (CBL) they formulated sustainability criteria for the pig and poultry sectors of the Dutch market in their 'Sustainable Meat Initiative'. The initiative entails standards for environmental factors, animal welfare and human and animal health, including standards on antibiotic use: 'No human antibiotics and controlled reduction of antibiotics' (GLOBALG.A.P., 2013).

Farmers are then forced by the supply chain to cooperate according these standards via the power of the market, instead of jurisdiction (PBL, 2018, p84).

In a recent article published by the Dutch newspaper Trouw farmers were said to be ready for a large-scale renovation of the livestock sector (Bouma & Marijnissen, 2018). Farmers are still sincerely proud of their profession, but feel misunderstood by politicians, media, supermarkets and NGOs. Up to 80% wants to switch to more environmentally friendly methods and almost half of the farms wants to switch to sustainable forms of livestock farming within the next ten years, as they are less polluting and more economically viable. Moreover 75% aspires working together with green organisations. According to professor Wiskerke these findings leave room for new sustainable policies that should be fixed for a longer period of time in order to secure farmers that the required investments are worthwhile (Bouma & Marijnissen, 2018).

The market attained responsibility to allocate resources needed by livestock farmers and thus has a large influence on their actions. Since the market is influenced by consumerism and demand, supply chains do not coordinate but enforce and monitor standards. Economic values overrule social and environmental values in the structure of the chain, hereby disabling the market to govern themselves. Economic competition discourages an often costly transition towards environmentally-friendly farming methods that enable a lower usage of antibiotics.

The state

Where today the market of Europe determines the structure of livestock farming, the European Union sets the guidelines for its governance based on the present public values (PBL, 2018, p77). To encourage a transition to sustainable livestock farming today, public parties employ several modes of governance. The state and the European Union regulate the use of antibiotics through European laws. In 1996 they implemented new measures to control certain substances and residues thereof in living animals and products thereof (Eur-lex, 1996). Later in 2009 the EU insisted on and developed a benchmark system with the maximum allowed amount of residues of pharmacologically active substances, like antibiotics, in food that originated from animals (Eur-lex, 2009; Eur-lex, 2009). Subsequently, the problem of antibiotic resistance received also global attention. 'In september 2016, The UN Assembly agreed to act on antimicrobial resistance. For the first time, heads of state committed to taking a broad, coordinated approach to address the root causes of antimicrobial resistance across multiple sectors, especially human health, animal health and livestock farming.' (Wertheim, 2017)

However, agricultural policy is for a big part still a national or even a local matter (PBL, 2018 p78) and the capacity to coordinate and direct the course of agriculture is decreased as well in the market sector as in the state. Today farmers are often crossing environmental boundaries, resulting in an

increase in the amount of scandals (i.e. manure fraud, the fipronil affaire). Several of these scandals harmed environmental welfare (biodiversity reduction, emission of greenhouse gases), human health, food security and cultural heritage (PBL, 2018, p13). Still, the state does not reconsider their distanced governing role in order to change the pathway of agricultural development, but continues to only regulating the frequent exceedances of the standards (PBL, 2018, p81). Although this end-of-pipe maintenance role comes with high executing costs, the state confirms and maintains the existing path dependency of the agricultural sector through rules and control.

Nonetheless, results from Dutch policies have proven to be effective in limiting the use of antibiotics. In 2009 due to a Dutch government intervention that mandated a reduction of antibiotic use of 50% in three years by defining daily dosages and transparency in the prescriptions (O'Neill, 2015), living conditions on livestock farms were optimized without a reduction in profits or production (McKenna, 2014 in O'Neill, 2015). 'It therefore seems clear that a reduction in antibiotic use need not lead to a less productive agricultural sector' (O'Neill, 2015). Insight in livestock antibiotic use on a national and individual level through mandatory registrations and public-private partnerships led to a decrease in the use of antibiotics in livestock farming with 58,4% during the period of 2009 and 2015, resulting in a substantial reduction of the levels of resistant microorganisms in livestock sectors. In that period resistance towards one or more sorts of antibiotica is in the veal sector decreased by 26% in the pig sector by 22% and in the broiler sector by 8% (SDa, 2018). Furthermore, 'the Netherlands has the lowest rate of methicillin-resistant *Staphylococcus aureus* in the world, but also relatively low resistance rates to many other pathogens' (Wertheim, 2017).

Internationally the successful Dutch approach is called the 'Dutch Model' and numbers of the European Medicines Agency (EMA) state that the veterinary use of antibiotics in the Netherlands is decreased the fastest compared to other EU members (Van Dam & Schippers, 2016). One of these public strategies to control the rising trend of antibiotic resistance is the surveillance system of The Netherlands food and consumer safety authority (NVWA) aimed at preventing resistance. 'As antibiotics are the drivers of resistance, we need to ensure that those who need it, get it and those who do not need it, do not get it.' (Wertheim, 2017). Antibiotic use in animals is strictly regulated (NVWA b, n.d.). The NVWA controls project-based and as a response of reports at livestock farmers on their compliance with the veterinary medicinal product regulations. They check if livestock farmers meet the conditions and requirements that apply when using antibiotics. This entails the correct and careful use of antibiotics, its registration, and compliance to the administrative demands: a 1-1 relation between farmer and veterinarian, and company health and treatment plan (NVWA c, n.d.). The state thereby operates in 'the shadow of hierarchy' where the state threatens the farmers with legal instruments (hard law) when farmers are unable to meet the standards through other forms of regulation (Steurer, 2013). 'A hard legal environment is often a prerequisite for functioning industry or firm self-regulation' (Steurer, 2013). In order to enforce those follow-up surveillance measures, benchmark values for antibiotic residue in livestock were called into life as a result of a national action plan developed by the Ministry of Health, Welfare and Sport to tackle antibiotic resistance. The NVWA has the power to penalize livestock farmers if they provide animals for slaughter that still contain too much residues of antibiotics on basis of those benchmarks (NVWA c, n.d.). The NVWA uses an information driven chain approach and together with the livestock sectors and KNMvD they want to enforce joint compliance (Van Dam & Schippers, 2016). Since 2014

antibiotics got an UDD-status (only to be used by veterinarians) and only under strict circumstances livestock farmers can administer antibiotics themselves. This to counteract resistance and promote careful use of antibiotics (NVWA d, n.d.). The intervention measures of the NVWA are described in detail in the 'Specifiek Interventiebeleid Diergeneesmiddelen' (NVWA e, 2017), see Appendix A for a summary on the relevant aspects.

The decline however has come to a standstill and even increased again in the veal sector by 4,3% in 2015. New policies are necessary, recognized by the cooperating livestock sectors and the Royal Dutch Society for Veterinary Medicine (KNMvD) (Van Dam & Schippers, 2016). Dutch policies are committed to reduce antibiotic use even further upto 70% compared to 2009. Follow-up strategies are aimed at sector specific policies, taking the differences between sectors and the diversity of animal problems into account. The state therefore invests in knowledge and research to limit the risks of resistance and to improve animal healthcare (Van Dam & Schippers, 2016). In the new vision 'Landbouw, natuur en voedsel: waardevol en verbonden; Nederland als koploper in kringlooplandbouw' by Schouten (2018) of the ministry of LNV, it is proposed that a further reduction of antibiotic use is based on good care for the specific needs of animals and proper housing that provide space for their natural behaviour. The design of stables, the barn equipment and the feeding practices should receive explicit attention to the prevention of diseases (LNV, 2018). PBL (2017) suggests that proper feed, better hygiene, ventilated stables and avoiding stress are also possibilities to reduce antibiotic use in a responsible way. Identifying the needs at livestock farms and directing resources and skills to meet those needs could then enable an even further reduction of antibiotic use.

The state governs antibiotic use with law. It regulates the exceedances of standards instead of governing a transition of sustainable livestock development. The NVWA mandates transparency of antibiotic use by registration, a 1-1 relation between farmer and veterinarian and a company health and treatment plan. These measures led to a decrease of antibiotic use of 58,4% between 2009 and 2015. In order to pursue this decrease research is required aimed at the prevention of disease, through animal health and welfare.

Civil society

Civil society encompasses all the non-profit and non-governmental associations in which membership is voluntary and activities are based on voluntaristic mechanisms (dialogue, persuasion, bargaining) instead of enforced compliance by the state or market incentives (Edwards, 2004). Regulation of civil society is then based on formal standard-setting (legitimacy and moral claims) and informal pressuring: "the ability and willingness of society to create collective pressure on business beyond the rule of law by threatening the productivity" of businesses (Steurer, 2013). The activities are aimed at influencing the public with regard to their ideology, through for example awareness

campaigns, boycotts, ecolabelling and certifications (De Vos & Bush, 2011). 'An insufficient density, diversity or depth of associations leaves societies more vulnerable to authoritarian rule because the ecosystem cannot withstand external shocks' (Edwards, 2004).

The benchmarks controlled by the NWWA were compiled by the independent Stichting Diergeneesmiddelen Autoriteit (SDa). The SDa consists of scientists of human medicine, veterinary science and epidemiology (SDa b, n.d.). They describe solutions to reduce antibiotic use in Dutch animal farming. The SDa was formed as a result of the actions from the Stuurgroep Antibioticaresistentie Dierhouderij (now the advisory board of the SDa) presented by minister Verburg in 2010 of the Ministry of Agriculture, Nature and Food Quality (SDa b, n.d.). Civil society, the market and the state interfere with each other on the use of antibiotics in livestock farming via the benchmark system. Since 2011 the SDa monitors animal farms on their antibiotic use according to these benchmarks defined per animal sector and category (SDa, 2018). Data provided by the animal sectors enables the expert panel to report on the development in the use of antibiotics and classify companies according to these benchmarks (SDa, 2018). In 2017 the mass of active antibiotic substance that is sold is 181.097 kg in the Netherlands, which means that the total mass is increased by 3% compared with the previous year. The sales are relatively high compared to the registered use in the monitored sectors.

The benchmarks are compiled through calculating the DDDAf (Defined Daily Dose Animal over the use of antibiotics on a farm) for every animal sector of livestock farming. This is the sum of treatable kilograms of antibiotics present at a farm during one year, divided by the average number of kilograms' animal present on the farm. This measure indicates the level of antibiotics used per animal sector and is used to benchmark farms. In every sector an expert panel then determines what the amount of DDDAf is of the target value (green), signaling value (orange) and action value (red) (SDa, 2018). The veal sector has the most companies with a signaling or action value. Although in some animal sectors up to 90% of the companies have a target value due to reduction in use or no antibiotic use at all (SDa, 2018). The state proposes to reduce the use of red or orange farms towards green. Therefore they want to research critical success factors. Success factors for low usage are tested for effectiveness and failure factors for high usage (Van Dam & Schippers, 2016)

Civil society together with the state and even the market is thus pressuring sustainability of the livestock sector. The task of coordination and regulation then possibly lies with civil society organisations, through enforcing guidelines and quality marks. Labels help the consumer choose sustainable products over non-sustainable ones. The state places the responsibility for some societal problems for the sector itself, via quality marks within the chain like the Beter Leven-keurmerk to improve animal welfare and hereby also stopping the preventive use of antibiotics (Beter Leven, n.d.), or the KDV+ quality mark for retailers that produce meat of pigs that have never been treated with antibiotics (Keten Duurzaam Varkensvlees, 2016). Another quality mark is the EKO that entails meat from the biological sector, that often need less antibiotics since their living environment of the animals are focused on improving their natural health/resistance (Voedingscentrum, n.d.). Labelling improves consumer knowledge and helps to enable consumers making an informed decision on antibiotic use. However, some say products should not be labelled as 'antibiotic-free' since farmers should still be able to give an antibiotic treatment if so required (O'Neill, 2015).

In May 2015 global organisations agreed upon taking action combating antibiotic resistance. The World Health Organisation (WHO) released its Global Action Plan on antimicrobial resistance, in which it opted to regulate the “inappropriate or unregulated use of antimicrobial agents in agriculture.” Collaborating with The UN’s Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE) they confirm to take action on all levels in order to minimize the corresponding risks through active use of standards and guidelines (O’Neill, 2015; Van Dam & Schippers, 2016). In 2017 a national action plan was derived nationally, through the Global Health Security Agenda (GHSA) (Van Dam & Schippers, 2016) called a ‘One Health’ to reduce the use of critical antibiotics.

The SDA monitors the livestock sectors as they set up benchmark values to report on the development in the use of antibiotics per sector, in order for the state and market to act upon. Furthermore civil society organizations like Beter Leven-keurmerk and KDV pressure sustainable practices on livestock farms through quality marks. Quality marks help consumers choose products that entail sustainable antibiotic use. On global level collaborations between WHO, FAO and OIE confirm to take action.

In summary

Over the years several modes of governance have appeared to change the present form of the livestock sector. However, the livestock sector is organised in such a complex network of relations, agreements, obligations, dependencies and contracts that it obstructs the governance of a swift transition towards sustainability. Change therefore should take place through the entire chain of stakeholders in order to improve the sustainability of livestock farming (PBL, 2018, p9). To ensure such a change an institutional approach is required in this sector with the proper governance. Key players should collaborate and take up the lead to governance. As public and private parties have the same interest, a common goal to improve environmental and human health, reduction of antibiotic use even further is feasible. Farmers should be supported with the required knowledge and financial and material resources to ensure the transition to sustainability. Farmers are ready to change, but they need someone to guide and govern them. For without proper governance, it is too risky to change. The following is therefore proposed:

- *It is expected that current regulative measures lack the influential power to maintain an increase in sustainable livestock antibiotic use.*

3: A theoretical framework on strengthening the role of purchasers

'In een stad zie je nooit jongens oefenen, je ziet ze alleen presteren. Alleen het succes is daar openbaar, niet de lange weg die erheen leidt' (Mak, 2001, p18).

A purchaser perspective

Since 'many nations states no longer have the resources to manage their environments' and lost faith in the state 'as a reliable custodian of nature', environmental governance is decentralized and modern forms of governance pop up (Lemos & Agrawal, 2006). Co-responsibility allows institutions to collaborate and strengthen governance. The effectiveness of processes is therefore becoming increasingly dependent on the engagement of citizens (Lemos & Agrawal, 2006). As the role of the market and state is currently more explored in their governance of antibiotics in livestock farming, the following paragraphs will discuss the role of the purchaser therein and how this role can be strengthened in the supply chain by suiting strategies.

What is the current role of the purchaser in the procurement of responsible and sustainable antibiotic use?

The importance of consumer values

If current consumption values do not change, nor will the unsustainable economic course that promotes overproduction. Altering the consumption needs of people in the current society is difficult, as satisfaction is established by the desire to own and consume and needs are shaped by our surrounding environment and the materials provided (Jonker, Stegeman & Faber, 2018). End-of-pipe solutions to control pollution with small enhancements after systems are implemented cannot compensate for the negative externalities such as the harm to public health and disease, and the effects on environmental quality, that are resulting from the global demand and current resource intensive consumption patterns (Ashford, 2001). There are proper incentives needed to accomplish a transition to a more sustainable society that changes its consumption behaviour and still integrates the needs and wants of people (Ashford, 2001). Social and cultural changes in society's values can be established by civil society through the creation of awareness of more sustainable needs that consider for example the quality of life (Stahel, 1986), the environment and happiness instead of economic growth. If more relevant social or environmental needs are addressed that are beneficial to human live and help resolve global challenges, it can contribute to a more sustainable production

and consumption culture (Korhonen, Honksalo & Seppälä, 2018). When the state, market and civil society collaborate in solving societal issues, meeting the actual needs of society, they can enjoy the perks of business and market strategies that are able to influence the values of the consumer and create societal benefits (Porter & Kramer, 2011). The strength of the consumer can then be used to change the demand towards sustainable and responsible use of antibiotics for products.

The influential purchaser

The role of the purchaser is thus becoming increasingly important in our society. The purchaser as a modern regulator could influence the livestock sector towards sustainability. Purchasers have the possibility to form networks and collaborations that influence and put pressure on the supply chain. However, consumers are often subjected to psychological factors (Vermeir & Verbeke, 2005) and expect the state to take responsibility. 'The last decades have seen a growing public concern about food. Better informed and critical and assertive consumers expect their government to secure safe and healthy food and protection against all risks.' (Havinga & Van Waarden, 2013). An increase in public awareness and transparency in the sustainability of antibiotic use of products could influence the values of purchasers and thereby policies of state and market actors. NGOs and food distributing companies have a part to play there (O'Neill, 2015). Together with NGO's purchasers are able to require demands on the sustainability of the product (Havinga et al., 2015). They can reduce the use of antibiotics in livestock farming through their role in the formation of policy between the state and market as they determine the values set by the state and demand for the market. The supply chain however is complex and between the purchaser and producer there are a lot of links in trade, state and market, making it difficult to ensure this sustainability. It is possibly needed to reduce the links for more direct influence and contact with the producer. Making the chain transparent is therefore important.

The power of demand

Change towards sustainable and responsible antibiotic use in large supply chains is able through the demand and concerns of the purchaser. This is already shown in the commitment of large restaurant chains in the US for the chicken industry (Dall, 2018). In 2013 the public demand for antibiotic-free chicken in the US influenced private companies. More than 60% of consumers was willing to pay more for antibiotic-free chicken. Sales even rose by 34%. (Kesmodel, Bunge & McKay, 2014). Retailers can use their purchasing power to enforce food safety and quality standards and other specific preferences on farmers and suppliers. Within the food industry retailers have thus become an important player in the governance of food chains as they develop own standards and partnerships. Since the size of chains is growing, suppliers are dependent on retailers and have to comply with these requirements (Havinga et al., 2015). The purchasing power of recognized brands are therefore able to influence the industry. In 2015, in order to act upon the calls from customers, McDonalds announced to phase out chicken raised with vital antibiotics for human medicine. (Reuters, 2015). Recently, they revealed that their focus will broaden to restraining the use of antibiotics for the production of beef. Their influential position is expected to set a new standard for the industry (Reuters, 2018).

The hospital as purchaser

High impact can be made if big purchasers and food distributors are encouraged to buy and provide product that are produced sustainably concerning antibiotics. Researching supply chain management through procurement policies presents an interesting case-study. The purchasing power of food service distributors could help identify, demand and procure these products (Bisnett, 2016). Food service institutions like hospitals and universities could access and afford better meat if they communicate and collaborate in that shared demand. 'Representing nearly 18% of the economy, the health sector has the power to help shift the entire marketplace, benefiting public health and making products safer for all consumers' (Bisnett, 2016). The Radboudumc as purchaser of meat products have increasingly more influence on the content of products. In their procurement policies they can aim for sustainability by making certain requirements of the content and quality of food (Havinga et al., 2015). Hospitals can have success by alternative procurements through the direct purchase of small to mid scale producers. Furthermore, there is the possibility for hospitals to collaborate with their distributors to incorporate farmers and ensure a guarantee on sustainable livestock antibiotic use (Bisnett, 2016). The following is therefore proposed:

- *It is expected that the transparency of the actors within the supply chain enables the purchaser to disclose the level of livestock antibiotic use in the meat they purchase.*

Sustainable strategies for the purchaser

The governing role of the purchaser can be strengthened through suiting purchaser policies that are able to guarantee sustainable antibiotic use for the purchased meat. The exploration of these policies is guided by researching two business strategies of Hart and Milstein (2003) that improve sustainability, namely: Sustainability Vision and Product Stewardship. The scope of exploration now has a narrow focus; a framework is positioned. The eventual purchaser policies will be composed in light of these strategies in order to guarantee sustainability in the antibiotic use.

How can the governing role of the purchaser be strengthened within the chain?

To enforce a coordinated transition towards sustainable livestock farming, sustainable value needs to be created that involves both social, environmental as economic concerns. A new sustainable business model therefore requires strategies that implicate opportunities on multiple dimensions. In the sustainable-value framework of Hart & Milstein (2003) the global challenges of sustainability are linked to the creation of shareholder value for the company, by identifying strategies that contribute to sustainable development. The challenge of the mis- and overuse of antibiotics is of a global scale. In this research the business strategies of Hart & Milstein (2003) will be used to provide implications for the Radboudumc to govern the sustainable use of antibiotics. Where the sustainable-value framework focuses on both internal as external strategies, this research will discuss only the external strategies as it explores the business opportunities within the chain that are 'infusing the firm with

new perspectives and knowledge from the outside' (Hart & Milstein, 2003). The internal strategies based on the need to develop the technical core of the Radboudumc (Clean Technology) or protect the organizational skills required to limit in-door pollution (Pollution Prevention) are beyond the scope of this research project. It is urgent to point out that the Radboudumc is in fact coping with the effects of antibiotics on the environment through these internal strategies. The hospital set up project groups aimed at taking medicines out of their wastewater through for example specialized toilets and urinal bags that can be processed separately, technical adaptations in the hospital's sewage systems and creating awareness with doctors on limiting or adjusting prescriptions of environmentally toxic medicines (Radboudumc b, n.d.).

The strategies that are used for this framework are the external strategies Sustainability Vision and Product Stewardship that help the Radboudumc to create sustainable value through their surrounding social environment. Sustainability Vision is meant to payoff in the future, as it focuses on the development of innovative strategies that are driven by incorporating the unmet needs found in the concerned society. Product Stewardship is meant to have direct payoffs, as it is aimed at legitimizing the procurement practices of the purchaser by integrating the views of all stakeholders in the current supply chain (Hart & Milstein, 2003). The strategies will be discussed in light of their opportunities towards influencing the antibiotic use in livestock farming as a purchaser. Hereby increasing sustainable value throughout the supply chain. The framework will serve as the fundament of the research design as the strategies will be examined during the research for current appearance and feasibility in the sector. The research will then be conducted to explore purchaser policy opportunities in the entire supply chain from Radboudumc to livestock farmer and help to define the role of the purchaser. The following is proposed:

- *It is expected that the activities within the supply chain currently do not adhere to a Sustainability Vision nor to Product Stewardship (Hart & Milstein, 2003).*
- *It is expected that purchasers are empowered to influence responsible and sustainable antibiotic use in livestock farming by reinforcing a Sustainability Vision and Product Stewardship (Hart & Milstein, 2003).*

Strategy 1: Sustainability Vision

The strategy of sustainability vision has the aim to 'create a shared roadmap for meeting unmet needs' of future markets (Hart & Milstein, 2003). In conventional economy, social improvements in a company are perceived as a constraint and a decrease in economic success. However, societal benefits embedded in a business model can lead to innovation and growth, and even expand the overall amount of profits and value creation (Porter & Kramer, 2011). As discussed earlier, this concept is observed after the second world war when public and private corporations shared the same interests in the production of food, which benefited both society and economy. More recently, aligned interests in Denmark to address the societal need of decreasing the use of antibiotics in livestock farming, led to even more production and financial profits (O'Neill, 2015). The creation of shared value thus results in societal and economic values through growth trajectory (Hart & Milstein, 2003) since, unmet needs can be a source of originality and serving those needs presents

opportunities. It is created by playing into the actual needs of society, instead of the perceived needs of economic consumption patterns. That is to say, since the needs of society are huge (e.g. health, nutrition, preservation of the environment, safety) and there is a growing demand for products and services that meet these needs (e.g. healthier food, environmentally friendly products) (United Nations, n.d.). Addressing the need to prevent antibiotic resistance should then be recognized as a possibility to create shared sustainable value throughout supply chains. A sustainability vision provides 'guidance to employees in terms of organizational priorities, technology development, resource allocation, and business model design' (Hart & Milstein, 2003).

Throughout the whole supply chain livestock farmers can be supported with limiting their use of antibiotics. Creating a suiting sustainability vision is then dependent on two aspects (see *fig. 5*). First the process should be aimed at identifying the drivers of livestock farmers (or other links in the supply chain) that determine their choices and their needs that can be met to enable responsible and sustainable antibiotic use. Furthermore, the potential cognitive, technological and financial resources and skills should be explored that can put force into action.



Figure 5: Implications Sustainability Vision: 1) Explore unmet needs; 2) Explore skills and resources

Explore unmet needs

The research is aimed at identifying and recognizing the needs in the livestock sector that influence sustainable antibiotic use and are of common interest in the supply chain. Companies can interact with stakeholders exploring the incentives and needs of the target group. Those at the lower end of the chain need support in capital and resources as they often already have the motivation to change. As the article in Trouw (Bouma & Marijnissen, 2018) reported that farmers are motivated to change towards more sustainable practices, but do not have the technology, information required and financial security to change. Management and political choices regarding the use of antibiotics in livestock farming are influenced by cognitive, material and regulative path dependencies. Governing the sector towards sustainability requires the recognition of the specific path dependencies and incentives that influence the choice of the farmer (PBL, 2018, p62).

Explore skills and resources

This research is aimed at identifying the cognitive, technological and financial skills and resources and the strategies needed to coordinate and support these resources in the supply chain.

Companies should interact with stakeholders exploring how their skills and resources can best be deployed to meet the unmet needs. Innovative products, services and practices can be developed that meet the need and stimulate growth at multiple levels within the chain of production (Hart & Milstein, 2003). A prerequisite to govern public values is to identify the functionalities such as the required knowledge, funds, influential power, specific expertise, financial resources and people needed (PBL, 2018, p95-99) to decrease the use of antibiotics in livestock farming. Shared value can then be created 'by reconceiving products and markets, redefining productivity in the value chain, and building supportive industry clusters at the company's locations' (Porter & Kramer, 2011). For instance, IT advancements that promote innovation and profits the environment or market strategies that are adopted by other institutions enabling to influence sustainable consumption behaviours (Porter & Kramer, 2011). Another example is the principle of procurement: when a retail company works intensively with its farmers, providing advice and improving techniques, this in result will enhance efficiency, production quality, yield per hectare, and therefore the income of the farmers, reliable supply and overall sustainability (Porter & Kramer, 2011). All links within the chain support the farmer with the material, financial and cognitive resources. Bundling their information to improve the quality, efficiency and resource utilization, and sharing this throughout the chain will result in a benefit for every link within the chain. Shared value consequently serves joint interests. Economic value creation through social and environmental value creation by lowering the use of antibiotics is a great opportunity for business models to create aligned incentives throughout the chain.

Strategy 2: Product stewardship

Product stewardship is focused on improving current practices by 'integrating the voice of the stakeholder into business processes through extensive interaction with external parties such as suppliers, customers, regulators, communities, non-governmental organizations, and the media' (Hart & Milstein, 2003). The entire chain of stakeholders in the production cycle is included to reduce ecological impacts and improve relations, legitimacy and corporate reputation. By inviting stakeholders to articulate their ideas about the activities of the company, the behaviour of the company can be influenced rapidly and consequently external trust can be increased in the sustainability of their practices and purposes (Hart & Milstein, 2003). Research will be focused on studying the current policies and activities in the supply chain in order to find the proper policy strategies that enhance sustainable antibiotic use. Product Stewardship is improved by an increase transparency and connectivity, and by interacting with civil society organisations (see fig. 6).

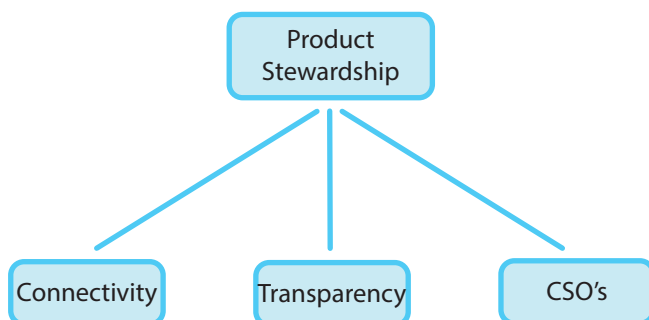


Figure 6: Implications Product Stewardship: 1) Increase transparency; 2) Increase connectivity; 3) Interact with civil society organisations

Increase transparency

The research is aimed at studying the current and needed regulative measures that ensure transparency on sustainable livestock antibiotic use and legitimacy throughout the supply chain and the potential role of the purchaser and the Radboudumc therein. Transparency enables fair and open markets by reflecting full costs and externalities, resulting in positive feedback loops of economic and societal merits (Porter & Kramer, 2011) and better compliance through higher support within the chain (PBL, 2018, p22). The effectiveness of governance is higher when problems in the practices of the chain can be observed and evaluated, by means of life-cycle analyses (Hart & Milstein, 2003) or for instance the output of the benchmark system (SDa a, n.d.). NGOs or leading companies with good reputations are able to put pressure on the chain when commercial interests are reconcilable with public values (PBL, 2018, p22). The sector therefore necessitates more transparency within the chain of production to exercise more influence.

Increase connectivity

Environmental partnership practices organized between the market, state and civil society are a feature of an ecologically sustainable organizations and can be encouraged by all links within the chain (Starik & Rands, 1995). Connectivity can be increased by building a network that stimulates information exchange. Ecologically sustainable organizations therefore invest comprehensive resources in strategies that promote collaboration within the chain. Chain collaboration will expectedly advance the support of shared sustainability values by the engaged links (Starik & Rands, 1995). As Dawson and Daniel (2010) described that 'the need for cohesion and delineation are suggested to be fundamental to the successful management of social innovation' by means of 'achieving resolutions to societal challenges that will advance social and environmental welfare'. Improving chain collaboration enables the innovation potential of the sector, optimizes production processes even further and sets goals and standards that transgress international aims (PBL, 2018, p22).

Interact with civil society organisations

In the research the current practices of and collaborations with civil society organizations will be studied regarding livestock antibiotic use and the possible strategies that encourage interaction. Interaction with civil society organisations, and therewith enhanced legitimacy, can be established by developing an active regulative NGO community that monitors all companies practices and even collaborates on certain issues. Moreover, active memberships with non-profit organizations results in enhanced reputation (Hart & Milstein, 2003). Acting upon a strong and society shared future perspective or value recognized by civil society provides direction and certainty for the course of the chain. The market is then responsible for the governance of the chain, but civil society organization have the responsibility to set up and enforce societal values. NGOs therefore co-regulate or collaborate through sustainable quality marks (PBL, 2018, p22).

4: Methodology

The study is organized following on the theoretical framework described in the previous chapter. To brush up, the current orientation is twofold; it focuses on the role of the purchaser and the implementation of sustainable strategies (Sustainability Vision and Product Stewardship) within a supply chain. In this chapter the methods and knowledge then will be portrayed that are needed to answer the main research question 'How can purchasers influence the chain towards responsible and sustainable antibiotic use by livestock farmers?'. First, the research philosophy will be described, then the choice of design for this research. The research model will form the structure of the research and includes the research propositions. The paragraphs thereafter explain the adopted methods more specifically and their implications; the data-collection and data-analysis. The last paragraph will discuss the research ethics.

Research philosophy

Validity and reliability of the research

'No inquirer, we maintain, ought to go about the business of inquiry without being clear about just what paradigm informs and guides his or her approach.'
(Guba & Lincoln, 1994)

Validity concerns the logic of the chosen path towards 'the correct operational measures that match the concepts' (Yin, 2014, p45). Assessing validity then starts by defining the right paradigm that guides the inquiry for the context of the current research. A paradigm is 'the basic belief system or worldview' from which the ontology ('what is the form and nature of reality?') and epistemology ('what can be known?') of the design can be derived (Guba & Lincoln, 1994). A paradigm will then have implications for the appropriate questions, tools, methodology, and data (analysis) to find the desired outcome (Leung, 2015). The basic belief system in this study is built on the accepted view of reality that antibiotic resistance is a result of the use of antibiotics in both livestock and healthcare sectors. The perspective of a realist 'assumes the existence of a single reality that is independent of any observer' (Yin, 2014, p17). The mechanism of antibiotic spreading is assumed to exist and to be driven by natural laws. However, this reality is not perfectly apprehendable by observers as they are bound by time and context and subjected to natural flaws, the ontology for this study is therefore 'critical realism' and the paradigm is 'post positivism' (Guba & Lincoln, 1994).

As for the epistemology it is necessary to look at the research aim. The aim of this study is fivefold: (1) to evaluate current governance, (2) to map the existing stakeholders, (3) to explore the activities in the supply chain, (4) to explore purchaser opportunities (5) and formulate effective policies strategies. These aims are considering that there is only one reality needed to be described and

made transparent, and that the findings will lead to substantiated recommendations. However, the investigated can be influenced by the perception of the investigator, since the facts can only be (and are) received through a theoretical framework hereby impairing objectivity (Guba & Lincoln, 1994). Since the view on reality is already based on the assumption of one certain reality where the findings only need to be uncovered, the appropriate epistemology is 'modified objectivist' (Guba & Lincoln, 1994).

External validity

The theoretical framework enables the formulation of the hypothetical story why acts occur and guides the data-collection and analysis. Furthermore, it helps to generalize the lessons learned to other concrete situations on an analytical level as it has 'the opportunity to shed empirical light about some theoretical concepts or principles' (Yin, 2014, p40). The case-study is positioned as health care supply chain management is able to effectively enforce sustainability and has the power to shift the marketplace (e.g. with Health Care Without Harm) (Bisnett, 2016). Hence, the role of the case-study is to explore the case in light of a theoretical expectation that the strategies Sustainability Vision and Product Stewardship are perceivable in this supply chain and that even with these conditions patterns can be observed. In light of post positivism the case-study then provides information on these conditions of the case study research. It is then a typical case, where the case could be relatively compared to other sustainable supply chain management cases of hospitals. Generalization is then based on proceeding and advancing the theoretical framework of Hart and Milstein (2003) in light of purchasers. Analytical generalization to other concrete situations can then be at a conceptual level higher (Yin, 2014, p41) than that of the case of the Radboudumc (i.e. all purchasers) and may potentially apply to an even greater variety of situations (Yin, 2014, p41). External validity is increased by means of analytical generalization through theory in case-studies (Yin, 2014, p45). Accordingly, validity can be guaranteed by placing extra emphasis on the pursuit of a probable truth through integrating the opinions of experts in this field and a thorough review of the literature. Hereby using various sources when developing a chain of evidence and have experts review the case-study (Yin, 2014, p45). Furthermore, validity can be enhanced by generalisability through the comparison of findings with existing knowledge of the context and through assuming probability at the repetition of findings (Guba & Lincoln, 1994).

Design

Research methods

The suiting methodology is qualitative, as the inquiry is prone to the discovery of new elements and viewpoints that determine the incentives and interests that participants ascribe to their actions (Guba & Lincoln, 1994). Although reality in qualitative methods can only subjectively be defined as it is extracted from the interpretations of men (Moses & Knutsen, 2012), interviews allow the researcher to discover the origin of actions and deviations in a broader context. In this study the institutional arrangements that define the policy context have great influence on the actual actions within a chain

of stakeholders and therefore should be considered. Qualitative methods will then consider situational information in natural settings as an important aspect as well as interpretations of hidden information on the rear side of the reality of participants. The inquiry will therefore make use of in-depth and semi-structured interviews. This means that while using a predefined list of questions to guide the interview (Saunders, Lewis & Thornhill, 2009), the participants are able to talk freely about their experiences that concern the topics. This will lead the conversations into previously unexplored fields. The inquiry has the aim to understand and explain the current situation and to predict appropriate strategies, as the knowledge obtained in the interviews are perceived as building blocks of reality. The generalised results could then inform policy and decision makers and enable them to justify their actions (Guba & Lincoln, 1994).

Assessing reliability in qualitative research refers to the extent the methods and results can be replicated. Consistency within the data is therefore relevant (Leung, 2015), as well as stability (Guba & Lincoln, 1994). To ensure reliability the data will be used comprehensively (including deviant information) attending to all evidence and analysed in a constant manner (Leung, 2015; Yin, 2014, p168). Hereby also aiming to avoid craft rivals as investigator bias. Ultimately reliability will be guaranteed by logical and clear reporting. The development of a database and a protocol to collect the data (described in paragraph 4.4) will be used to contribute to the reliability of the case-study (Yin, 2014, p45).

Accountability

The research questions asked are focused on an empirical inquiry about the effective policies for purchasers within supply chains. Hereby noticing the possibility of addressing the problem of livestock antibiotic use and of developing thoughts on the transparency thereof in the chain. The questions have the aim to both explain the complexity of a contemporary phenomenon within its context (i.e. the role of purchasers in sustainable livestock antibiotic use), while retaining a 'holistic and real-world perspective' (Yin, 2014, p4 & p16), and explore presumed patterns in-depth over which the researcher has no control (Yin, 2014, p4 & p14). The study gives insight in the societal framework purchasers acts and are bound to. Understanding the opportunities, conditions and restrictions within the context of a real-world phenomenon will provide lessons for general purchaser strategies within supply chains. The potential of such social innovations requires 'iterative negotiations to re-evaluate resolutions and outcomes for fit with the community and the continuous inclusion of shared knowledge, evolving perspectives and interactive experiences' (Dawson & Daniel, 2010). The suiting research design therefore is a case-study design with a supply chain as case, because it allows to analyse one case individually and in-depth (Verschuren & Doorewaard, 2007) where 'the objective is to capture the circumstances and conditions of an everyday situation - again because of the lessons it might provide about the social processes related to some theoretical interest' (Yin, 2014, p52).

A clear case enables system learning of that case, since generalisability is possible to other similar cases. This case-study will be held from the perspective of the Radboudumc as purchaser pursuing the guarantee of sustainable antibiotic use in the meat they serve to their employees, students and

patients. Limits and concrete boundaries are then necessary to set during case-studies (Yin, 2014, p32). Therefore, the scope of the project will be demarcated to the supply chain of fresh pig meat served at the Radboudumc. In 2017 the pig sector comprised more than a third (70.743 kg) of the total amount of antibiotics delivered that year (181.097 kg) (SDa, 2018). The rationale behind this direction is that it is argued that 'fresh' and 'pig' meat in the Netherlands is often supplied in the most transparent way regarding antibiotic use in their entire life for all concerned parties (Mevius, 2018), which allows the researcher to examine the research objective at every level of the supply chain. The supply chain is defined by partnerships between organisations. This means that during the case-study the activities of organisations and stakeholders involved at supplying fresh pig meat at the Radboudumc can and will be examined in depth. The incentives and interests at every level of the supply chain from livestock farmer towards the purchasers at the Radboudumc should be made transparent in order to formulate recommendations on the purchasing power in the entire chain. Exploring all stakeholders concerned with the supply of fresh pig meat will contribute to the quality of the case-study as the phenomenon being studied.

The research model and propositions

Out of the theoretical framework research propositions arose that are able to guide the research process and answer the main research questions. A research model has therefore been developed (see *fig. 7*) that describes the different research paths that derive from the propositions. The outcomes of the paths reflect the propositions. The design can be divided into five paths that represent the research paths that the investigator had to pass through when exploring recommendations for effective policy strategies concerning antibiotic use in livestock farming throughout the supply chain. The outcomes of the five research paths will be merged to formulate concrete and integrated recommendations and help to provide the answers of the research questions in the conclusion chapter. Each path is explained in detail below as well as their theoretical propositions that are able to guide the analysis. The propositions will help to show relevant contextual conditions and explain the current patterns in need for attention. They will then cover the analysis of the sub-questions in a logical and feasible matter (Yin, 2014, p37 & p136).

Path 1: Evaluating current governance context

Path 2: Mapping stakeholders

Path 3: Evaluating supply chain activities

Path 4: Exploring policy opportunities of purchasers

Path 5: Explaining effective policy strategies

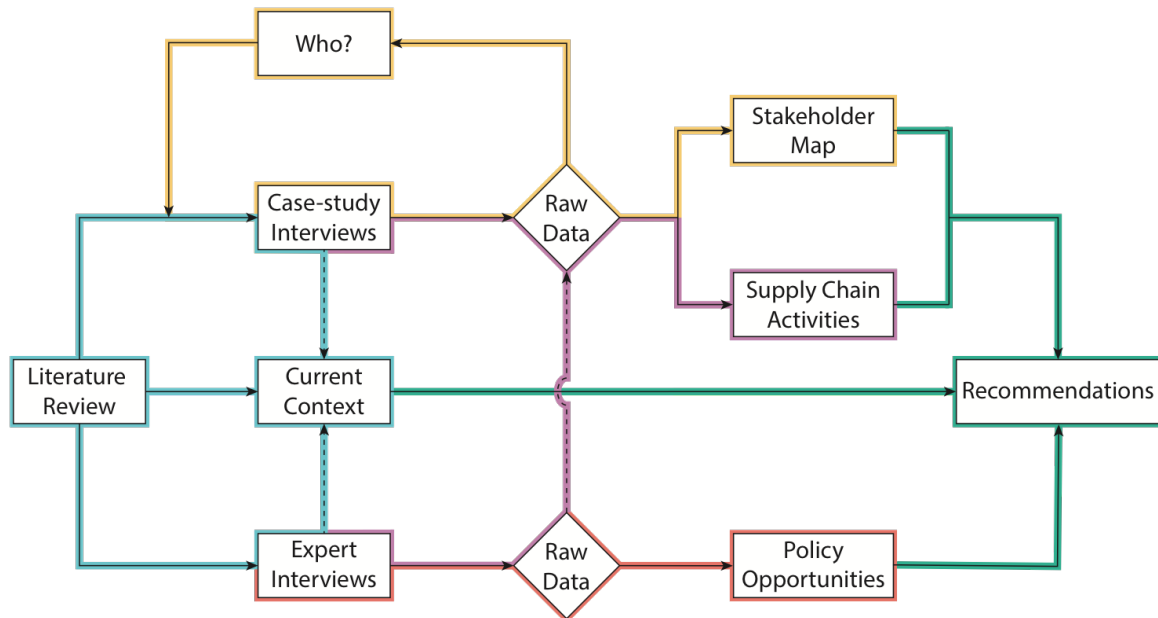


Figure 7: The methodological paths (path 1 = blue; path 2 = yellow; path 3 = purple; path 4 = red; path 5 = green)

Path 1: Evaluating current governance context (blue)

(Literature review + Case-study interviews + Expert interviews → Current context)

Governing responsible and sustainable antibiotic use relies both on the demand and structure of the market and the efficacy of state regulations on the actual activities within the chain. Research will be directed towards examining current governance to explore relevant contextual conditions and patterns worth examining (Yin, 2014, p136). The outcomes developed in the first path then contributes to the answer of the first sub-question 'How is antibiotic use in livestock farming currently governed by the institutions of market, state and civil society?'

Proposition

It is expected that current regulative measures lack the influential power to maintain an increase in sustainable livestock antibiotic use.

Path 2: Mapping stakeholders (yellow)

(Case-study interviews → Raw data → Who? → Stakeholder map)

The stakeholders in the chain were mapped through a bottom-up approach from in-house stakeholders at the Radboudumc towards the farmers. In order to discover the trajectory that the fresh pig meat went through from livestock farmer towards purchaser. The outcomes developed in the second path then contributes to the answer of the third sub-question 'Who are the stakeholders within the chain and what are their interests?'

Proposition

It is expected that the transparency of the actors within the supply chain enables the purchaser to disclose the level of livestock antibiotic use in the meat they purchase.

Path 3: Evaluating supply chain activities (purple)

(Case-study interviews → Raw data → Supply chain activities)

This path is aimed at examining the contemporary actions within the chain that influence antibiotic use, within the proposed theoretical framework. It is directed to explore the incentives of farmers, the interests of stakeholders and the activities of purchasers concerning antibiotic use, alongside the strategies Sustainability Vision and Product Stewardship (Hart & Milstein, 2003). The outcomes developed in the third path then contributes to the answer of the second, third and fourth sub-question. Analysing implementation of the strategies will describe the complexity of the field and therewith the possible opportunities for a purchaser.

Proposition

It is expected that the activities within the supply chain currently do not adhere to a Sustainability Vision nor to Product Stewardship (Hart & Milstein, 2003).

Path 4: Exploring policy opportunities of purchasers (red)

(Expert interviews → Raw data → Policy opportunities)

The fourth path *aims* to explore the possible role and opportunities of the purchaser by examining how the strategies of Sustainability Vision and Product Stewardship best can be carried into effect. The strategies will be reviewed with the experts in light of the possible influence of a purchaser within a chain of stakeholders to ensure responsible and sustainable antibiotic use. The outcomes developed in the fourth path then contributes to the answer of the fifth sub-question 'How can the governing role of the purchaser be strengthened within the chain?'

Proposition

It is expected that purchasers are empowered to influence responsible and sustainable antibiotic use in livestock farming by reinforcing a Sustainability Vision and Product Stewardship (Hart & Milstein, 2003).

Path 5: Explaining effective policy strategies (green)

(Current context + Stakeholder map + Supply chain activities + Policy opportunities → Recommendations)

The fifth path defines state-of-the-art purchaser policies that integrate the outcomes of each independent path. Thereby it has the aim to 'fill in the blanks' and create policies for a modern form of regulation. The outcomes of path 5 will result in concrete stakeholder management strategies from an organisational perspective to approach the problem on multiple levels. Effective corporate

policy recommendations for purchasers are developed. The outcomes developed in the fifth path then contributes to the answer of the sixth sub-question 'What are effective policy measures for the Radboudumc to ensure sustainable and responsible antibiotic use by livestock farmers?'

Proposition

It is expected that the policy opportunities of purchasers derived from path 4 (e.g. on how to increase connectivity) are able to encourage responsible and sustainable antibiotic use, by acting upon the current strategic gaps in the supply chain activities derived from path 3.

Data-collection

In the following paragraph the research procedure followed will be described. The research is conducted with a qualitative research strategy, where semi-structured interviews at all levels of the supply chain are substantiated with expert interviews within the field (Yin, 2014, p45). This paragraph will comment on the participants, the materials used and how the data will be collected.

The stakeholders in the case-study

In total 11 in-depth interviews were conducted. The selection of participants was based on their role in the supply of fresh pig meat towards the Radboudumc. The stakeholders within the supply chain were consecutively uncovered in response to the information that was acquired during the interviews in order to determine the next interviewee contributing to the information needed for path 2. Hereby it was necessary to be persistent in inquiring about the involved stakeholders in order to collect the relevant evidence from every stakeholder within the case-study (Yin, 2014, p203). The levels where the research was conducted are consecutively in-house at the Radboud, the stakeholders within the supply chain and the livestock farmers. Jaap Buis, Jasper Geijssen, Bert Van den Broek and Lucia Kilkens are affiliated with the Radboudumc. Vermaat and Maison van den Boer are the caterers of the Radboudumc. The Radboud University, Oregional, Sligro and Kaldenberg are the stakeholders within the supply chain. Oregional represents local biological farmers from the region of Arnhem and Nijmegen, where Jos Bolk with his Natuurkoeien is one of. The foundation Keten Duurzaam Varkensvlees is a cooperative that involves Dutch pig farmers. Since the civil society organisation Beter Leven Keurmerk is an important influential party in the activities throughout the entire supply chain, it is also considered to represent livestock farmers in this case-study in need for analysis.

Tabel 2: Information on case-study interviews

Name	Position	Affiliate organisation	Date interview	Mode of interview
Jaap Buis	Contract manager	Radboudumc	3/10/2018	Face to face
Jasper Geijssen	Venue manager	Food for Care	17/10/2018	Face to face

David Niessen	Manager retail and catering	Radboud University	23/10/2018	Face to face
Bert Van den Broek	General manager	Vermaat	23/10/2018	Face to face
Harrie Marinus	KAM manager	Maison van den Boer	26/10/2018	Face to face
Lucia Kilkens	Facility manager	Radboudumc	31/10/2018	Face to face
Jos Bolk	Livestock farmer	Oregional & Natuurkoeien	2/11/2018	Face to face
Ivan Huntjens	Head of quality department	Sligro	30/11/2018	Face to face
Gerrit Wafelaar	Account manager meat	Kaldenberg	16/11/2018	Telephone call
Bert van den Berg	Program manager livestock farming	Beter Leven	5/12/2018	Face to face
Anonymous	Anonymous	Keten Duurzaam Varkensvlees & Westfort	10/12/2018	Telephone call

The experts

The 13 participants were selected through an extensive field research both online as well as via expert inquiry. They were selected on their specific expertise concerning the studied context (i.e. guaranteeing sustainable antibiotic use in livestock farming). During the in-depth interviews the emphasis lay for six of the expert interviews on the role of purchasers in a supply chain, whereas the other seven experts had more background in the current governance context concerning antibiotic use in livestock farming. These enabled the interviewees to advice in the development of appropriate external strategies for purchasers in the current governance context.

Tabel 3: Information on expert interviews (Governance Context)

Name	Position	Affiliate organisation	Date interview	Emphasis	Mode of interview
Jaap Wagenaar	Professor Clinical infectiology	University Utrecht	9/10/2018	Governance context	Telephone call
Jan Dirk van de Voort	Agrarian entrepreneur	Remeker	24/10/2018	Governance context	Face to face
Jamal Roskam	Researcher Wageningen economic research	Wageningen University & Research	24/10/2018	Governance context	Face to face

Dik Mevius	Professor Veterinary medicine	University Utrecht	31/10/2018	Governance context	Face to face
Ron Methorst & Annet Velthuis	Lector and Researcher & Cattle research Manager	Aeres Hogeschool Dronten	6/11/2018	Governance context	Skype call
Heleen Prinsen	Specialist Animal Health	ZLTO	6/11/2018	Governance context	Face to face
Henk Jan Ormel	Chief veterinary officer	Food and Agriculture Organization of the United Nations	14/11/2018	Governance context	Skype call

Tabel 3: Information on expert interviews (Purchaser Context)

Name	Position	Affiliate organisation	Date interview	Emphasis	Mode of interview
Gary Cohen	President and Co-founder	Health Care Without Harm	11/10/2018	Role purchaser	Face to face
Sigrid Wertheim-Heck	Researcher Consumption sociology	Wageningen University & Research	24/10/2018	Role purchaser	Face to face
Mike Venekamp	President	Atlantis Handelshuis	26/10/2018	Role purchaser	Telephone call
Tetty Havinga	Associate professor Sociology and migration law	Radboud University	26/10/2018	Role purchaser	Face to face
Emiel Beekwilder	Quality Manager Food	Ahold	4/12/2018	Role purchaser	Face to face
Cathy van Beek	Quartermaster sustainable health care & Sustainability coordinator	Ministry of Health Welfare and Sports & Radboudumc	10/12/2018	Role purchaser	Telephone call

Materials

As mentioned before the interviews were semi-structured. This meant that there was a predetermined list of unbiased open-ended questions created to guide the interviews. The list of questions started with a short introduction of the topic: 'The role of purchasers: research on the possibilities in the supply chain of the Radboudumc to guarantee sustainable antibiotic use at livestock farms according the SDa benchmarks.'

The questions were based on the theoretical framework and research model. There were two lists of questions developed specifically for this study; for the stakeholders (Appendix B) and for the experts (Appendix C). The questions were shaped iteratively, as they were created, performed, improved and polished in response to the consecutive interviews. The questions were for both participating groups were asked in two research directions based on the type of evidence that was expected:

- First of all, evidence on path 1 was expected. Since the current governance on regulating antibiotic use in livestock farming was evaluated for both the stakeholders as the experts selected that were familiar within this field. An example of such a question was 'How is the mode of regulation experienced in the supply chain?'

The second direction in the interviews was to examine the strategies of Sustainability Vision and Product Stewardship in more detail. Evidence on path 3 (and as a consequence path 2) and path 4 was expected:

- During the stakeholder interviews their functioning was evaluated in light of the implementation of the strategies (path 3). A question for example was 'what are needs and obstacles for you and for the supply chain? and for the livestock farmers?'
- During the expert interviews the governance opportunities were explored in light of the strategies (path 4). An example of a predetermined question in this direction was 'To what extent can the Radboudumc (as a purchaser) address the needs and obstacles?'

During the interviews the researcher made use of a recorder and paper and pen to make notes.

Methods to collect data

The data sources were individuals representing their personal views on organizations or activities as well as providing explanations on the researched objective. The participants were contacted via email or telephone call in which the research aim was explained. Access to the contacts of a few key organizations and interviewees in the supply chain were gained through the assistance of other stakeholders motivated for the subject. Most of the organizations were contacted independently. Before the interview took place, the participants were sent the list of questions to allow them to prepare themselves and improve the quality of the interviews. The in-depth interviews were preferably face to face or else via Skype or telephone call.

The interview started with a short protocol (Appendix D) in order to inform the interviewee on some basic elements of the research. First a short introduction including explaining the research and its aims. This was followed by informing the interviewee on the publicity of the results, inquiring about the permission to record the interview and hereby ensuring the confidentiality of the raw data, the offer to review the used and translated evidence in the study, and discussing the anonymity. Whereas all but one agreed on the use of name and affiliate organization throughout the whole report. And one did not agree on the use of quotes. During the interviews the researcher was prepared to be unbiased, adaptive and informed 'much like a good detective' where the researcher 'hears the exact words ... captures the mood and affective components, understands the context from which the interviewee is perceiving the world, and infers the meaning intended by the interviewee' (Yin, 2014, p74-76). Although the protocol of questions was followed closely to cover the research aims, the participants were allowed to take interesting side steps going beyond the researched scope hereby

enabling fluid conversations (Yin, 2014, p110). The interviews were recorded and transcribed later on. The information of the transcriptions was then converted and sorted in a first raw data-base along the paths and divided in case-study and expert interviews. This raw data-base was used to create a chain of evidence for the analysis and the report. It is important to note that inaccuracies and response biases could occur during interviews (Yin, 2014, p106), but can be remedied by comparing the outcomes of multiple interviews and sources. Additional desk research was performed to support the evidence collected through the interviews with multiple sources; the internet, archive, books, contracts, emails and (in)formal documents (Yin, 2014, p119) if deemed necessary.

Data-analysis

In the following paragraphs the methods for processing and analysing the collected evidence will be described for each research path. First the data preparation will be discussed and after that the specific analysing implications. The methods for analysis rely on the theoretical orientation described in the third chapter and the corresponding propositions that led to the case-study.

Data preparation

The qualitative data gathered was processed and coded using remarks in the transcriptions. Relevant information and quotes per interviewee were coded and organized in the five different paths described in the research model. Information on the third and fourth path was even further subdivided in the three pillars of Sustainability Vision ('unmet needs', 'skills and resources') and the two pillars Product Stewardship ('transparency', 'connectivity', 'civil society organizations').

Analysing propositions and implications

The methods were to describe an overall pattern of the complexity in the case study that can explain the researched phenomenon within its context. The case-study will make use of explanation building as analytic technique, where the aim is to analyse the data by building a theoretical explanation about the case (Yin, 2014, p147). The theoretical explanation for the case-study builds on the propositions. The explanation of presumed causal links in the case-study reflects insights into the societal processes. The theoretical and societal propositions could lead to policy actions and theory building if they are correct when comparing the evidence against the iteratively shaped and revised explanatory propositions in the case-study (Yin, 2014, p147-149). The transcriptions therefore will be analysed on supporting and non-supporting evidence for each of the propositions, in order to eventually estimate the validity of the statement. In the coming paragraphs the implications of analysing each research path will be discussed.

Implications path 1: Evaluating current governance context

A broad literature review was done in the second and third chapter in order to meet this research aim and reflect on current policies. During the case study, both experts as stakeholders were inquired about the evaluation of the current regulative methods, specifically the SDa benchmarks.

Outcomes were analysed on the extent of current influence of the regulative methods in light of the governance context and the appreciation in the sector. The corresponding and deviating statements were highlighted (Yin, 2014, p135).

Implications path 2: Mapping stakeholders

Research will be directed by examining the evidence inquired from the interviews with stakeholders on Product Stewardship and hereby extracting the information that points towards involved stakeholders and their relations. Data will be displayed using graphics to examine the concerned stakeholders (Yin, 2014, p135). Results will be presented in a map that describes the interlinkages between the concerned parties as a network of stakeholders including their roles.

Implications path 3: Evaluating supply chain activities

Research will be directed by exploring the current implementation of Sustainability Vision (unmet needs; skills and resources) and Product Stewardship (transparency; connectivity; collaboration with civil society organisations) within a chain of stakeholders. How are strategies applied and where is room for purchaser policies? The evidence will be placed categorised and thereafter analysed on the occurrence of coded statements (Yin, 2014, p135). Needs and resources are complementary and therefore analysed against each other. Hereby connecting unmet needs with the corresponding available capacity on resources. Moreover, results on Product Stewardship will be presented in a heat map that describes the state-of-the-art by emphasizing the activities that occur more during the analysis opposite to the activities that occur less.

Implications path 4: Exploring policy opportunities of purchasers

The evidence of the possible policy opportunities of purchasers will be categorised per strategy of Sustainability Vision (unmet needs; skills and resources) and Product Stewardship (transparency; connectivity; collaboration with civil society organisations).

Implications path 5: Explaining effective policy strategies

The policy opportunities of purchasers will be analysed across the activities within the supply chain. Research is directed at testing to what extent purchaser strategies could be connected with the activities within the specific chain and context. The data of path 3 per subcategory per strategy will be analysed against the data of path 4, in order to examine if the strategy could connect with the strategic need. If there is a fit, the results will be analysed in light of the context and stakeholder mapping.

Research ethics

In this paragraph the procedures for protecting participants (Yin, 2014, p78) during the research will be discussed. With regard to ethical concerns, the researcher protected the data by promising confidentiality concerning the researched parties. This means that the raw data (records, transcriptions and databases) are only available for the mentors during the thesis and that the raw

data will afterwards be archived. At the start of the interview informed consent was obtained by inquiring if the data could be collected and used for the report, and privacy was discussed by inquiring their preference for anonymity. The researcher enabled the interviewee to review the statements used in the report in order to promise integer use of the name and affiliated organization of the interviewee. Since 'the most desirable option is to disclose the identities of both the case and the individuals, within the constraints for protecting human subjects' as it helps the reader of the report to recollect and review (Yin, 2014, p197). It was important to avoid deception, that is why the research aims were explained at the initial contact and at the start of the interviews. Moreover, the researcher aimed to be free of value during the interview 'even when objectivity is, in the case of post positivism, but a regulatory ideal' (Guba & Lincoln, 1994).

5: Results

Path 1: Evaluating current governance context

The first path concerns evaluating the policy context that is at play and evaluating the regulative measures in the field. Governance is determined by the actions of the different institutions of state, market and civil society. Defining the power play between the institutions in regulating antibiotic use and evaluating the current state of the art helps to formulate the role and thereby possible actions for the purchaser. Examining the efficacy of current regulations throughout the entire chain creates a starting point for the development of new policies on the level of the purchaser. First, we will take a closer look at feedback from the case study on the evaluation on current regulation, followed by the feedback from the experts on livestock antibiotic use.

Proposition

It is expected that current regulative measures lack the influential power to maintain an increase in sustainable livestock antibiotic use.

Case study

Current governance is hardly affecting the activities in the case-study

Governance on antibiotics in livestock farming is predominantly aimed at the livestock sector and thereby mainly influences the practices on the actual production side. The rest of the chain towards purchaser and consumer, including all the different stakeholders in the retail and processing industry are not influenced or involved with antibiotic use in livestock farming and regulations do not affect their work. 'We do not do anything with the benchmark as Radboudumc' (Kilkens, 2018). Livestock farmer Jos Bolk and the cooperative Keten Duurzaam Varkensvlees (KDV) as sustainable producers already have a low usage of antibiotics incorporated in their systems. 'The livestock farmers notice more of our standards because ours are stricter [...] companies that are affiliated with us are also enthusiastic and motivated companies, which are generally low as well' (KDV, 2018). The standards of the Stichting Diergeneesmiddelen Autoriteit (SDa) apply for all livestock farmers and are based on means and outliers. It is logic that their standards are less strict than those of KDV. Since, KDV works with a select pool and offers guidance (KDV, 2018). 'The standards are an incentive to motivate the pig holders; they are enthusiastic and really want to move forward [...] to keep the DDDAf (Defined Daily Dose Animal of antibiotic use per farm) as low as possible. At a given moment this becomes a bit of a sport' (KDV, 2018). The influence of governance regulations is time-bound as antibiotic usage stands for the entire year (KDV, 2018). Although green benchmarked farmers are less influenced by governance, the extra labour of administrating registrations and using alternative (often less effective) medication is perceived as a burden (Jos Bolk, 2018).

Experts

Balancing values when aiming for further reduction of resistance

The experts describe that antibiotic use in livestock farming is subjected to different factors. Policies on livestock antibiotic use require an integral approach to balance multiple values in human health, animal welfare, climate impact, the income of farmers, and the Dutch economy (Ormel, 2018; Wertheim-Heck, 2018). There is a discussion on the difference in antibiotic use between intensive and extensive farming. Ensuring animal welfare in intensive farming (high stock density) is linked with a higher use of antibiotics, while animal welfare in extensive farming (low stock density) is linked with a lower use of antibiotics and possibly other environmental benefits. However, even under all the right conditions, diseases can spread and issues with welfare arise when sick animals are not being treated (Ormel, 2018; Prinsen, 2018; Roskam, 2018). Procuring the green benchmark in intensive farming thus results in a dilemma for farmers, as they are economically penalized when they treat their animals, but also with a higher mortality rate (Ormel, 2018; Prinsen, 2018). According to Ormel (2018) intensive farming contributes significantly to the Dutch economy as 70% is exported internationally. That is to say as Dutch agriculture is economically the largest after the US (Mevius, 2018). The FAO expects a global increase in animal protein production of 70% in the next 20 years. In line with the mandate to counteract global hunger, they strive for a long-term sustainable production of food in the world. 'On a global level you could better invest in reducing the risk of resistance internationally [...] we are totally interconnected with the world around us where it is much worse. Invest in there, make it a little better there' (Ormel, 2018). Ormel (2018) argues that Dutch intensive livestock farming is then needed to maintain a science based (WUR and Faculty of Veterinary medicine, Utrecht University) production of high-quality animal protein (including a responsible use of antibiotics). 'I think it is of global importance that the Netherlands continue to produce animal proteins and also to export animal proteins' (Ormel, 2018). However, Europe also has minimum standards on animal health and animal welfare, without the negative consequences of so many animals on such a densely populated delta. Sustainable procurement policies could then enable the maintenance of high standard livestock farming (Van den Berg, 2018).

There was some contradictory evidence on the impact of intensive farming on climate change, as both extensive farming (large land required, high CO₂ emissions; Ormel, 2018) and intensive farming (soil toxicity; Cohen, 2018) were simultaneously accused of having a negative impact. Van de Voort (2018) explains how climate and health problems are often related to livestock antibiotic use. Antibiotics are for example used to treat infections resulting from concentrated feed (instead of grass fed). The content of the feed, the composition of nutrients, effects the health of livestock and therefore the antibiotic use at the farms the feed supplier delivers (Prinsen, 2018). Although concentrated feed (such as soy or corn) is cost-efficient, it is toxic due to the wry ratio of omega 6 (inflammatory) and omega 3 (anti-inflammatory). This wry ratio also ends up at the microbiome of the consumer. Moreover, the production of concentrated feed often exhausts the soil, and thereby the environment (Van de Voort, 2018). Wertheim-Heck (2018) underpins that procuring responsible and sustainable livestock antibiotic use can only be achieved with extensive farming. To prevent unintentional effects (e.g. inefficiency induced waste, CO₂ emissions, insufficient demand) meat consumption should be decreased. 'Decreasing our meat consumption does not only affect CO₂

emissions, but also has a huge impact on the antibiotics used in livestock farming. Consumers should be made aware of this linked message' (Wertheim-Heck, 2018).

Current governance does not change the cost-driven system

Livestock antibiotic use is perceived as a result of the cost-driven system and current governance does not address changes. 'We have the cheapest supermarkets in Europe, while we are the most prosperous country' (Venekamp, 2018). As farmers invested a lot in their systems to produce enough food for a low price, it is hard to change their unsustainable patterns. Especially as today supermarkets sell animal proteins dog-cheap and constantly on sale for it is perishable (Van den Berg, 2018). 'Consumers are used to see fresh meat products without brands, no advertising on taste or cosiness. It's only about price, and what's on offer this week. The result is that the chain, which produces animal products, earns very little, and also has little opportunity to set aside money for research and innovation' (Van den Berg, 2018). Retail organizations are driven by dividend and maximizing profits, which often inflicts social and environmental improvements (Venekamp, 2018). Van de Voort (2018) perceives a system focused on efficiency and increased production where the farmers, the supply chains and consumers are trapped in. 'You cannot escape the system, because to do different you have to change everything' (Van de Voort, 2018). The entire supply chain (the feed industry, the retail, the slaughters, even Rabobank via the provision of loans) has an interest in producing as many animals as possible per unit of time (Mevius, 2018). Breeding and concentrated feed heighten the production of livestock up to unnatural levels, effectively harming the resilience of animals and increasing the need for antibiotics. The revenue model is (also globally) based on cost reduction and production increase. As quality and nutritional values of the products fall away due to processing 'the consumer gets distanced from the farmer, as they only want advertised products' (Van de Voort, 2018). Farmers still perceive antibiotic use as a solution to minimize health costs and maximize production. 'They say, but now we can't get lower! They do not like that they are obliged to use less. No, we can go much further and they will see that their entire system will be less burdened, because it burdens the whole system' (Van de Voort, 2018). In 15 years (research with the WUR) the microbiome of the soil changed when Remeker stopped using antibiotics, as toxins were accumulating in the soil (and reducing the number of insects). This heightened the quality of the product, as the microbiome of the soil, transfers directly to the animals, and then also to the consumer: 'Stopping the use of antibiotics was the first step to disconnect from the system [...] we started to observe nature, as a mirror, and then you see reality. Then it also gets a lot easier, because nature guides you, it helps you' (e.g. instead of controlling disease use flies as guide to uncover the root of animal disease as they are attracted to waste; Van de Voort, 2018). Van de Voort (2018) explains that in a proper revenue model production decreases, quality will rise as farmers recycle in-house, and the consumer has to pay one and a half times as much as now. 'A lot of farmers will stop, but they will be a lot happier. A lot are now totally unhappy. At forums you do not know what you hear. It really isn't nice' (Van de Voort, 2018). The RUMC could communicate this story and explain the higher price.

Antibiotics were often used to mask management problems (Mevius, 2018; Ormel, 2018). It was cheaper to use antibiotics than to rebuilt your farm and hold less animals per square meter. Moreover, a farmer goes bankrupt when his animals get sick. 'I always said, make them just ten times as expensive. Then you take away an incentive' (Mevius, 2018).

Current governance is effectively reducing the development of resistance

The benchmarks indicated by the SDa were a part of state policies and over the years (dependent on the sector) led to a substantial reduction in antibiotic use. The SDa is able to analyse the results of sectors and farms anonymously and witnessed a lot of variation in use on farms within the sectors (Mevius, 2018). When a farm is persistently high in its antibiotic use, the SDa signals the sector that measures to improve the situation are needed and the NVWA inspects the proper management of antibiotic use on the farm. 'General measures are already so good, compared to other countries. [...] That is craftsmanship of Dutch farmers and veterinarians. If I buy Dutch meat, I know it is produced with a lot of attention for reducing the use of antibiotics' (Ormel, 2018). However, the consumer is often not able to choose for Dutch meat. The Netherlands set up policies to reduce the contamination of antibiotic resistant bacteria, while the meat that is purchased is produced and raised in foreign countries that do not have these benchmarks yet and the label does not allow the consumer to identify the country where the animals were produced (Mevius, 2018).

The effects of current governance have flattened

When around 2005 it became clear that livestock antibiotic use affected human health and the number of resistant pathogens with livestock farmers and their families, the livestock sector felt a large responsibility to act. The MRSA carrier of pig farmers was discovered in the RUMC. Farmers felt stigmatized as they were isolated due to a risk for other patients and became thus aware that there are not only economic consequences (Mevius, 2018). Van den Berg (2018) however notices that part of the farmers after a serious start, relapsed in denial when altering their methods appeared to be difficult. 'People have halved the antibiotic use in most industries, but a half of a lot is still a lot.' (Van den Berg, 2018). The state and society should keep on pressuring the livestock sector. 'One has, despite the efforts, picked the low-hanging fruit. Changing the structure, creates fear and uncertainty. And they don't want that' (Van den Berg, 2018). Moreover, the goal of 70% reduction of antibiotic use has not yet been achieved. Mevius (2018) explains that this is predominantly because of the antibiotic use in in the veal sector and some individual farms. In the veal industry they even use all sorts of mechanisms to influence the results on the SDa benchmarks (e.g. at times selecting healthier livestock to even the scores out over the year) (Van den Berg, 2018). Currently, benchmark values are altered and critical success and failure factors for antibiotic use on farms are evaluated. The benchmark values are however artificial, they merely indicate the percentage of reduction (and inquire on achievability and measurability) and not imply anything about responsible antibiotic use (Mevius, 2018) nor resistance for that matter. The benchmarks are then a standard for the farm, and not for the safety of the product. 'It is often the perception of a problem' (Mevius, 2018). The 50% reduction target was based on the antibiotic use before 2000. In the early nineties Dutch farmers became by law responsible for the choice in antibiotics and the veterinarians for vaccination. Since the ban of growth promoters in 1998 the antibiotic use rate had roughly doubled. Veterinarians sold the cheapest antibiotics in big volumes, causing a conflict of interest as they mainly profited from their own pharmacy. Current governance now limits veterinarians and lawfully oblige them to only use registered medicines that are less harmful for human medicine, disabling him to always make the best choice and resulting in dissatisfaction (Mevius, 2018). Prinsen (2018) perceives that to maintain a decrease in antibiotic use, it is important to look at the obstructing convictions with

farmers influencing their knowledge, attitude and behaviour. For instance, farmers believe they are not capable to reduce antibiotics or do not use it too much. Behavioural coaches can help to change their beliefs in order to create a proactive attitude. Furthermore, if the collaboration between the farmer, the veterinarian and the feed advisor strengthens in order to improve the health of animals, antibiotic use can be reduced (Prinsen, 2018). As some sectors have high ambitions and other ones are aiming for the margins, a plateau emerged (dependent on the sector), requiring new benchmarks. This is risky as the farmers took a lot of effort to change their management (Mevius, 2018). Roskam (2018) argues that it is now important to look at farm-specific circumstances instead of general regulations when aiming for reducing antibiotic use.

Farmers adhere to current governance

'The livestock market is seen as rather unreliable, as apparently the incentives to commit fraud are relatively large, whereas the risks to be discovered are low' (Havinga, 2018). The benchmark system made the antibiotic use in the sectors transparent also for the farmers and as a response they started changing their management. However, farmers were economically driven to aim for a DDDA_f that was just on the approved side (the orange value, which is now excluded in the new governance). 'In the livestock sector there is still a tendency to treat animals preventively with antibiotics on risky moments, were it not for the monitoring' (Mevius, 2018). Green antibiotic use results in higher costs due to other production systems and without financial compensation farmers will be more willing to behave fraudulently. 'Everyone keeps looking up the boundaries of the law, harming the systems, because 9 out of 10 they transgress it if they are not caught' (Venekamp, 2018). Currently, what happens (concerning antibiotic administration) during the growth and transportation of an animal is not registered nor incorporated in the benchmark. 'In companies we thought were completely clean, all animals carried residues of antibiotics' (Mevius, 2018).

Concerning the proposition:

Current regulative measures are limited in influence as the market is responsible and they are trapped in a cost-driven system. However, governance over the years appeared to effectively reduce antibiotic resistance through concerned livestock farmers. Maintaining the reduction is dependent on a system change where values are balanced.

Path 2: Mapping stakeholders

The second path aimed to map involved stakeholders. Policies are dependent on the actors and their relations within the chain. Mapping the stakeholders bottom-up from purchaser to farmer enables the purchaser to take all the stakeholders and their interdependencies into account when formulating policies. As witnessed in the third chapter, Product Stewardship is an important asset for creating sustainable value within a chain. Integrating the values of stakeholders, requires transparency of the involved stakeholders and a map of their relations.

Proposition

It is expected that the transparency of the actors within the supply chain enables the purchaser to disclose the level of livestock antibiotic use in the meat they purchase.

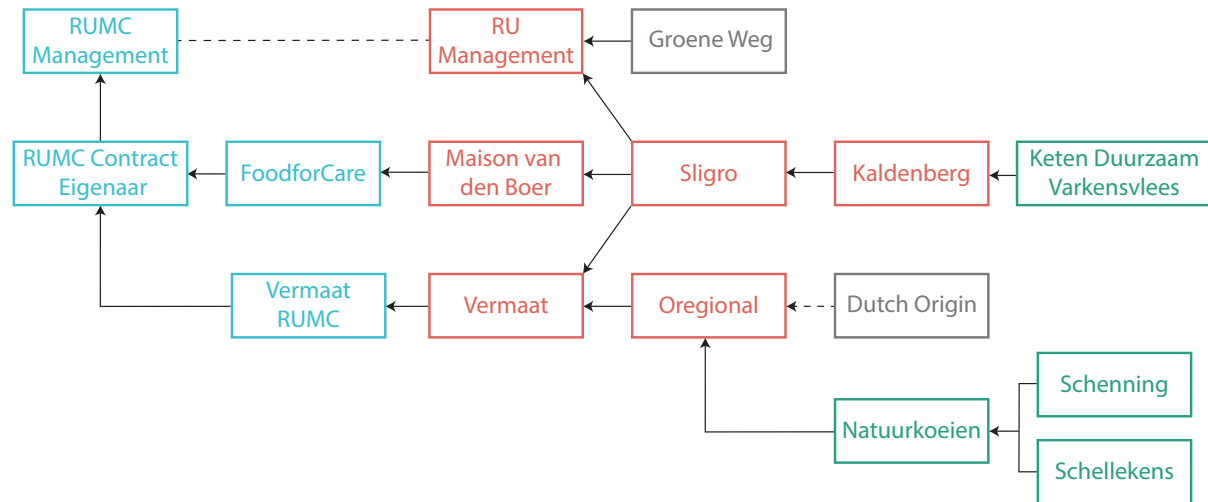


Fig 8: Stakeholder map of pig meat supply (Purchasers = blue; Stakeholders = red; Livestock farmers = green; Other = grey; Straight line = appeared relationship; Dotted line = no significant relationship)

Purchasers

Radboudumc collaborates with caterers in order to have a specialized offer per consumer. Vermaat provides food for staff and FoodforCare provides food for patients as they are focused on tailored nutrition in health care (i.e. custom food matching the needs per disease; Geijssen, 2018). The Radboudumc is bound to these caterers until the end of their contract (Vermaat in 2020, FoodforCare in 2023). FoodforCare is affiliated with their supplier Maison van den Boer and is therefore dependent on their purchasing department. The dishes for FoodforCare are prepared in the kitchen of Maison van den Boer in Veghel and transported daily to the hospital. Van den Broek (2018) from Vermaat is stationed at the Radboudumc on terms of management and collaborates with the contract owner of the Radboudumc on the procurement policies. As partners they decide on the interpretation of the hospitals' catering. It was argued that Vermaat bought most meat from Oregional (Buis, 2018), with a ratio of 50% Oregional's Natuurkoeien and 50% of their preferred supplier Sligro (Van den Broek, 2018). Although Vermaat procures products through their purchasing organisation, Van den Broek (2018) is responsible for the communication with Oregional.

Stakeholders

The stakeholders follow the national legal standards concerning livestock antibiotic use approved by the NVWA. Radboud University does not collaborate with the Radboudumc, although the management of the facility services occasionally have meetings. As they do not make use of caterers and are directly contracted with retail suppliers, policy is therefore completely different. Sustainable meat is procured at the Groene Weg and pig meat is mainly supplied by Sligro (Niessen, 2018). Sligro is also the preferred supplier of Maison van den Boer, unless Sligro is not able to supply the desired quality or variant (Marinus, 2018). Sligro is responsible for composite meat and does not

disclose information about their suppliers. Their fresh meat is supplied by their fresh partner Slagerijen Kaldenberg. Kaldenberg sells their processed meat in the shops of Sligro and therefore carry the responsibility for the products (Huntjens, 2018). Kaldenberg purchases pig meat from trade or from KDV. Only the latter ends up at the Radboudumc (Wafelaar, 2018).

Livestock farmers

KDV (2018) is certified by De Hoeve and consists over 300 sustainable pig farmers, a slaughterhouse and a meat processor (i.e. Westfort). KDV is also not prepared to disclose specific information about their suppliers, but in their quality mark they guarantee sharper standards on antibiotic use than the national green benchmark. Oregional, a local umbrella organisation, guarantees the supply of products from affiliated local farmers, or guarantees a Dutch origin of products. Due to transport logistics in trade the latter are always different livestock farmers, hereby losing the track & trace and therefore any guarantees on antibiotic use (Bolk, 2018). Bolk (2018) of Natuurkoeien states that currently Vermaat scarcely procures local meat from Oregional. 'Sporadic meatballs that are fifty-fifty beef and pig or composite meats that are only guaranteed a Dutch origin. Most of the meat served at the Radboudumc is probably supplied through the wholesale' (Bolk, 2018). For the meatballs he collaborates within a cooperation of free-range farms 'Bon Vivant' that are certified with two stars by the Dierenbescherming and have an 85% lower antibiotic use than average pig farms. The pig meat is supplied by local farmers Schenning and Schellekens. Transparency on livestock antibiotic use and a green benchmark is required of the farmers of Bon Vivant.

Concerning the proposition:

The purchaser is able to guarantee a green benchmark concerning fresh pig meat, locally and through the retail. However, without specific criteria on transparency, they lose track & trace as they are dependent on stakeholders to disclose information on suppliers.

Path 3: Evaluating supply chain activities

In this path the activities in the case-study are explored. First, current needs and resources are researched in order to examine possible innovative strategies (Sustainability Vision). After that, the current transparency, connectivity and interactions with civil society organisations are assessed in order to examine how procurement practices concerning livestock antibiotic use are legitimized (Product Stewardship).

Proposition

It is expected that the activities within the supply chain currently do not adhere to a Sustainability Vision nor to Product Stewardship (Hart & Milstein, 2003).

Sustainability Vision

Needs

Livestock farmers

Environmental value

KDV (2018) aims for the lowest administration of antibiotics, but considers that despite reducing antibiotic use as much as possible it remains necessary; animals may not be denied healthcare. Livestock farmer Bolk (2018) then describes a need for insight in the industry in the impact of sustainable antibiotic use and the hazards of (incidental) unsustainable antibiotic use. Improving animal welfare results in lower antibiotic use (Van den Berg, 2018). In livestock farms basic hygienic and biosecurity systems are often not in order, constraining the animals in their needs and creating stressors. When these stressors eventually affect the immune system, this leads to (bacterial) health problems demanding the use of antibiotics (e.g. veal standing above their fermenting faeces resulting in respiratory problems due to the created ammonia; or long and exhausting international transportation at a vulnerable age after separating them too early from their mother). 'The livestock sector has in its design just a large health problem. [...] General health should be improved on livestock farms to reduce the rest of the antibiotic use. The industry then really should structurally change and that creates a lot of resistance' (Van den Berg, 2018).

Social value

KDV (2018) argues that livestock farmers are in need for guidance and support. Their extra veterinary consultancy based on analyses of farm specific bottlenecks regarding antibiotic use, helps farmers to meet their criteria. One aspect thereof is acknowledging that processes take time, especially when scientific grounding is desired (Wafelaar, 2018). The negative stories in the meat industry currently overshadow the endeavours of sustainable farming, affecting the motivation of farmers. The concern of the consumer is missed. 'The consumer desires healthier and better food, but in the end is often not prepared to pay 5% extra when you offer such exceptional products. Money is really an obstacle.' (Bolk, 2018).

Financial value

Financial needs are strongly apparent with livestock farmers in order to reduce antibiotic use. 'Changes are financially so difficult that only a few supply chains work on this sort of stuff' (Van den Berg, 2018). There are periods of low or even negative income 'When times are tough in the livestock sector, it is hard to make alterations' (KDV, 2018). Farmers are dependent on loans from the bank and at better times have to compensate for the shortages with double interest. Banks demand farmers to expand and intensify to guarantee returns. Bolk (2018) expresses the need for sustainable behaviour to be financially rewarded for their investments, whereas now sustainable farmers have to compete with regular farmers. 'As an entrepreneur I am convinced that economic stimulants are the best stimulants' (Bolk, 2018). He argues that the Radboudumc should therefore prioritize the quality of products over price (Bolk, 2018). Price of a product is often decisive for a purchaser. Only when the price is equal, sustainability could prosper (Bolk, 2018).

Resources

Livestock farmers

Environmental value

Environmental value can be created through information and research done by livestock farmers, technical companies and the WUR to develop knowledge for technical improvements. Mapping and analysing the different factors that influence antibiotic use (e.g. type of disease, the housing, the feed, the climate, etcetera) creates possibilities to improve farms (KDV, 2018). Over the years, information on proper and responsible use of antibiotics to reserve the most medication for human health care contributed to a reduction in antibiotic use (Bolk, 2018).

Social value

KDV (2018) offers support to implement research and development. They also provide extra advice and guidance to meet the standards and communicate their empathy towards the difficulties. This creates social value as farmers feel supported and motivated to stay within the chain and meet the standards. 'Often it just takes a little time, to see the effects' (KDV, 2018).

Financial value

The farmers do not have resources to create financial value on sustainable livestock antibiotic use. Improving animal welfare does appear to be beneficial as farmers have to administer less medication and it increases the quality of the taste (Bolk, 2018; KDV, 2018; Wafelaar, 2018), however in the current intensified system farmers are not equipped to structurally improve their farms for the next 25 years. Oftentimes antibiotics are only replaced with vaccinations keeping the veterinary costs at the same height or even higher. Beter Leven Keurmerk aims to set up segments in the market showing possible sustainability possibilities (Van den Berg, 2018). KDV supplies financial resources or suggests alternatives enabling farmers to improve measures that limit antibiotic use all times. In order to create financial resources and gain yield as a reward of their sustainable practices, KDV created an added value concept that guarantees an 'antibiotic-free life'; during the course of an animal's life it has never been treated with antibiotics (registered through Smart Farming technology: Earmarks with a Radio Frequency Identification-tag) (KDV, 2018).

Stakeholders

Environmental value

Marinus (2018) of Maison van den Boer notices that the regular quality system does not provide guarantees on the impact of the indirect food safety risk in the long term, as the monitoring is predominantly on the amount of antibiotics in the end product at the time of slaughter. He perceives that a large part of the problem consists in the preliminary stage during the trajectory at the livestock farm; how much antibiotics is used during the rearing of the animal. Marinus (2018) has therefore incentive to create a goal around livestock antibiotic use, especially in the context of FoodforCare. 'In the hospital you have to deal with resistance everyday as a result of excessive use [...] I find it a very appropriate goal for us, so we will implement it [...] the question is how firm this goal can be'

(Marinus, 2018). The goal could aim that 'fresh meat should originate from a supply chain where antibiotic use is monitored by a program (like KDV) and the results of this program should be transparent. After it is transparent, the next goal would be to reduce antibiotic use' (Marinus, 2018). Using this goal as a resource to pressure the supply chain is dependent on a clear demand from their client on the transparency of fresh meat in the context of livestock antibiotic use. Marinus, 2018). Inciting the fresh meat supply chain, will incite the total supply chain as composites are merely residual flows. 'No animal is slaughtered to make a composite meat product' (Marinus, 2018). Sligro follows the policy of CBL. They monitor their private label on the conformity of lawful agreements for the direct food safety risk of antibiotic (mis)use in order to prevent reputational damage of their brand name. In their suppliers-handbook they elaborate on their intentions towards the supply chain, e.g. demands on Beter Leven (Huntjens, 2018). Kaldenberg (Wafelaar, 2018) embraces the concept of 'antibiotic free life' of KDV, especially for catering in the care sector. Kaldenberg already guarantees their future demand to support and stimulate production.

Financial value

Resources to increase financial value are described on multiple levels. In the new food court, the Radboud University will have an opportunity for sustainability and price differentiation in their product range. However, the Radboud University is bound to certain limits due to a restricted budget. Niessen (2018) could test with multiple suppliers if demanding sustainable livestock antibiotic use is realistic. Demanding biological meat is only possible with the right volume. If only a selective part of the product is purchased the rest gets downgraded. Biologically farming is then often not profitable and harming the environment (Wafelaar, 2018). 'Even with the right amount of consumer demand for meat produced with sustainable antibiotic use, there is not such an offer in volume' (Huntjens, 2018). In principle Radboudumc is responsible for possible increased costs, although they could negotiate with their partners to share the pain (Marinus, 2018). Sustainably produced meat (concerning antibiotics) should then be accompanied with a narrative on the animal's living environment to increase value for hospitality entrepreneurs or with a (costly) label to increase value for the care sector (Wafelaar, 2018). Sligro is able to obligate certain conditions from their suppliers, dependent on the interest of their target audience. And consumers remain obtaining unsustainable products. As for livestock antibiotic use this requires a collaborative demand and clear generally accepted standards. A niche product (instead of world trade) increases the price enormously as specific production means less sales and turnover for the few possible suppliers, which will be calculated throughout the supply chain (Huntjens, 2018). And increases price due to the monitoring on such claims and the canalization throughout the whole supply chain (Masja, 2018). If a purchaser demands a niche product, he is responsible for sourcing it. As this is client only, Sligro is only responsible for transportation (Huntjens, 2018).

The purchasers

Environmental value

The purchasers have the resources to increase environmental value via their contracts. Buis (2018) describes that they have the possibility to unilaterally enforce demands in the new Public Tender of 2020. Instead of 40% sustainable purchases, they could demand 70% local food purchases (by all means Dutch) of their caterers including a detailed description of the certificates and specifications

on the suppliers (Buis, 2018; Kilkens, 2018). Specification is necessary as 'commercial parties want to keep the money in their own pockets' (Buis, 2018). The Radboudumc is able to give penalties to their suppliers according procurement conditions based on extra-legal requirements for sustainable antibiotic use (earned money will be put back in the supply chain to improve). There is a need for a clear target to collaborate with partners in the supply chain. Contact with microbiologists to discuss reducing antibiotic resistance creates motivation and drives to create added value for the patient's health. 'Every reduction is a success' (Kilkens, 2018). At this point purchasers do not know the effectiveness of the current governance and if their contribution would be of added value (Geijssen, 2018). FoodforCare is able to demand transparency and the supply of sustainable livestock antibiotic use in their contract. However, Maison van den Boer is responsible for their purchases and that is their partner. It might be effective if the caterers bundle their forces towards Sligro via contract, or combine efforts with all suppliers and producers of patient nutrition (Geijssen, 2018).

Social value




The caterers are motivated to contribute to the strategies of the hospital, even without incentives they make efforts towards livestock antibiotic use (Kilkens, 2018). In Vermaat's Food Vision '2020 proof', developed in collaboration with Radboudumc, livestock antibiotic use is briefly mentioned. A lot of the hospital's staff are not actively aware of the added value of sustainable food. However, the consumer is changing and is asking for healthier, good and honest food. 'You see a new more conscious generation emerging that wants to make conscious choices and eat more consciously' (Van den Broek, 2018). The consumer can be encouraged by means of adding this dietary choice (Buis, 2018). Radboudumc is also able to create social value by means of screens, flyers, and online movies (Buis, 2018). Vermaat starts with QR codes on tables, which open a chat box that could communicate customers on the meat product (Van den Broek, 2018), and the benefits of low antibiotic use. The Radboudumc could thus contribute with their in-house knowledge on the consequences of antibiotic use as a resource to create awareness and urgency, also towards their suppliers and partners (Kilkens, 2018).

Financial value

Since there is a demand from Radboudumc, Van den Broek (2018) sees a clear need to respond to the demand from the customer. Demanding transparency and meat that is sustainably produced concerning antibiotics is only achievable if there is a supply and now there is no such offer (Van den Broek, 2018; Kilkens, 2018). Ensuring financial value is dependent on different criteria; support from other purchasers (Geijssen, 2018) and a constant uptake to create a sufficient demand. If suppliers can be ensured that their meat (i.e. the whole animal) can be distributed, suppliers are more willing to commit. As a purchaser it is then also more interesting as it enables them to create a narrative around the food they sell, increasing financial value (Buis, 2018). Added value is also created with transparent guarantees (on the packages) that ensure a predetermined level of sustainable antibiotic use approved by the Radboudumc. This could include a high animal welfare and a fair price for the farmer. Then Radboudumc is prepared to invest in catering and patient nutrition, when they can communicate a certain guaranteed quality (Kilkens, 2018) that is balanced with other sustainability values (Buis, 2018). Buis (2018) does perceive that costs are a barrier, as livestock farmers are cost-driven and probably take more financial risk if they use less antibiotics; while the purchaser in general is aiming for equivalent prices for the meat they are buying and not per se willing to pay more for

meat that is produced sustainably. 'If regional meat would be cheaper than wholesale then we would go in the right direction' (Buis, 2018). When the price difference is small, an occasional customer is prepared to pay extra for sustainability. With a large price difference, no customer is prepared to pay extra. The right price on sustainable antibiotic use is necessary that fits a business case (Van den Broek, 2018). 'You have to make sure that daily guests do not pay the bill, because then they will not come anymore' (Buis, 2018). FoodforCare has a sustainable business model and they are committed to purchase sustainably and locally. The concept of sustainable livestock antibiotic use has a sustainable marketing value, when there is more information on the adequate standard (Geijssen, 2018) and on its sustainability (Van den Broek, 2018).

Figure 9: Perceived resources in the case-study able to influence the farmer's needs

-  = Livestock farmers
-  = Stakeholders
-  = Purchasers



Product Stewardship

Connectivity

Farmers

KDV (2018) is able to collaborate by offering information flyers towards the supply chain. They do not collaborate with other stakeholders in the supply chain to meet the standards on antibiotic use, this is mainly internally organised within Westfort and KDV. As they are frontrunners in reducing antibiotic use through guidance, support and research, they recruit experts themselves. Bolk (2018) does not feel supported or connected with the supply chain concerning livestock antibiotic use. He describes that livestock farmers are merely monitored by the supply chain on (the deviations of) their activities. The rest of the supply chain (butcher, retail, caterer) is not involved (Bolk, 2018). Beter Leven Keurmerk connects with supermarkets, although that is difficult because there is little yield. They have to negotiate with supermarkets on the required costs that can be solved by either increasing the price or products or handing in a part of their margin (Van den Berg, 2018).

Stakeholders

The wholesale's lack of transparency obstructs connectivity within the supply chain. Marinus (2018) explains that it is Sligro's responsibility to be proactive and connect. Maison van den Boer might be willing to increase their volume and thereby the incentive towards Sligro, by collaborating with FoodforCare and Vermaat on the goals for livestock antibiotic use. Or with other caterers, as they are in a purchasing combination called HorecaPact (big purchasing partners of catering). Or a collaboration with Kaldenberg and Sligro to explore the possibilities (Marinus, 2018). The Radboud University is not able to collaborate with suppliers to ensure a green benchmark, due to the restrictions of their Public Tender. They talk with Sligro about sustainability, but always mind the

commercial interests (Niessen, 2018). Huntjens (2018) connects on livestock antibiotic use in the supply chain, by transferring the information they receive from CBL towards other stakeholders (creating awareness and enabling the possibility to act). Sligro connects with the Radboudumc and expects a proactive attitude from their client with clear realistic desires. When the Radboudumc connects with a few big national accounts requesting on this topic that creates an incentive. If Sligro cannot live up to their demands, the client has to go somewhere else, but not without consultation (Huntjens, 2018). Kaldenberg perceives KDV as an example for balancing values on animal welfare and on the environment. They collaborate by exchanging and sharing knowledge and complementing each other. 'Everyone wants a higher animal welfare level, a constraint on the environmental impact and a tastier product for the consumer. And yes, we have to eat less meat, but it should be better also' (Wafelaar, 2018).

Purchasers

Kilkens (2018) always has to actively motivate the partners to pursue, secure and control. The partners are interested to collaborate on the topic for the added value towards the Radboudumc to compete as the best caterer. Awareness on the impact of the activities in the supply chain concerning antibiotic use would help connecting with the supply chain. 'Everybody has pure motivation, but the connection is lost' (Kilkens, 2018). As they only specified a minimum of 40% sustainable purchases in their public tender, at this point the Radboudumc is not able to collaborate with local suppliers so that the region profits of it. Buis (2018) increasingly collaborates with Vermaat and FoodforCare to purchase more locally, but not per se on livestock antibiotic use. Vermaat has core values on sustainable entrepreneurship, including (local) fair trade, and therefore involve local suppliers (Van den Broek, 2018). Geijssen (2018) only connects with the Radboudumc to ensure sustainability, and might search for another supplier if Maison van den Boer cannot meet the demands (although they are in the same holding). 'The collaboration with the Radboudumc as contract partner is the most important. [...] The innovative strength that Radboud has encourages me to innovate at FoodforCare' (Geijssen, 2018). Collaboration could be done together with Diverzio (also stationed in the surroundings of Nijmegen) that advocates rights on fair, sustainable and healthy local food, and might be able to connect with farmers. Moreover, Buis (2018) describes that Cathy van Beek might help with her network as quartermaker sustainable health. 'It is important to connect and know of each other that you are there' (Buis, 2018). The Rabobank Rijk van Nijmegen that sponsors local short supply chains might facilitate direct contact with farmers. Current collaboration within the supply chain (even with Oregional) is only on reducing costs and discounts, at the expense of the farmers' income. 'Always looking for an opportunity to squeeze the other person out' (Buis, 2018). Caterers rather purchase at Sligro where there is a possibility on volume discount. 'All their establishments are more expensive if we want local purchases, increasing our and their price' (Buis, 2018).

Transparency

Farmers

A complete guarantee on sustainable livestock antibiotic use can only be given when the entire development of an animal is made transparent and the whole production happens in the Netherlands (born, raised, slaughtered, processed). Often animals arrive in the Netherlands after the

risky phase of their life, when they need less antibiotics. Oregional offers various product streams that guarantees a certain traceable farmer, or from a Dutch origin without the guarantee of a specific farmer (Bolk, 2018). Bolk (2018) is transparent on his antibiotic use, even published it once online. He only treats animals with first generation medication and has a DDDAf of 0.05 (the green benchmark level is 4 DDDAf). Free-range farmers are also transparent on their benchmarks and have a demanded improvement trajectory when farmers are in the orange benchmark. If farmers increase their price due to sustainability, the supply chain often multiplies these costs to profit from it, decreasing the incentive of the consumer to buy the product (Bolk, 2018). KDV (2018) is also transparent on their DDDAf. They publish the average of all their farms compared to the green benchmark of the SDa. In 2017 KDV had an average DDDAf for sows of 2,48 (SDa = 4), for weaned piglets of 12,63 (SDa = 15) and for meat pigs of 3,03 (SDa = 4). Generally, the participants of KDV satisfy. When a farm exceeds the standards, they acquire immediate support to create a plan of action that limits the use for the rest of the year. After positive results the farm will meet the standards the year after. Farmers can be kicked out after two years of failed improvements. (That is realistic as measures take time.) Meat can be traced back and KDV monitors the DDDAf of certified farms at all time. They do not provide meat from specific suppliers and are not transparent on the DDDAf towards the customer. That is confidential information and probably confusing for a consumer. In theory due to Smart Farming technology the product could be connected to the farm and the database of DDDAfs, however this also conflicts with privacy. They do offer a guarantee on a 'antibiotic free life' (KDV, 2018). Beter Leven Keurmerk (all stars) require a green benchmark. A separate foundation audits farmers yearly on their antibiotic use for the rating of the quality mark. These databases fall under the rules of privacy protection as farmers did not gave the permission to make information publicly. There should be a demonstrable reason and plan of action between farmer and veterinarian when he exceeds the DDDAf to return in two years, or in four years after an external expert analysis on the possible (multifaceted) risk factors. Beter Leven Keurmerk is not able to guarantee that their products do not consist farms that are in an improvement period (Van den Berg, 2018).

Stakeholders

Transparency is hard to guarantee with composite products as it is residual processing from the trimmings of large batches of maybe 100 farmers, disabling to track down which farmer produced the meat. 'It is easier to stimulate the supply chain regarding fresh meat as it is traceable, and only remotely fans out' (Marinus, 2018). Maison van den Boer is reserved in sharing the volumes they purchase. As quality service of Maison van den Boer it is beneficial that the responsibility on food safety lays with Sligro. They then only have to monitor the systems of Sligro with periodic audits and certification. This quality service and the goals on CSR are all transparent for (potential) clients (Marinus, 2018). Huntjens (2018) explains that they are also not responsible for livestock antibiotic use and expect their suppliers to act upon the market values. Sligro is not transparent on their external suppliers that fall under their private label and does not share names or analysis rapports, to prevent the risk of clients sourcing the products themselves through their purchasing organisations as it reduces costs (Sligro asks a 20% margin). The client is able to view the anonymous rapports of the product range of their order set. Information on antibiotic use would then be handled by Sligro. The outcomes might be confidential or match the demands of the Radboudumc. However, the supply chain is long and Sligro only has insight in the last point of assembly and the country of

origin. 'It is as a utopia to get information from the other side of the supply chain regarding composite products' (Huntjens, 2018). The wholesaler is able to trace the origin of meat via batch numbers (that are linked to earmarks). However, on the moment of slaughter animals from multiple farmers are processed together and tracing is lost. Kaldenberg does not have insight in livestock antibiotic use (they purchase meat from all over the world). Only the approval of the NVWA (who control the information on antibiotic usage) is transparent, hereby cancelling out the influence of the retail and processing industry. It is also not their interest towards their customers. They are oriented on taste. The Radboudumc only gets pig meat from KDV. Kaldenberg supplies mostly from KDV (40% of their revenue) and communicate their positive efforts regarding animal welfare and a low environmental impact through presentations and company visits. Kaldenberg benefits from the constant uniformity and sustainability of KDV (Wafelaar, 2018).

Purchaser

The caterers questioned Sligro on the traceability of products towards the farmer, however they have not acquired information. A taboo on the topic is felt and a lack of transparency counteracts clear communication (Van den Broek, 2018). 'If you start about antibiotic use it is like if you ask if they do something criminal [...] people are so afraid of losing trade' (Kilkens, 2018). The closed system almost entirely disables the purchaser to intervene as he can't acquire prove of the sustainable practices of farmers concerning antibiotics. Although in the Netherlands antibiotic use in the livestock sector is better organised, a lot of the meat that is purchased is not produced here. 'We do not know anything at all' (Buis, 2018). (Wafelaar (2018) however argues that other countries have comparable systems and that the NVWA also regulates the import.) Livestock antibiotic use (or green benchmarks for that matter) was not a condition and therefore there is no transparency. In the future transparency should be integrated in policy and determine the course of the Radboudumc (Buis, 2018). The Radboudumc is not responsible for the benchmark as they do not purchase food. The only agreements on antibiotic use is that they should satisfy legal standards. Their partners satisfy to that, are transparent on that and would be if something changes 'There is not more to offer' (Kilkens, 2018). Sligro and Kaldenberg were not able to expand on the specific farmers that supplied, sometimes not even the country of origin. 'Meat crosses the border to return back later. It is not clear what happens in the meantime. In the Netherlands we have guidelines on antibiotic use, but across the border there is no guarantee of a closed supply chain' (Kilkens, 2018). Kaldenberg could indicate where most meat came from, as they are focused as meat processor, while Sligro is a general wholesaler that also supplies dry groceries. 'Sligro or did not know or would not share the information' (Kilkens, 2018). Caterers could purchase meat from a focussed meat supplier in the future. Van den Broek (2018) claims transparency on their purchasing policies and shows every four weeks the percentages of the sustainable purchasing. He tells that 50% of the meat is purchased with Sligro and 50% is purchased with Oregional. This is not confirmed by Oregional.

Civil Society Organisations

Farmers

KDV (2018) connect with civil society organisations through research, for instance with the WUR, the Ministry of Economic Affairs and Climate, the NVWA and De Dierenbescherming. They are certified by Varken van Morgen and Beter Leven Keurmerk and collaborate to improve the criteria of the latter with possible adjustments on feasibility. Affiliated quality marks encourage alternative methods to limit antibiotic use. For instance, Beter Leven and Free-Range encourage consultation between the veterinarians and livestock farmers to develop knowledge together and reduce antibiotic use (Bolk, 2018). Van den Berg (2018) knows from their contact with supermarkets that they realise an important part of their clients have a dormant need that the supermarkets (or the government) address animal welfare and the environment. However, supermarkets are quickly criticized that their efforts are not enough resulting in name damage. Big companies want to work on sustainability and search societal partners to act. With their Beter Leven Keurmerk (since 2007) de Dierenbescherming therefore took responsibility to guarantee sustainability up until the package (Van den Berg, 2018). Bolk (2018) and KDV (2018) do notice an increasing demand of their (international) customers for meat produced without antibiotics. 'The public is interested where their food is from, what is inside and how healthy it is. Regarding antibiotics people are immediately concerned about resistance, and want to play a part' (KDV, 2018).

Stakeholders

Sligro perceives some quality marks as an add-on their private label, those that are not interesting, but requested to include to meet the clients target, are client only. The Radboudumc is the first customer that asks Sligro substantive questions about the antibiotic use for the meat they purchased. The topic is felt to be more active in the House of Representatives and at the level of branches, than it is with customers. 'When more customers come and ask, the more this topic is important for the suppliers in the chain. The fact that you are the first that comes and asks, says something about how this concerns purchasers' (Huntjens, 2018). Guarantees on antibiotic use that are above regular standards can then only be in a specific closed supply chain with a quality mark (without mixing and with full contribution of all the stakeholders to meet the standards), which is often pricier and increases the risk of food fraud by mixing chains. The whole branch has to cooperate (even internationally) to ensure guarantees (Huntjens, 2018). It is then difficult to join a quality mark and meet their standards. Stakeholders have to be tested in order to supply (Kaldenberg, 2018). Marinus (2018) explains that it is possible to assign claims in the future on purchased products and make those insightful for clients. For instance, the meat dishes of FoodforCare could have a claim on sustainable livestock antibiotic use (Marinus, 2018).

Purchasers

The Radboudumc does not collaborate with civil society organisations. Kilkens (2018) is prepared to communicate their efforts and their contribution towards decreasing antibiotic resistance. 'As Radboudumc we have to set exemplary behaviour, as we are a health institution and profile to bring health, we have to integrate that in our DNA and actually propagate' (Kilkens, 2018). However, there are only a few of their customers (patients and staff) that ever asks about antibiotics (Kilkens, 2018);

Van den Broek, 2018). Only 25% of 380 questioned patients expressed the provision of sustainable food in the hospital to be important. Procuring sustainable livestock antibiotic use is only translating the vision of the Radboudumc and is not as a result of the desires of the customer. 'Individual consumers all have their own needs. Organisationally we want very good and big things, but our average consumer, nurse and doctor is not thinking about that at all' (Kilkens, 2018). Buis (2018) demands the use of sustainable quality marks or local products, but not specifically concerning antibiotics. In the future they will specify reliable quality marks. Quality marks help in the formulation of policy and contributes to consumer insight and behaviour change as the customer is offered a choice. Geijssen (2018) explains that according their contract minimal 40% of their purchases should have a quality mark. Over the years Vermaat increased their sustainable purchases up to 43% for food & beverage in 2017. Sligro supplies per quarter term their purchases on quality marks as a percentage of their purchases. Those amounts can be added up of the sustainable purchases from Oregional to calculate the total amount of sustainable products compared to the total purchasing amount. Sligro is then able to determine which products meet quality marks on the basis of the given percentage of Vermaat (Van den Broek, 2018).

Table 4: Heat map on performance Product Stewardship activities influencing livestock antibiotic use (green = high; orange = medium; red = low)

	Connectivity	Transparency	CSO's
Farmers	Red	Green	Green
Stakeholders	Red	Red	Orange
Purchasers	Orange	Green	Red

Concerning the proposition:

Sustainability Vision and Product Stewardship are not implemented as the lack of transparency in the wholesale obstructs the purchaser to act and livestock antibiotic use is up until now only of concern with the affiliated farmers and not yet integrated in the procurement policies (see table 4).

Path 4: Exploring policy opportunities of purchasers

In this path experts will shed their light on the purchaser strategies to increase multiple values.

Proposition

It is expected that purchasers are empowered to influence responsible and sustainable antibiotic use in livestock farming by reinforcing a Sustainability Vision and Product Stewardship (Hart & Milstein, 2003).

Sustainability Vision

Environmental values

Farmers produce economically and to ensure sustainable antibiotic use they are therefore dependent on the financial input of purchasers when investing in costly sustainable systems (Methorst, 2018) or in certificates (Havinga, 2018; Venekamp, 2018). Havinga (2018) opts for three procurement measures that enable the hospital to influence livestock antibiotic use, being that the hospital is relatively small and therefore not a dominant actor for large suppliers. Sustainable livestock antibiotic use can be ensured though:

- Adequate quality marks
- Increasing the demand
- Local procurement

First, the purchaser could seek for existing standards or certifications that satisfy the purchaser's criteria and demand suppliers to meet these. 'I think that is the most achievable solution' (Havinga, 2018). Developing an own niche concept around antibiotics is difficult and increases the price of the product (Prinsen, 2018), since certification requires canalisation of the product throughout the entire process in the supply chain and fragmented volumes are less efficient in industrial processes compared to uniformity (Beekwilder, 2018). Secondly, Havinga (2018) proposes that the purchaser could increase its demanding power by collaborating with fellow thinkers, hereby creating a valid opportunity for retail organisations to meet the requests in search for a new concept. Thirdly, the purchaser has the option to shorten its supply chain and request for local (by all means Dutch) suppliers that are willing to guarantee transparency on their antibiotic use (Havinga, 2018; Velthuis, 2018). The purchaser is able to extend their influence when procuring locally in a closed supply-chain and ensure sustainable livestock antibiotic use with their financial resources. In the US farmers declared the need for a guaranteed market income to compensate the risks. As it would take a couple of years to change their farming practices and get to the level of desired antibiotic use, hospitals had to stick with them over a contracted period of time (Cohen, 2018). Venekamp (2018) offered his expertise to organize a tailored supply chain that comprises a selection of suitable farmers. They can cooperate with the hospitals ambitions on different (sustainability) criteria in a 'balancing act' (Beekwilder, 2018) and the nutritional value of their supply could respond on patients' prognoses. Local supply also ensures other markets of food produced with sustainable livestock antibiotic use (Venekamp, 2018), as decreasing antibiotic use to zero will eventually improve the farms' ecosystem and the investments will be earned back (Van de Voort, 2018). Purchasers could then also participate or facilitate a revolving fund for a selected group of supplying farmers that enables them to sequentially borrow money to invest in sustainable systems and repay when they have earned back on the reduction of health costs (Van den Berg, 2018). As it only profits farmers and environmental value, it is not interesting for wholesalers to support. Van Loon/Meat Friends implemented this in a Beter Leven pork chain to facilitate a barn coating method (HyCare) that improves hygiene and reduces antibiotic use completely (Van den Berg, 2018).

Social values

Farmers require acknowledgement for their efforts. Producing food is a difficult and costly process. Farmers are bound by the choices they make, whereas the purchaser can act more freely (Ormel, 2018). Society requested farmers to decrease antibiotic use and change the system they trusted, increasing contamination risk and therefore risking financial loss (Methorst, 2018). 'With thousands of animals together, it is essentially a daycare where diseases are going around. This can sometimes be difficult to manage' (Mevius, 2018). Methorst (2018) describes a need of farmers to be taken seriously and be approached with respect in their profession. There is often felt a discrepancy between both ends of the supply chain that can be overcome by investing in the relation with the farmers (by means of occasional visits for instance) (Beekwilder, 2018). 'Farmers should be seen as heroes, putting them on stage, as they supply our first basic needs' (Venekamp, 2018). In the hospital in Hoorn farmers are invited to eat there once a year to see what happens with their product. This creates a lot of momentum and solidarity that contributes to enhancing social values. 'From that positive angle you will get a lot of ambassadors of your hospital in your region' (Venekamp, 2018). The costs on sustainable and healthy food ensures quality hygienic supply and care available in the region. 'Health care will radiate health' (Methorst, 2018) as the chance procedures succeed increases with healthy nutrition (Venekamp, 2018). As largest employer of the region they can calculate how much of their purchasing power is supporting the local economy. 'Part of the broader mission of the institution is how are you supporting the green economy in the region [...] they should be talking about it' (Cohen, 2018). A local supply chain also benefits communication on sustainability. In Hoorn customers of the hospital can scan their placemats with their telephones, showing interactive movies of local farmers telling about their product. Oftentimes patients run into the farmer afterwards and talk about their experiences regarding the food (Venekamp, 2018). Knowing their consumers (in health care) encourages farmers, they become proud on their profession (Methorst, 2018).

Financial values

Sustainable grown meat costs more money and 'the hospitals can't afford to spend more money' (Cohen, 2018). Cohen (2018) opts for a solution where hospitals reduce the amount meat they serve to patients by 20%. The money saved on serving less meat, as it is the most expensive thing that they buy, is used to serve better meat and support more sustainable forms of farming. 'As the hospitals are serving too much meat anyway. From a health point of view people do not need so much meat' (Cohen, 2018). The Radboudumc has the possibility to alter their offer and ban the regular, cheaper and less sustainable meat options (Roskam, 2018). Replacing the animal protein uptake with vegetal protein uptake is both beneficial for human health and the climate. Decreasing animal protein consumption and investing in costlier sustainable alternatives then contributes to the procurement of sustainable livestock antibiotic use (Wertheim-Heck, 2018). As procuring sustainable food is expected to cost a bit more, it is important to communicate on the sustainability towards the staff (Wertheim-Heck, 2018) and explain the demonstrable value of sustainable food for the recovery and cure of patients in discussions with the board. 'It is a medicine, in the positive sense' (Van Beek, 2018). The staff can either pay the extra price because they support the sustainability, or they are not willing to pay extra and eat more replacement products instead of animal protein. 'You win both ways' (Wertheim-Heck, 2018). Often customers believe that sustainability is properly addressed in regular

products and are not prepared to pay extra (Beekwilder, 2018). A revenue model could then focus on marketing aspects related to sustainable antibiotic use; veal that is not separated from their mother, (in the future) the proper omega 6 omega 3 ratio benefitting human health substantially, and taste (Van de Voort, 2018).

Investing in sustainable food, will often result in financial savings on another level 'as in an ecosystem' (Venekamp, 2018). 'People rely on antibiotic as a critical tool to address disease, and so, for using antibiotic in animal production to the detriment of human medicine makes no sense at all. So there is a big piece of the healthcare sector's interest in it' (Cohen, 2018). The cost-analysis of a hospital's management should include the preventive and curative benefits of healthy food as it addresses antibiotic resistance. The Radboudumc could act as an example (Wertheim-Heck, 2018). 'If health care institutions provide healthy and quality food, integrally there will be an effect on medication use, on recovery, on welfare or how people arrive at the hospital' (Venekamp, 2018). Antibiotic use as a sustainability condition (due to the indirect societal risk) should then become more relevant in the procurement policy of the hospital (Wertheim-Heck, 2018).

Cohen (2018) describes how to interact with the supply chain that perceives financial problems when procuring meat that is produced sustainably concerning antibiotics. It is important to talk about the difficulties, sometimes seek compromises, and patiently help them resolving the problems they see. 'You can't rely on these companies alone to do the right thing [...] It requires societal pressure to make them better than they are' (Cohen, 2018). Integrating all interests might even lead to a collective result. The supply chain might be able to decrease costs in another way (for instance reducing the amount of sugar) (Van Beek, 2018). The purchaser can be specific and firm: 'it should not cost more money; you are taking chemicals out. It should be just as price competitive' (Cohen, 2018). Without cooperation the purchaser has to find another more suiting partner, as he has the option between boycott and bycott where he consciously not buys the product or buys it elsewhere (Wertheim-Heck, 2018). 'Ultimately the buyers have a lot of power. Which they have not exercised yet sufficiently [...] my experience is that the demand drives the transformation' (Cohen, 2018).

Product Stewardship

Transparency

The entire supply chain and their processes must be mapped in order to analyse the power of the purchaser in the procurement of sustainable antibiotic use (Wertheim-Heck, 2018). It is important to disclose the supplying farms. The purchaser needs a guarantee that the supply chain will not make shortcuts (Cohen, 2018). Ensuring transparency is able through a certified examined chain. 'People are afraid for the administrative burdens, but if we want to green the environment it cannot go without accountability and transparency. A lot happens under the radar' (Van Beek, 2018). The GRI poses a possible solution as non-profit organization that has a global standard for sustainability reporting (Van Beek, 2018). However, every link in the supply chain has to be paid in order to disclose transparency on the end product (Prinsen, 2018). Maintaining such a system is costly and often the extra money does not end up at the farmer. The hospital's procurement policy is then key to request

sustainability of the farmer's methods, where transparency and evidence on the ratio of the price structure should be incorporated (Ormel, 2018; Venekamp, 2018). The benchmarks are not public now; it is shielded information only available for the quality systems within the sector at the farmer. 'At this point it is only made insightful, but there is not a driving factor to encourage farmers to improve' (Beekwilder, 2018). At slaughter the information on antibiotic use is filled in by the livestock farmer and made available in the shielded 'Veehouderij Keten Informatiesysteem' and the accuracy of the information in the VKI forms is difficult to predict (Mevius, 2018). Farmers are reserved when it comes to sharing information on their antibiotic use (Beekwilder, 2018). Communicating on transparency risks scandals for the farmers and bankruptcy (Prinsen, 2018). It is thus important to be open and receptive towards their honesty and not to abuse their transparency (Methorst, 2018).

Demanding maximal transparency throughout the whole supply chain then facilitates a system change as it triggers a responsible production. 'The health care has the key in hand to change the whole agriculture. From producing towards a low price for a lot of volume towards producing for an honest price for quality food' (Venekamp, 2018). However, supply chains are large and diffuse, making it hard to guarantee the tracking of meat (Methorst, 2018). Food should be traceable by European law, but the origin of the meat is currently not available for the purchaser and also the wholesale often does not have regular suppliers (Havinga, 2018). Guarantees on transparency of general markets and insurance of the sustainability of the product is lower than direct purchases or connecting with an already existing system, chain of quality mark (Havinga, 2018). When purchasers buy food directly with a constant and transparent price they can bypass the 20% margin of wholesalers. Products can be picked up and shipped via post offices that only charge 6,25 euro per package (independent on weight), which is less than the margin of wholesalers (Van de Voort, 2018).

Connectivity

Connect with other hospitals

Van den Berg (2018) argues that procuring sustainable livestock antibiotic use with the collaborate effort of multiple hospitals, is a way to influence the farmers at the end of the chain. Support of the (academic) hospitals and healthcare leaders (e.g. sustainable health care suppliers; Van Beek, 2018) will create a big marketplace and an opportunity to counteract antibiotic resistance through the procurement policies (Wertheim-Heck, 2018). The engagement of doctors is important as they comprehend the consequences of antibiotic resistance (Cohen, 2018). Inviting people on this topic creates a sense of urgency. 'In society nurses and doctors are viewed at the most reliable persons [...] Maybe the doctors and the nurses should be giving the example' (Van Beek, 2018). The department for Medical Microbiology could give advice, a visit, lecture or talk for their colleagues or the Supervisory Board. 'It is important to always offer help when you want to improve sustainability [...] I would advise a meeting with all the microbiologists, a meeting with the medical staff management and presentations with the Supervisory Board and the facility company' (Van Beek, 2018). Doctors could go to the purchasing departments of hospitals and explain: 'The meat that you are buying is actually contributing to antibiotic resistance, this is one of the things you are most concerned about. And yet you are contributing to the problem, so you need to understand and lead the society to saying we cannot be overusing antibiotics and then having people die because of

antibiotic resistance. That is crazy. So that as leaders in health, they should be modeling the kind of purchasing practices that would get us out of this mess' (Cohen, 2018).

Connect with stakeholders

First, the purchaser could create support in the supply chain and connect with their existing partners as preferred partners to collaborate on sustainability, while pressuring them with time restrictions and amount of progression (Van Beek, 2018). After connecting with a couple of partners, all the stakeholders of the supply chain could be gathered around a table (a third party that organizes the whole strategy and supply chain around this demand; Cohen, 2018). 'If you do not join together in the chain, you simply get opposing interests and hardened relationships' (Van Beek, 2018). Collaboration is most effective when everyone has an interest, facilitated by offering knowledge and support (Havinga, 2018). The Radboudumc could play an important role by getting the right people (professors, gastronomes, NGOs) together that want to pressure the system (Van de Voort, 2018). It is important to be clear about the hospital's aim: 'the road towards that aim we want to discover with you, with the least damage and the most value creation for everyone' (Van Beek, 2018).

Furthermore, purchasers could connect on shared topics (where antibiotic resistance is part of) with supply chain companies to increase political and economic power (Cohen, 2018) or with big stakeholders in a public-private collaboration (Mevius, 2018). For instance, Rabobank Rijk van Nijmegen that is familiar with the local sustainable farmers (Van Beek, 2018), although they might be conflicted with interests (Van de Voort, 2018). Purchasers could link up with other institutional buyers, such as universities, to put pressure on big national suppliers and create more volume and more security for the farmer (Cohen, 2018). In that way the demand is worthwhile for the farmers to meet (Havinga, 2018). Health Care Without Harm created model specifications (recommendations) to be united in the procurement criteria across all the sectors with all the people that were putting pressure on the suppliers (Cohen, 2018). The criteria of all the linked partners then overlap to demand the same specifics, albeit from other suppliers (Van Beek, 2018; Wertheim-Heck, 2018).

Connect with farmers

The hospital's demands are huge making it complicated to deal with many different farmers. They therefore need to connect with large farms or middlemen that aggregate or collectivise (Cohen, 2018). A local supply chain enables multiple possibilities to enhance connectivity and ensure sustainable and responsible livestock antibiotic use. Contracted farmers that are bound to the hospital over a period of time could be organized in a joint venture with the hospital to develop knowledge on antibiotic resistance together (Methorst, 2018). Policies on awareness creation have already been appreciated in the pig farming sector when Andreas Voss (Radboudumc) discovered the antibiotic resistant bacteria MRSA. 'Andreas Voss did not point out what was wrong, but also co-conceived at farms' (Mevius, 2018). Convincement of the importance of the issue enhances the motivation to comply (Havinga, 2018). Since, farmers might not fully comprehend the consequences of antibiotic use and the possibilities to reduce it, as reducing antibiotic use does not necessarily have to be negative for a farms' technical and economic performance (Roskam, 2018). Moreover, livestock farmers are in need for knowledge and research; on valid and affordable alternatives of antibiotics (Havinga, 2018; Velthuis, 2018), the effective use of antibiotics (i.e. the right medication

and treatment) to limit the chance of resistance development (Velthuis, 2018), and the fast detection of bacteria and viruses to prevent diseases from spreading (Prinsen, 2018). Veterinarians should therefore be well-trained to adequately determine the right treatment, as problems are often multifaceted and demand farm specific solutions (Roskam, 2018). The role of the hospital to support interventions might be more on a coordinating level, as they are not equipped to directly help the farmers at the end of the supply chain. 'The hospitals have no expertise on this, we get it, understand it' (Cohen, 2018). The least performing supplier regarding antibiotic use can be helped by facilitating collaboration and sharing of best practices among farmers (Beekwilder, 2018). Hospitals could bundle their information on antibiotic resistance bacteria and transfer some of their knowledge (Cohen, 2018). Since, the RUMC has a lot of expert information in-house on medication use, vaccinations and infection prevention (Prinsen, 2018; Velthuis, 2018).

Civil society organisations

NGOs

The experts are reserved in recommending collaboration with civil society organisations. 'They might see everything more black-and-white as they represent their members' interests' (Methorst, 2018; Velthuis, 2018). It is therefore imperative to make the right choices in NGOs to maintain trust throughout the sector (Velthuis, 2018). De Dierenbescherming is an appreciated NGO in the livestock sector as they understand the production systems, the animal welfare, environmental issues and the economic situation the farmers are in. Furthermore, they are scientifically driven and they translate research to honest and good information that they bring to farmers to create science-based decision making (Velthuis, 2018). Civil society organisations do have knowledge on the topic and how to influence the supply chain, but it is imperative to first consult the farmer (Van Beek, 2018). 'When the hospital sits down with suppliers they should not necessarily bring NGOs, because it is more powerful in some cases to sit with the suppliers and the hospitals, because that is the primary relationship.' (Cohen, 2018). Though, purchasers could develop specifications and standards together with a number of different focused certification agencies, to support more sustainable and healthier livestock farming and use their purchasing power to drive the market place (Cohen, 2018). Van Beek (2018) also explains how you could invite the Works Council (OR) in a role as consultant to give advice and decide on issues how to procure sustainable food regarding antibiotics, aiming to investigate the supply chain and explore how the hospital could improve equality and fair prices. 'Using activist civil society organisations to put more weight or threat is not proper behavioural change, and does not consists of empathy towards the farmers' (Van Beek, 2018).

A market concept on sustainable antibiotic use

'Some quality marks are communicating on antibiotic free meat. Some say, there is no antibiotic in Dutch meat as a solution to the problem, the problem is of course not the residues in the meat for consumption. It is the residue in the environment' (Wertheim-Heck, 2018). Beekwilder (2018) explains that antibiotic is a difficult concept to commercialize, as antibiotic free does not say anything on multi resistant bacteria on the product. Animals that are not treated with antibiotics, come in contact with animals that do (Mevius, 2018). Moreover, it encourages the selection of animals and

depreciate animals from the same farm that got sick as therefore cannot get the claim. 'Claims on antibiotics often have a misleading character' (Beekwilder, 2018). Though, KDV shows that internationally there is a market for the concept of 'antibiotic-free meat' (Mevius, 2018).

Quality marks

To ensure guarantees on antibiotic use without full transparency is through quality marks that incorporate the benchmark (Havinga, 2018). However, most quality marks do not incorporate guarantees on antibiotic use (Van de Voort, 2018). The purchaser could inquire on the structure and control measures of the quality mark and (with sufficient demand) might inquire if the quality mark is able to incorporate controlling the benchmark during their audits (Havinga, 2018). However, 'the hospital should not pressure the farmer on antibiotic use if they are not purchasing directly and are not prepared to pay extra for it. That is the task of the quality systems' (Prinsen, 2018). The purchaser should take the role of promoting and purchasing the sustainable concepts in the market that demand extra statutory requirements, hereby improving the quality mark and profiting farmers. 'The more buyers you get from it, the more farmers will produce it' (Prinsen, 2018). Currently there are too much quality marks for the consumer, and it costs a lot of effort to position one (Velthuis, 2018). Moreover, according to Roskam (2018), research showed that livestock from existing quality marks mostly use less antibiotics compared to conventional livestock production. As a large purchaser it is then important to find a balance in the diversity of problems when choosing a quality mark (Ormel, 2018).

Concerning the proposition:

The role of the purchaser is strengthened through investing in a Sustainability Vision that incorporates multiple values in a short supply chain. Moreover, sustainability is ensured through Product Stewardship with a collaborative demand on transparency and quality marks that guarantee sustainable livestock antibiotic use via wholesalers.

Path 5: Explaining effective policy strategies

The fifth path has the aim to uncover effective policy measures for the Radboudumc that ensure sustainable and responsible livestock antibiotic use. The strategic opportunities described by the experts will be applied to the possibilities from the case-study. Shared value can be created although the incentives and motives for change along the supply chain might differ. An increase in sustainable value in the livestock sector is dependent on the demand of the purchaser. However, the needs of purchasers are subjected to psychological factors and shaped by an environment created by the institutions at play (Jonker et al, 2018; Vermeir & Verbeke, 2005). The food-service distributor could influence the livestock market through their procurement policies and hereby strengthen the power of the purchaser. The Radboudumc as a purchaser could be the one to govern the chain and encourage collaboration and support throughout the supply chain. Experts describe various ways to

utilize resources that contribute to the creation of multiple values of sustainable livestock antibiotic use for a Sustainability Vision or to improve Product Stewardship. What are suiting purchaser strategies to govern the supply chain towards the responsible and sustainable use of antibiotics?

Proposition

It is expected that the policy opportunities of purchasers derived from path 4 (e.g. on how to increase connectivity) are able to encourage responsible and sustainable antibiotic use, by acting upon the current strategic gaps in the supply chain activities derived from path 3.

Concerning the proposition:

The lack of Sustainability Vision and Product Stewardship in the activities in the supply chain can be filled with the policy strategies derived from the expert interviews. The purchaser can encourage responsible and sustainable livestock antibiotic use through the following recommendations.

Recommendations

Environmental value can be enhanced by the procurement policy of the Radboudumc when they increase their demand, procure a quality mark that incorporated sustainable livestock antibiotic use, or procure locally.

Social value can be enhanced by investing in involvement and communication. The hospital is able to create awareness through screens, flyers, online movies and QR codes on the tables. Farmers need a concerned consumer that understands them. 'A farmer does not know what his product is used for, what is happening here; and we often do not understand them, or think too easily from our position' (Beekwilder, 2018). Social value can be created through acknowledging the drivers and rationale behind the choices to run a farm. When providing meat from Dutch farmers 'you can communicate that there has been done much to reduce the use of antibiotics' (Ormel, 2018). Communicating on the topic of livestock antibiotic use with farmers should be done with great care, primarily focused on the good practices and achievements.

Financial value can be enhanced when purchasers pay extra and ensure the farmer's margin. Although red benchmarked companies should be pressured to achieve a green benchmark. Above all green benchmarked companies should be rewarded (Bolk, 2018). Radboudumc should specify demands on local sustainability conditions regarding livestock antibiotic use in their next public tender. The procurement policy is most decisive, where sustainability conditions are balanced. Antibiotic use as a sustainability condition should become more relevant (Wertheim-Heck, 2018).

Farmers are only aware of treatment during the period that they own the animal. **Tracking livestock over their lifetime via the Dutch benchmark system** ensures basic sustainable antibiotic use. KDV incorporated the green benchmark (Wafelaar, 2018) as well as Oregional. Vermaat however stated that 50% of the purchased meat was from Oregional, but this was not confirmed. Most meat is from Sligro who is not transparent on the external suppliers of their private label. Guarantees on antibiotic use are then dependent on quality marks. Due to privacy regulations, quality marks do not provide the antibiotic use of specific farms. And meat can be purchased in a farm's improvement period. Maison van den Boer (Marinus, 2018) formulated a **CSR goal that demands monitoring and transparency** of livestock antibiotic use in fresh meat supply.

The whole chain of production should be engaged to establish the creation of multiple values (Jonker et al., 2018). The stakeholders and current collaborative networks should therefore be made transparent as well as their roles, relations, interests, capacities and values. Especially since the livestock sector is a complex network of relations, dependencies and agreements (Van den Elshout, 2018). There is a lack of importance felt to connect on livestock antibiotic use in the supply chain, although there have been some efforts with direct partners. Farmers do not feel supported. They need insight in the impact of (un)sustainable antibiotic use and information on proper antibiotic use. The hospital could **coordinate guidance and support with in-house knowledge** from microbiologists. The purchaser could connect with farmers and veterinarians directly to help them. The hospital could **connect and organize commitment** with: the hospitals in Gelderland, hospital leaders, executive boards, suppliers on sustainability and health (Van Beek, 2018) and general supply chain companies.

Experts are reserved in promoting collaboration with **civil society organisations** as it might harm the trust of farmers. KDV however collaborates with civil society organisations to develop knowledge. As civil society organisations and academic institutions have a lot of knowledge and research on the issue, hospitals as important actors in society, can be **linked with that expertise** (Cohen, 2018). The systems of quality marks consist extra statutory requirements to prevent diseases and create environmental value (Bolk, 2018) and are integrally balanced with values on animal welfare, by reducing and improving livestock farming (Van den Berg, 2018). Developing a quality mark on the SDa benchmark will not be financially worthwhile for the supply chain. The hospital should first look for existing certificates and quality marks that (almost) meet the criteria (Havinga, 2018). If that doesn't suffice completely they could inquire if a quality mark is able to control something extra during their audits. However, this too is accompanied with extra costs for the farmer. Through wholesale such extra requirements would then be client only (Huntjens, 2018). It is difficult to demand more specific products than general quality marks by Sligro (Havinga, 2018).

6: Conclusion

In this chapter the sub-questions will be discussed to answer the research question: How can purchasers influence the chain towards responsible and sustainable antibiotic use by livestock farmers?

Subquestion 1. How is antibiotic use in livestock farming currently governed by the institutions of market, state and civil society?

Current governance on antibiotics in livestock farming is predominantly focused on state and market interaction. The state and market are responsible for regulating livestock antibiotic use through maintaining the independently created Stichting Diergeneesmiddelen Autoriteit (SDa) benchmarks. Farmers and veterinarians are influenced by current governance. They are obliged by law to report antibiotic prescriptions and usage in a digital portal. Over the years (dependent on the sector) governance led to a substantial reduction in antibiotic use. Nevertheless, the goal of 70% reduction of antibiotic use has not yet been achieved and the efficacy of the SDa benchmarks, after enormous positive results, came to a standstill in 2015. Mevius (2018) explains that this is predominantly because of the antibiotic use in the veal sector and some individual farms. However, current governance is developed from within the existing cost-driven framework and does not address integral system changes. Society should therefore keep on pressuring the livestock sector. 'One has, despite the efforts, picked the low-hanging fruit' (Van den Berg, 2018).

It was expected that current regulative measures lacked the influential power to maintain an increase in sustainable livestock antibiotic use. In the case-study it became clear that current governance was hardly affecting the activities within the supply chain. The supplying pig farmers already have high standards due to quality marks (KDV, Beter Leven Keurmerk) and a green benchmark incorporated. Additionally, to current governance, all the links in the chain of production should bundle their knowledge and collaborate to improve transparency and sustainability of antibiotic use, as the outcomes are not transparent for the stakeholders in the supply chain. Policies on livestock antibiotic use require an integral approach to balance multiple values (Ormel, 2018; Wertheim-Heck, 2018). There has to be more attention for the quality of feed, housing and measures to prevent infections, moreover there should be attention for economic incentives and other business models to limit antibiotic use in the livestock sector (NVWA b, n.d.). The benchmarks of the SDa and prescriptions for proper antibiotic practices are there to guide farmers. However, to realise a vital, sustainable and societal accepted livestock farming all links in the chain should participate actively, including the retail and the manufacturing industry. Increasing transparency on the origin and production methods, involving and informing the consumer through quality marks, and offering a large range of sustainable products could contribute to that (SER, 2016).

Subquestion 2. What are the current practices and incentives of livestock farmers in antibiotic use?

The organized sectors of the primary production regulate the implementation of the benchmarks independently, and confidentially without state interference. Livestock production is organized in quality systems per sector that determine the standards and audit them through the integral chain monitoring system. The quality systems incorporate the regulations by prohibiting the use of certain antibiotics and demanding a certain benchmark value from their farmers. This is a prerequisite to use the benefits of the system like costly lawful controls and acceptance of the farmers' products (Mevius, 2018). Velthuis (2018) witnessed that the farmers are supporting the policy and worked very hard to make it a success. The sector could fill in what was needed in order to meet the target values of antibiotic use. However, changing the behavior and optimizing the management of farmers requires time (Prinsen, 2018; Velthuis, 2018). Farmers were afraid that animals would get sick, but due to preventive measures on biosecurity and biosafety they needed less antibiotics than they initially thought (Ormel, 2018). It used to be cost effective to give a preventive welcoming cure treating a whole barn with thousands of animals (Mevius, 2018). 'It was necessary to comfort them' (Velthuis, 2018). They needed information and training on preventive management measures and insurance through research that the impact on mortality (which is also monitored by the quality systems; Prinsen, 2018) is rather low opposite to the savings on antibiotics. 'That is a tough message, because it means that the chance your cow gets sick is simply higher' (Velthuis, 2018). Exporting companies economically compete with Eastern Europe, where welfare standards are lower and antibiotic use is higher. However, if the animal health management (preventive measures in hygiene, quality of the feed, barn equipment) of exporting companies is sufficient than farmers do not have to use much antibiotics (Prinsen, 2018).

Farmers also perceive the negative influence of antibiotic use on their own health and their children and livestock, and they also want to farm properly in the future (Havinga, 2018). However, a low usage of antibiotics and high animal welfare are often still related to the ideology of livestock farmers, almost always harming their financial income. Deciding to change towards more sustainable methods is therefore difficult (Bolk, 2018). Needed transitions are often the result of lawful obligations. They are not financially supported by the supply chain and do not earn extra for sustainable farming, but are excluded from sales when they do not (Wafelaar, 2018). Animal health care is therefore exceptionally vulnerable, resulting in symptom control measures (Van den Berg, 2018). However, a proper environment, the self-healing ability of an animal and the increased veterinary information contributes to reducing antibiotic use (Bolk, 2018). The pig farmers in the supply chain of the Radboudumc are transparent on their sustainable antibiotic use.

Sub-question 3. Who are the stakeholders within the chain and what are their interests?

Wholesale organisations do not sense societal awareness on the indirect harms of livestock antibiotic use to create value on transparency. *It was expected that the transparency of the actors within the supply chain enables the purchaser to disclose the level of livestock antibiotic use.* Specific levels are available in a short chain, in a long chain only general levels are available through quality marks. The stakeholders are dependent on demand and driven to act consistently also meeting unsustainable demands. There is no incentive for Sligro to disclose the level of livestock antibiotic use or ensure

transparency (Huntjens, 2018). Marinus (2018) is interested to formulate goals on monitoring sustainable antibiotic use for corporate social responsibility, since the combination of nutrition and health is very directly linked to antibiotic use. However, the volume of the hospital is small. Maison van den Boer only acts when Radboudumc pressures them to ensure added value (Marinus, 2018). The Radboud University is bound by cost restrictions and weighs the financial consequences for the organisation as sustainability is often a lot pricier (Niessen, 2018). Kaldenberg is not interested in traceability when products are legally approved. The responsibility for sustainable antibiotic use is always placed one step back in the supply chain. Transparency of the actors is restricted by privacy.

Sub-question 4. What is the current role of the purchaser in the procurement of responsible and sustainable antibiotic use?

Procuring sustainable livestock antibiotic use is translating the vision of the Radboudumc and is not as a result of the desires of the customer (Kilkens, 2018). *It was expected that the activities within the supply chain did not adhere to a Sustainability Vision nor to Product Stewardship.* Currently the purchasers merely follow the law; no demands on connectivity, transparency, country of origin or green benchmarks. The purchasers need increased information about the environmental urgency of the problem (in the media) to effectively pressure the supply chain. Geijsen (2018) explains that they cannot cross the wholesale (and their partner's contracts) and are therefore not able to directly connect with suppliers on antibiotic use. They are dependent on the knowledge and transparency of the supply chain, especially regarding composites (Buis, 2018). There occurs despondency to influence the long and interdependent supply chain and meet conditions without a proper approach (Kilkens, 2018). They are interested in (scientific grounded) transparency on antibiotic use (Kilkens, 2018; Van den Broek, 2018). Vermaat and the Radboudumc want to improve mutually and serve the needs of the customers. The better Vermaat does it financially, operationally, qualitatively, the better it is for the Radboudumc (Van den Broek, 2018). Costs are perceived as a barrier, as products have to stay affordable for customers. Collaboration with stakeholders (even Oregional) is only on reducing costs and discounts (Buis, 2018).

Subquestion 5. How can the influencing role of the purchaser be strengthened within the chain?

It was expected that purchasers are empowered to influence livestock antibiotic use by reinforcing Sustainability Vision and Product Stewardship. The role of purchasers can be strengthened by increasing demand through collaboration with other purchasers, by improving transparency, through shortening the supply chain and by connecting with farmers (creating positive feedback loops and knowledge sharing). The state places the responsibility for sustainable use of antibiotics in the hands of the market, while the market is dependent on demand. The role of purchasers is extremely important in the formulation of market and state policies. Purchaser's values regarding the security and safety of food are the basis for governmental policies. And furthermore, today's values on sustainability, lifestyle risks, health and animal welfare, require adaptation from the food producers and distributors within the supply chain (Havinga, Casey & Van Waarden, 2015). Legal responsibility and 'fear for potential reputation damage due to food scandals caused by claims of unsafe or unfair food products' made by consumers, pressures and regulates the producers and suppliers to develop solutions to improve food safety and customer trust (Havinga et al., 2015).

However, it is difficult for the purchaser to influence farmers at the other end of the chain. In the economic system farmers are able to choose if they will meet standards and supply when they perceive demands are worthwhile. Product Stewardship strengthens purchasers in a long and short supply chain. As the hospital's demand is relatively small in a long supply chain, purchasers could use quality marks or collaborate with other institutions. The demand is relatively big in a short supply chain; transparency and a fair margin for suppliers guarantees sustainable antibiotic use. Extra (often negligible) costs meant to reduce livestock antibiotic use then actually end up at farmers who are able to act (Van den Berg, 2018). Hence, the retail often exploits their powerful position to earn money for valid consumer concerns on the farmers account (Ormel, 2018; Van de Voort, 2018). Demanding true transparency and guarantees on the origin of the product with contracted farmers allows purchasers to keep an eye on the practices and performance of farmers. It enables purchasers to steer on such aspects (Beekwilder, 2018). Havinga (2018) opts that in a short chain with contracted farmers the purchaser can select farmers locally. He can make agreements and set up a testing program to control if they meet the hospitals conditions. In a closed supply chain, a condition might transparency of the SDA data. This allows purchasers to analyse the least performers and distribute resources in the supply chain to improve antibiotic use (e.g. collaboration, sharing best practices among farmers (Beekwilder, 2018). This contributes to the implementation of a Sustainability Vision.

Subquestion 6. What are effective policy measures for the Radboudumc to ensure sustainable and responsible antibiotic use by livestock farmers?

Procuring existing certification where different environmental values are already balanced is more promising than developing a new one concerning transparency on antibiotic use (Beekwilder, 2018). Quality marks often represent different aspects and this should match the interests of the purchaser (Mevius, 2018). Civil society organisations as KDV, Beter Leven Keurmerk and 'free-range' have next to demands on animal welfare demands on sustainable antibiotic use (green benchmarks). Negative deviations require accountability and a plan of action to avoid exclusion of the quality mark (Van den Berg, 2018; Bolk, 2018). The benchmark is only transparent in the supply chain where it is necessary. The supply chain guarantees that quality with audits. Purchasers should trust and encourage existing quality marks. Increased demand on consisting concepts benefits farmers. If the demand increases on consisting concepts, the more farmers reciprocate to meet criteria and make the costly transition (Prinsen, 2018).

Increase the demand through collaboration with other hospitals (Van Beek, 2018). This ensures a more interesting and viable market value for wholesalers in a long supply chain to improve transparency. The hospital has multiple resources that it can eclectically use: it could use positive financial incentives, create awareness, search for the right and natural moment, and increase evidence that it helps care, health and society (Van Beek, 2018). Van Beek (2018) argues that for such processes it important to steer on the one hand, while constantly seeking support by like-minded people. Doctors could become advocates as they understand it and are worried about antibiotic resistance, as some of their patients are dying as a consequence (Cohen, 2018). Connecting can be done by creating a roundtable with the entire supply chain (after a careful lobby to create acknowledgement from a couple of the stakeholders in advance). If the preferred partners after multiple efforts do not want to connect to solve the problem, the purchaser has to search for other

partners (Van Beek, 2018) that meet the conditions. Stakeholders are motivated when listening to their interests and finding ways to meet them, instead of focusing only on the hospital's concerns.

Connecting with farmers in long term contracts facilitates certainty and preparedness to cooperate with the hospitals ambitions on different (sustainability) criteria in a 'balancing act' (Beekwilder, 2018). Farmers can be supported to ensure sustainable antibiotic use via long term guarantees or a revolving fund. Venekamp (2018) from Taskforce Korte Ketten offered his expertise to develop a food vision and prepare for the next public tender. A tailored supply chain can be organised around a sufficient demand for local products. This would comprise a selection of suitable farmers that conform with the hospital's criteria on antibiotics, food safety, quality, hygiene, but also for example on nutrients and vitamins in products to fit treatment (Venekamp, 2018). Big food suppliers will only act as a safety net when products cannot be locally supplied, since Venekamp (2018) expects that big food suppliers are not willing and able to cooperate with the criteria.

Investing in the relationship with local suppliers creates the opportunity to meet the needs concerning social values. This can be done by creating acknowledgement, collaborating and online and offline communication in the hospital about the farmers. The moment that the hospital invites farmers and makes them aware that they produce and supply for the health care, they will think and act differently (Venekamp, 2018). Farmers become proud on their profession knowing the people that eat their products. A shortened supply chain allows farmers to elaborate on their product to the customer, hereby intensifying a good relationship and creating multiple values (Van de Voort, 2018). Local supply also reduces CO2 emissions (in food kilometers). And the costs that healthcare institutions pay on food comes back into the local economy and with the people that eventually will be treated in the hospitals. The Radboudumc could connect with farmers to jointly improve the health of society. With this common goal they contribute to human health but also to system health in the livestock sector on the long-term, as (the quality and origin of) food is an integral part of health (Methorst, 2018). In a dedicated relationship the hospital could reward farmers (Velthuis, 2018) and negotiate criteria to maintain the green benchmark (Van Beek, 2018; Havinga, 2018).

Livestock farmers are in need for knowledge, a sense of urgency and awareness creation. The general idea is that reducing antibiotics harms mortality, feed conversion and growth, while costly interventions to reduce antibiotics might be worthwhile since reduction does not necessarily have to be negative for a farms' technical and economic performance (Roskam, 2018). The hospital can **provide knowledge and create awareness** on the urgency of antibiotic resistance and create involvement. Methorst (2018) opts for the organization of a joint venture where knowledge is developed together with a selected few farmers that are bound to the hospital over a period of time.

Increasing financial value through customers is dependent on communication. The careful choice in supplier thus means supporting the way that supplier produces its meat. In addition, the purchaser could **communicate on the sustainability** of the production processes towards stakeholders, patients and customers to create awareness (Ormel, 2018). The Radboudumc has an intrinsic motivation, financial incentives could contribute to their marketing and reputation (Van Beek, 2018). Purchasers want to show their support of local and sustainable farmers for image and

public relations. Financial values can be created through proper marketing of sustainable antibiotic use, where different aspects are integrated; veal with the mother, omega 6/3 ratio and taste. Hence, antibiotic resistance is difficult to understand as a consumer (Mevius, 2018).

Radboudumc has a direct influence on food provide for patients, while food provide for staff is subjected to the price the customers want to pay (Roskam, 2018). **Reducing the supply of non-sustainable meat** saves money to invest in sustainable meat. The hospital has the opportunity to ban non-sustainable food in their procurement policy: Predominantly, veal is proven to be unsustainable regarding animal welfare and antibiotic use. And globally imported meat cannot guarantee benchmark values nor transparency on antibiotic use (Beekwilder, 2018). Reducing meat consumption and replacing it with sustainable (by all means Dutch) meat and alternative vegetal proteins is also recommended by health professionals (Cohen, 2018).

The hospital's management **cost-analysis should include the preventive and curative benefits of healthy food** for the recovery of patients, as it reduces costs in stay. Wertheim-Heck (2018) proceeds as she defines food as inseparable when counteracting antibiotic resistance. 'Anything is possible and everything is connected, but then you have to deal with it in an integral way, that is really essential' (Wertheim-Heck, 2018). Investing in sustainable food often results in financial savings on another level. 'While looking at the problem as an ecosystem, it will tell you that the moment you eat better and healthier, you will also use less medication. The money that will be earned on that should be invested in better food and a fair price for the farmer' (Venekamp, 2018).

Demanding transparency throughout the whole supply chain increases the responsibility for the products of the farmers and hereby might even cancel out the need for quality marks as maximal transparency is the guarantee. 'People could get on their bikes and see if it is true' (Venekamp, 2018). The information on suppliers is now collected in large databases of the retail and quality systems. Vion Food Group aims to guarantee transparency on the track and trace to meet the needs of society (Mevius, 2018). However, not all farmers dare to be transparent due to different experiences of image and relation damage. Developed criteria could be shared with all hospitals. When hospitals get together they could change the market through their contracts and through their demands for transparency (Cohen, 2018).

Concerning the research question:

Purchasers are able to influence the supply chain and regulate sustainable livestock antibiotic use. Procurement policies entail (increasing) a demand on transparency of responsible and sustainable livestock antibiotic use. Long term guarantees with farmers facilitates involvement and acknowledgement, supporting farmers to improve sustainable antibiotic use. Intensifying the relationship with farmers creates societal awareness and improves collaboration to counteract the overuse of antibiotics. Through grassroots innovations the purchaser is able to acquire a new role in supply chain management. The policy strategies could then be implemented by hospitals and purchasers to influence sustainable livestock farming and facilitate a system change in society.

7: Reflection

In this chapter the research is reflected. While the paths explored in the research were thoughtfully designed, the applicability of the methodology is confined due to lack of transparency, privacy regulations and time. The first paragraph will reflect on the methodology and theory. Thereafter, recommendations for future research will be discussed.

Reflection on methodology and theory

The structure of the research is divided in five paths requesting different methods. The first path entailed a literature review on the transitions in the institutional landscape concerning antibiotic use in livestock farming and the influence of current governance on the activities in the supply chain. Although there was sufficient information on the impact of governance on antibiotic resistance, the examined supply chain in the case-study did not experience the regulations as they were bound to quality marks that require higher standards. This poses a direct rival as an intervention other than the target intervention accounts for the results (Yin, 2014, p141). As a result, a thorough understanding of the impact of Dutch governance on livestock antibiotic use in a real-life situation was absent, which caused the relative importance of incorporating the context in policy recommendations to be devaluated. The current case-study only examined the pig farming sector, while other livestock sectors might be more subjected to the influence on governmental regulations. To overcome this aspect, experts in the governance field were also asked to shed light on their views on the impact of regulations on all animal sectors. Moreover, a societal rival (Yin, 2014, p141) appeared for the theoretical framework as the lack of sustainable activities of the case-study concerning the procurement of livestock antibiotic use were due to the societal trend that the purchaser and stakeholders in the supply chain are excluded from information on suppliers and benchmark values.

The second and third path entailed the case-study. The contacted interviewees were dependent on information during the interviews and online research. Some interviewees were not willing to provide contact information due to fear of losing trade (wholesalers) or due to privacy regulations (farmers). This means that not the entire supply chain could be examined in-depth. Moreover, due to time and privacy constraints the affiliated feed advisors were not interviewed, while it was suggested during the interviews that they also play an influential role in the eventual livestock antibiotic use. In the fourth path the expert interviews resulted in an overview of possible policies. The number of experts was sufficient and they equally represented purchaser and governance context to create a critical analysis.

Furthermore, the third, fourth and fifth path observes the case-study from within a theoretical framework that is focussed on a purchaser perspective. It is possible that social value, environmental and financial value are not enhanced by the proposed policies. Hence, the used framework was not designed for purchasers in an entire supply chain, but to improve sustainable value for a company. The research has been developed in light of the sustainable value framework of Hart and Milstein (2003), where strategies can increase sustainable value by incorporating unmet needs in the

development of innovative strategies or by legitimizing procurement practices. However, implementing Sustainability Vision and Product Stewardship by a purchaser is in line with the thinking of Porter and Kramer (2011), where shared value could reconceive products and markets and redefine productivity in the value chain and facilitate support throughout the supply chain. For example, by advancing innovations that support farmers in their practices and profits the environment and therefore the purchaser. Or procurement by intensively collaborating with farmers in developing knowledge and providing advice, or stimulating the improvement of techniques. This enhances efficiency, the income of farmers, reliable supply and sustainability (Porter & Kramer, 2011) of livestock antibiotic use. The policies can also be explained by market-based supply chain management theory. In that way hospitals could serve as role model for other networks or food service providers. The hospital's procurement policy could be generalized to other hospitals and purchasers that desire to actively work on sustainable supply chain management through self-governance. With the support of stakeholders an agglomeration of decentralized processes experimented in such protected 'niche' spaces could shape socio-technical transformations in the current regime system (Seyfang & Haxeltine, 2012). The procurement policy of hospitals can facilitate a system change in the livestock sector and society.

Recommendations for future studies

Future studies might embark upon exploring the width of sustainability on other levels in procurement policies in order to strengthen the influential role of hospitals. As hospitals are perceived as trustworthy and exemplary in society. It would be interesting to deepen in the role of stakeholders and wholesalers and research the altruistic incentives for corporate social responsibility without purchaser demand in sustainable livestock antibiotic use. Moreover, it would be interesting to research how sustainable innovations in livestock farming can be supported and shape a socio-technical transformation in the current cost-driven system.

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10: Appendices

Appendix A

Controlling enforcement measures Interventions of the NVWA towards livestock farmers regarding antibiotic use specifically, according attachment 1 of the 'Specifiek Interventiebeleid Diergeneesmiddelen' (NVWA f, 2017; NVWA g, 2016).

Description	Norm	Violation	Deviation	Intensity category (A to D)	Motivation for category	Fine (€)	Interventions	Follow-up	Justice
Report data for database veterinary medicines registration	Providing data from the farmer and the animals that had abs	Not providing the correct data from the farmer and animals that had abs		C: Violation	No direct health risk, but violation must be lifted.	2500	Written warning, compliance support, record in case	Re-inspection <4 months, corrective intervention	Administrative settlement
Having UDD veterinary medicines available (Antibiotics Appendix 9 Regulation for veterinary medicines (ARVM))	Only veterinary medicines or medicated animal feed available for the animals present according the licence and label of the medicine	UDD medicines available without compliance with the exception ARVM	If 1- 1 relation and company health plan / treatment plan are present, but not entirely correct or complete, then a written warning can be given	B: Serious violation	Risk to public health or human safety.	2500	Report of findings, corrective intervention, compliance support, record in case	Re-inspection asap, corrective intervention, penalty report, administrative punishment order, official report, if repeatedly not sufficient 'hard where necessary' route	Possible criminal justice
Notification of designated veterinary medicines in the veterinary medicines registration database	Report receipt of antibiotics in a veterinary medicines registration database	No report of antibiotics in a veterinary medicines registration database	Not allowed	B: Serious violation	" "	2500	" "	" "	Possible criminal justice
Administration UDD veterinary medicines	Apply according to the licensing regulations	Application of a UDD veterinary medicinal product by another than a veterinarian (no compliance with the exception ARVM	If 1-1 relation and company file are present, but not entirely correct or complete, a written warning can be given	B: Serious violation	" "	5000	" "	" "	Possible criminal justice

Appendix B

Subjectlist supply chain De rol van de afnemer; Onderzoek naar mogelijkheden in de keten van het Radboudumc om duurzaam antibioticagebruik bij veehouders te garanderen volgens de SDa benchmarks

Naam:

Werkzaam bij:

Functie:

Over de stakeholder

Kunt u kort wat vertellen over uw werkzaamheden?

- Organisatie en projecten
- Doelstellingen en visie

Evaluatie van de huidige governance methode (benchmark systeem)

Kunt u wat vertellen over de huidige methoden om een reductie van antibioticagebruik te reguleren bij veehouders en hoe deze worden uitgevoerd? Hoe worden de methoden van regulering ervaren in de sector?

- Wat gaat er goed en wat gaat er minder goed?
- Op welke manier beïnvloeden de methoden van regulering de werkzaamheden in de keten en bij de veehouders?

Sustainability Vision Een gedeeld plan maken om te voldoen aan onvervulde behoeften

Hoe zou een gedeeld plan eruit zien om te voldoen aan onvervulde behoeften in de keten?

1. Onvervulde **behoefte** rondom duurzaam antibioticagebruik van veehouders
 - Wat zijn de behoeften en obstakels bij u en in de keten? en bij de veehouders?
 - Wat zijn de incentives en belangen die de keuzes van de keten beïnvloeden? en bij de veehouders?
 - Welke pad afhankelijkheden spelen er in de keten?
2. Vaardigheden en **middelen** in de keten om antibioticagebruik te reduceren
 - Worden veehouders ondersteund vanuit de keten? Zo ja, door wie en hoe?
 - Welke technologische/cognitieve/financiële middelen en vaardigheden zijn er nodig om bij te dragen aan de verduurzaming van antibioticagebruik? Hoe kunnen deze bijdragen en wie heeft ze?
 - Welke rol wilt en kunt u spelen om het antibioticagebruik te verduurzamen? Wat is de waarde hiervan voor u?

Product Stewardship De visies van stakeholders integreren in bedrijfsprocessen

Hoe benadert u product stewardship en waar wordt dit door gedreven?

1. **Transparantie** rondom antibioticagebruik in de keten (inzicht in benchmarks)
 - In hoeverre is de productieketen en hun beleid transparant? En uw eigen beleid?
 - Kunt u wat vertellen over de huidige praktijken en problemen bij u en in de keten rondom antibioticagebruik bij veehouders?
 - Hoe wordt er omgegaan met publieke waarden in de keten omtrent antibioticagebruik bij veehouders?
 - Welke rol spelen de consument, NGOs of maatschappelijke organisaties hierin?
2. **Connectiviteit** om antibioticagebruik te reduceren
 - Wie zijn de betrokken partijen (stakeholders) in de keten van consument (Radboudumc) tot veehouder?
 - Hoe wordt er samengewerkt? Wat zijn de onderlinge relaties en afspraken?
 - Wat zijn de belangen, capaciteiten en struikelblokken om samen te werken?
 - Wat zijn gedeelde waarden in de sector?
 - Wat is er nodig om samenwerking te bevorderen in de keten?
3. Samenwerking met **maatschappelijke organisaties** om antibioticagebruik te reduceren
 - Wat is de rol van maatschappelijke organisaties? En de rol van keurmerken?
 - Wordt er samengewerkt met maatschappelijke organisaties in de keten? Zo ja, hoe?
 - In hoeverre zijn partijen binnen de keten betrokken bij maatschappelijke organisaties?

Appendix C

Subjectlist experts De rol van de afnemer; Onderzoek naar mogelijkheden in de keten van het Radboudumc om duurzaam antibioticagebruik bij veehouders te garanderen volgens de SDa benchmarks

Naam:

Werkzaam bij:

Functie:

Over de expert

Kunt u kort wat vertellen over uw werkzaamheden?

- Organisatie en projecten
- Doelstellingen en visie

Evaluatie van de huidige governance methode (benchmark systeem) *NB: alleen voor experts in governance context*

Kunt u wat vertellen over de huidige methode om een reductie van antibioticagebruik te reguleren bij veehouders en hoe deze wordt uitgevoerd? Hoe wordt de methode van regulering ervaren in de keten?

- Worden gestelde richtlijnen nageleefd en doelen behaald? Hoe?
- Wat zijn succesfactoren of struikelblokken in de regulering? Hoe wordt daar mee omgegaan?
- Hoe wordt er omgegaan met ziekte preventie in de veeteelt en hoe kan dit worden gestimuleerd?

Sustainability Vision *Een gedeeld plan maken om te voldoen aan onvervulde behoeften*

- *Hoe zou een gedeeld plan eruit zien om te voldoen aan onvervulde behoeften in de keten?*
- *Wat is de winst die met een gedeelde duurzame visie te behalen is? (ecologisch/economisch/sociaal)*

1. Onvervulde **behoeften** rondom duurzaam antibioticagebruik van veehouders

- Welke behoeften en obstakels zijn er in de keten en bij de veehouders? In hoeverre kan het Radboudumc (als afnemer) hiermee omgaan?

2. Vaardigheden en **middelen** in de keten om antibioticagebruik te reduceren

- Welke technologische/cognitieve/financiële middelen en vaardigheden zijn er nodig?
- Welke rol kan het Radboudumc (als afnemer) spelen om deze vanuit de keten in te zetten en te coördineren?

Product Stewardship *De visies van stakeholders integreren in bedrijfsprocessen*

- *Hoe kan product stewardship benaderd worden en waar wordt dit door gedreven?*
- *Wat is de winst die met product stewardship behaald kan worden? (ecologisch/economisch/sociaal)*

1. **Transparantie** rondom antibioticagebruik in de keten (inzicht in benchmarks)

- Kunt u wat vertellen over de transparantie in de praktijken en problemen van de keten? Welke rol kan het Radboudumc (als afnemer) spelen om deze te bevorderen?
- Welke rol spelen de consument, NGOs of maatschappelijke organisaties hierin?

2. **Connectiviteit** om antibioticagebruik te reduceren

- Wie zijn de (mogelijke) betrokken partijen (stakeholders) in de keten van consument tot producent?
- Hoe wordt er samengewerkt tussen partijen? Wat is er nodig om samenwerking te bevorderen?
- Welke rol kan het Radboudumc (als afnemer) spelen om samenwerking te coördineren?

3. Samenwerking met **maatschappelijke organisaties** om antibioticagebruik te reduceren

- In hoeverre wordt er samengewerkt met maatschappelijke organisaties? Wat is de rol van keurmerken?
- Hoe kan het Radboudumc (als afnemer) samenwerking met maatschappelijke organisaties bevorderen?

Appendix D

Interview protocol

Checklist:

- Express gratitude for cooperation
- Introducing myself: study background, research aim: exploring the influence of purchasers to guarantee sustainable livestock antibiotic use. Case-study in the supply chain of the Radboudumc for pig meat. Expert interviews to explore strategies.
- Notify that the research is held from the Radboud University and Radboudumc. The results of the research are therefore public.
- Inquire if the interview can be recorded and if they approve on making notes.
- Express that the raw data (transcriptions and recordings) is treated confidentially.
- Explain that the raw data is only shared with the supervisors and second reader of the thesis. Eventually, the raw data will be confidentially archived on the database of the Radboud University.
- Notify that there will be a possibility to review the results of the interviews before publicizing in order to give feedback and approval on the used quotes
- Notify that the used quotes will be translated to English.
- Ask permission to use the information from the interview.
- Ask permission to use the name of their organisation and/or their position (anonymous) and/or the interviewees name (not anonymous). Preferably all information is used for the thesis.
- Ask if they would like to receive the thesis.
- Express that if they have any questions they could contact.