

Antimicrobial Resistance: Collective action in the face of a common-pool resource dilemma

An institutional analysis of self-regulation in Dutch human medical care and the animal food-production sector with regard to antibiotic consumption.

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Voor u ligt mijn masterscriptie ter afronding van de masteropleiding Bestuurskunde aan de Radboud Universiteit Nijmegen. In deze scriptie beschrijf ik mijn onderzoek naar de beleidsmatige aspecten achter het antibioticagebruik in twee afzonderlijke cases: de Nederlandse eerstelijnsgezondheidszorg en de intensieve veehouderij.

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Preface & executive summary

This thesis explores the differences in the handling of inappropriate antibiotic use between the Dutch medical health and veterinary sectors from an institutional perspective. Within my analysis I translated the risk of antimicrobial resistance into a common-pool resource problem.

Consequently, individuals, if left unchecked, will tend to use antibiotics on an inappropriate level; facilitating the rise of antimicrobial resistance both inside and outside medical communities. Within Europe, the Dutch are historically known for their low levels of antibiotic consumption in medical care. Within animal-food production, however, antibiotics are used at a large scale, elevating the Dutch consumption of veterinary antibiotics among the highest in Europe.

An explanation for this discrepancy was found in the institutional context of both sectors. Through a communitarian configuration, the various professional organizations within human medical care are able to supply a great number of institutions that support the sustainable use of antibiotics. In animal agriculture, on the other hand, the dominant market forces have prevented the supply of such institutions. A changing perception of the risk of antibiotic resistance in combination with increased state pressure, however, has paved the way for a new associative-type of collective action within animal agriculture. Through a process of negotiation and cooperation the various sector parties involved in the antibiotics discussion, are together supplying the institutions that hopefully will assure the sustainable use of veterinary antibiotics in the future.

Initially, my research started out as a cross-sectoral analysis of a seemingly good and bad practice within the same country. The period in which I wrote my thesis, however, was characterized by major changes with regard to antibiotic policy in animal agriculture. In my opinion, these changes uncovered the sector's capacity to adapt its institutional configuration to a changing environment. I could have made it myself a bit easier by limiting myself to an analysis of only the situation before the start of these sectoral reduction efforts. Fortunately, I did not. The events that took place provided me with a perfect case to illustrate the possibilities of an associational solution to collective action dilemmas on a societal level. Although, the initial discrepancy between human medical and veterinary care still forms the starting point of my thesis, it can no longer be seen as just a comparison between a good and bad practise. The evolution of antibiotic policy has uncovered strengths within animal agriculture and weaknesses that still need to be addressed in human care.

Finally, it is important to mention that this thesis does not aim to focus blame on just one group of actors. Although individual free riders must of course be punished, collective action problems can only be solved through the cooperation of all parties involved. As one respondent remarked: 'We should simply look at the facts, at together work from there...' In order to effectively combat the risk of AR, both in medical and veterinary care, cooperation is needed on various levels between a number of complementary organizations and individuals. This way the Netherlands can hopefully remain an example to the rest of the world and contribute to the sustainable consumption of antibiotics on an *international* level.

1 Introduction

1.1 Introduction

Within the Netherlands antimicrobial resistance is getting more and more attention. Around the world, prominent health care professionals have stressed the importance of countering this risk for decades and lately also media, political actors and NGOs are focusing on the problem. This is not without reason: The rise of multi-drug resistant bacteria will impose a significant social and economic burden on society. In the long run it could even mean the end of modern medicine (Laurance, 2012). One way to counter the problem of antimicrobial resistance is limiting the inappropriate use of antibiotics. Reducing antimicrobial consumption also reduces the chance of bacteria to develop resistance. Within Dutch hospitals and ambulant care the use of antibiotics is regulated not directly by the government, but by professional communities themselves. Guidelines on the prescription and use of antimicrobial agents are created and distributed by working groups consisting out of representatives of different health care subsectors (SWAB, 2011). According to European monitoring organizations, the Netherlands can be seen as a best practice (or one of the best practises) when it comes to the appropriate use of antibiotics. Relative to its European neighbours, the Netherlands are known as a contaminant free island in Europe (ECDC/EMEA, 2009, p. 10).

Recent discoveries of resistant bacteria, however, have alarmed the Dutch government and public. Resistant bacteria like animal-associated MRSA and ESBL have been found in several animal species, e.g. chicken, pork and veal. Not surprisingly, the blame is mainly focused on the agricultural sector, where antibiotics are used in large amounts to prevent sicknesses among livestock (Geenen, Koene, Blaak, Havelaar & van de Giessen, 2010, p. 3). Instead of imposing government regulation, the Dutch State Secretary of Agriculture tried to force the agricultural sector to self-regulate (Ministry of Economic Affairs, Agriculture and Innovation [ELI], 2010). Since then the sector has come a long way. New institutions have been introduced through which a more sustainable use of antibiotics must be achieved.

Despite these sectoral efforts the fact remains that in comparison with human medical care, it took a long time and substantial external pressure, before sectoral self-regulation would occur. This notion functions as the main starting point of my Master Thesis.

1.2 Problem definition

For some reason enormous differences have appeared in the handling and attitude towards the risk of antimicrobial resistance within the same country. The Dutch government stood idly by whilst the antibiotic consumption in agriculture soared through the roof. Over the last decades, the Dutch consumption of antibiotics in agriculture became one of the highest in all of Europe. Furthermore, the public debate on this subject has intensified. The presence of multidrug resistant-bacteria in Dutch agricultural products explains this trend. Despite these developments the Dutch government does not try to regulate antimicrobial consumption within the sector. Instead, as was stated above, it is left to the sector to regulate itself.

Until the government became actively involved, self-regulation never really set into the veterinary care sector. Unlike human medical care there traditionally was little evidence of effective

guidelines, peer-pressure or monitoring concerning the use and prescription of antibiotics. Although, some within the branch organization of Dutch veterinarians, the KNMvD, and the Dutch Federation of Agriculture and Horticulture (LTO) have pointed to the need for self-regulatory mechanisms, no real action has been taken within the sector itself (Beemer e.a., 2010). This changed at the end of the 2000s. After pressure from the Dutch government and parliament, certain forms of self-regulation were explored and implemented (Ministry of ELI, 2010). However, the increasing number of problems with multi-resistant bacteria has made effective (self-) regulation on the use of antibiotics ever more urgent. Might it therefore be naïve of the Dutch government to rely on sectoral self-organization? Since no effective self-initiated activities were undertaken in the past, one has sustainable reason to doubt the possibility of effective self-organization with regard to veterinary antibiotic consumption in the future. The Dutch human health care sector, on the other hand, already has years of experience concerning the use of self-regulatory mechanisms. Let us first take a look at these mechanisms.

1.2.1 Policy in the Dutch medical sector

The self-organized control of antimicrobial resistance within the Dutch medical sectors is based on three pillars: the provision of evidence-based guidelines, the surveillance of antimicrobial resistance and training of health care professionals. The methods used in Dutch policy relate to the soft governance approach as described by Brandsen, Tops and Boogers (2006): It focuses on persuading hospitals and general physicians to limit their use of antibiotic agents and apply proper hygiene procedures within their practices- i.e. limiting the spreading of bacteria and increasing the time it takes for them to become resistant.

Within the field of hospital care, policy is coordinated on a central level by the 'Working Party on Antibiotic Policy' (the Dutch acronym is SWAB). This working party was founded in 1996 as an initiative of the Society of Infectious Diseases and the professional societies of medical microbiologists and hospital pharmacists (Homepage SWAB, 2010). SWAB is mainly funded by the Dutch Ministry of Health Welfare and Sports (VWS) and consists of a wide range of experts and professionals within the field of medicine and microbiology. In cooperation with organizations on different levels, like the National Institute for Public Health and Environment (RIVM), the Dutch Society for General Practitioners (NHG), and individual academic hospitals, SWAB developed guidelines for the use and prescription of antibiotics in hospitals (RGO, 2000, p. 33). The guidelines also contain hygiene protocols concerning the handling of bacterial infections. In addition, SWAB conducts surveillance on the state of bacterial resistance. By participating in larger European surveillances the SWAB keeps a clear view on a possible increase in bacterial resistance and adjusts their guidelines accordingly (Homepage SWAB, 2010). Within the field of ambulant care guidelines are generally provided by the Dutch College of General Practitioners (NHG) (RGO, 2000, p. 33). Although this association closely cooperates with SWAB, it sends out its own guidelines concerning the use of antibiotics in GP practices.

The Dutch Health Inspectorate (IGZ) sporadically monitors the antibiotic policies of individual hospitals and nursing homes. Based on these monitoring activities, the Inspection has concluded that central guidelines are generally upheld in practice (Ministry of VWS, 2008). These relatively high compliance rates can be explained by the high amount of consensus on antibiotic policy (RGO, 2000). The cooperation of both professionals in the field, academic experts and governmental organizations results in a widespread support for central guidelines. Furthermore, it

creates opportunities to incorporate local experiences into these guidelines. As a result, a process of mutual learning between local and central organizations is set in motion: A form of synergy which might explain the success of Dutch antibiotic policy (Brandesen, Tops & Boogers, 2006, p. 548).

Antibiotic policy within the agricultural sector has historically been much less successful. Although, the surveillance of resistance and consumption is organized on both national and international levels, as will be discussed in the next chapter, the promotion of appropriate use has been almost entirely absent until recently (RGO, 2000, p. 35). What could cause this difference in attitude within the same country? What makes the agricultural sector so different from human care? In this thesis, I will set out to answer these questions and explain why self-regulation never was effectively implemented in Dutch animal-agriculture. By comparing this sector with the more successful Dutch human health care sector, I hope to derive conditions which made it possible for self-regulation to emerge or which prevented it from being formed. In order to enhance the feasibility of my research I have chosen to only address one part of the human health care sector: primary care, from which over 85% of human antibiotic prescription originates.

The following research question will be the main focus of this thesis:

How can the large discrepancies in the adoption of self-regulatory mechanisms concerning the appropriate use of antibiotics between the Dutch human primary care and veterinary health care sectors be explained?

This question is still rather broad by nature and therefore requires more focus. A Theoretical framework might provide this focus.

1.3 Theoretical focus

Finding an answer to this question is no easy task. The numerous actors and institutions that are active within both sectors give rise to a high amount of complexity and a lack of transparency. Furthermore, the two sectors differ a great deal in both structure and actor constellations, which can make a useful comparison of the two troublesome. The use of theory might enable me to simplify this complex arena in which AR manifests itself. In addition, a theory can posit general causal relationships among some subsets of these factors, determining the importance of a certain factor for explanatory purposes (McGinnis, 2011, p. 170).

1.3.1 *Antibiotics as a common-pool resource*

The starting point of my search for such a theoretical angle is the very nature of antibiotics and the problem of antimicrobial resistance. The first section of this chapter already briefly described the problem of AR. At the heart of this problem lies the decline of antimicrobial effectiveness due to inappropriate use. From an economic perspective, antibiotic effectiveness can be seen as a good with high subtractability and low excludability. The former concept refers to the extent to which one person's consumption reduces the supply of others. The latter concerns the controllability of its consumption or, in other words, to which extent persons can be excluded from consumption (Polski & Ostrom, 1999, p. 10). In the case of antibiotics, inappropriate use by one person has a lasting effect on the effectiveness of antibiotics as a whole. In addition, from an ethical point of view it is hard to exclude a member of a medical community (either human or

veterinarian) from prescribing antibiotics. Both professional and case specific knowledge is required to make a proper assessment of the need for an antibiotic treatment in a certain situation. Based on these attributes one can label antibiotic effectiveness as a Common-Pool Resource (CPR). This CPR-nature has consequences for the handling of AR and might partly explain the relative success of self-regulatory institutions in containing this threat. In chapter 2 of my thesis I will provide a deeper analysis of the CPR-attributes of antibiotic effectiveness and its implications for self-regulation. The work of the metaphorical mother of CPR-research, Elinore Ostrom (1990), will serve as virtually inexhaustible source of knowledge and inspiration during this process. Ostrom's work on CPR-theory provided me with a better understanding of the underlying causes of AR and gave me a stepping-stone from which I could derive several theoretical conditions for the effective self-regulation of CPRs like antibiotic effectiveness.

1.3.2 *Modelling social order*

CPR-theory enables me to identify AR as basic collective action dilemma, in which 'self-interested individuals will not act to achieve their common or group interest' (Olson, 1977, p. 2). It does, however, not yet help me to cope with the inherent complexity of the background in which AR manifests itself. Elinore Ostrom's work on common-pool resources mainly focuses on small CPR-settings, in which individual appropriators often belong to the same community. However, even within the limits of the selected cases, the appropriation of antibiotics occurs on a societal scale by a large amount of unrelated appropriators. How are these seemingly independent individuals able to overcome collective action dilemmas?

In their work on social order Streeck and Schmitter (1985) have reduced the complex processes behind societal collective action to a set of four ideal-typical models. These models of social order are identified by their central institution: the state, market, community and association. Within each model individuals find lasting ways to cooperate and find solutions to various types collective action dilemmas. These theoretical concepts do not only help me to reduce complexity, they also uncover the institutional conditions for effective societal collective action. In other words, exploring them will uncover those 'rules of the game' that enable individuals to overcome both the first and second order collective dilemmas affiliated with the sustainment of a CPR. When applied to an institutional perspective the research question will be rephrased as follows:

In what way has the institutional configuration within both the veterinary and human healthcare sectors affected their collective action capacity concerning the sustainable appropriation of antimicrobial agents?

The following guiding sub-questions will help formulate a conclusive answer and structure my thesis:

- ▶ Against which contextual background has the problem of antimicrobial resistance and inappropriate use of antibiotics manifested itself in both sectors (chapter 2)?
- ▶ What are conditions for the effective and long-durable governance of CPR-systems (chapter 2)?
- ▶ Against what institutional background can these conditions best be supplied on a sectoral scale (chapter 3)?
- ▶ What institutional configurations are present in both the veterinary and human medical sectors (chapter 7)?

- ▶ To which extent are the conditions for the effective and long-durable governance of CPR-systems supplied in the scrutinized sectors (chapter 7)?

Even with simplifying concepts and models in place, however, the empirical research needed to answer this question is still in danger of becoming overly complex. In order to overcome this danger I will turn to what Mayntz and Scharpf (1995, p. 66) call an institutional variant of Lindbergs rule of diminishing abstraction. Basically, this means that one should try to explain a phenomenon with individual factors, only when it is clear that institutional explanations are not satisfactory. I will therefore first explore if the institutional context of both sectors affects the effective implementation of self-regulation. If the outcomes of this part do not answer the research question sufficiently an individual approach will be applied, which will hopefully bear more fruit.

1.4 Social and scientific relevance

This thesis aims to be both socially and scientifically relevant. Antimicrobial resistance is a continuously increasing threat to modern society. Although, microbiology, pharmacy and other medical disciplines are at the vanguard of combating this threat, social, organizational and economical sciences must also play their part. Policy analyst can on the one hand help create ways to promote research for new types of antibiotics and on the other put a halt to inappropriate use. Naturally, this thesis will focus on the latter. Furthermore, it can provide more insight on the effective implementation of self-regulation. A regulatory method that, if successfully introduced, helps to internalize the externalities produces by certain sectors and at the same time takes away a burden from the state. When linking the above together, one receives another important possible outcome of this thesis: It might provide insights in the possibilities and conditions for the effective implementation of self-organizational mechanisms within the agricultural sector.

In addition, the theoretical insights that result from this thesis might prove to be a valuable contribution to existing CPR-theory. Elinore Ostrom and her colleagues mainly focussed on small-scale CPR-situations, in which communitarian institutions influence individual behaviour on a rather personal level. AR, however, manifests itself on a societal scale. By combining Ostrom's individual rationalists approach with Streeck and Schmitter's societal perspective, I hope to contribute to a theoretical foundation underneath the resolution of large scale CPR-dilemmas.

1.5 Methodology

The methodological design of this thesis will be a qualitative case-study. An in-depth approach is required to cover the rather complex and theoretical components or variables of social order. This thesis only uses data from two cases in a single country. Of course, a comparison between several different countries would provide me with a more comprehensive answer to the research question. This would, however, go beyond the limits of this thesis. Furthermore, a thorough and in-depth analysis of the two Dutch cases can still provide me enough data to provide a sound answer to my research question.

The case-study as presented in this paper will be approached in what Scharpf (1997, p. 219) calls the spirit of the "most similar case". The analysis will be based on the comparison of two relatively similar sectors within the same country. The actors that are present in both medical and

veterinary care are more or less the same, or at least have the same role. Health care professionals, pharmaceutical companies, inspection services and branch organizations: All play a role in both areas. Yet, for some reason effective self-regulatory mechanisms have spontaneously appeared in only one. In order to solve this puzzle, I will rely for the most part on a qualitative research approach. By using content analysis and semi-structures interviews I hope to retrieve information on the actions of the involved actors, their underlying beliefs and the role of institutions, both as dependent and independent variables.

1.6 Thesis outline

After this overall introduction the next chapter will give a more in-depth description of the problem of inappropriate antibiotics use and the context in which it manifests itself. In addition, it will explain the CPR-nature of antimicrobial resistance in greater detail. In chapter 3, I will then discuss the various models of social order through which a society can deal with collective action dilemmas. Using the work of Elinore Ostrom I will argue which models would be best suited to keep the consumption of antibiotics at a sustainable level. Chapter 4 will then form a bridge between the theoretical and empirical part of my thesis. In it, my decisions concerning the structure of my research, case selection, data collection and operationalization will be uncovered and explained. Chapters 5 & 6 will then introduce the main actors, interests and policy within respectively the human primary and veterinary sector. In chapter 7 I will then uncover and discuss the institutional configuration that lies at the base of each sector and relate it to their collective action capabilities. Finally, in chapter 8 I will present my conclusion, which will contain an answer to the research question and a reflection on the theoretical, practical and methodological aspects of my thesis.

2 The risk of antibiotic resistance

2.1 Introduction

The previous chapter has already globally introduced the main puzzle of my thesis. Before I can go off and put together the pieces, however, it is important to create a clear overall picture of the actual extent of the problem. In the first part of this chapter I will therefore present a more comprehensive description of inappropriate antibiotics use and its affiliated negative effects both on the international as well as on the Dutch national level (section 2.2). In the second part of the chapter, section 2.3, I will then show how the Dutch medical and veterinary care sectors compare to other European countries when it comes to antibiotic consumption. Finally, in section 2.4, I will describe the risk of antibiotic resistance as a so-called *common-pool resource*.

2.2 The risk of antibiotic resistance

The introductory chapter of my thesis already discussed the increased presence of antimicrobial resistance in not only Dutch hospital communities, but also among the general population. It remains unclear, however, what this exactly means for society. What are its social and economic consequences? How does the misuse of antibiotics contribute to the aggravation of the problem and, not unimportantly, what causes lie behind the rise of AR in general and the misuse of antibiotics in particular? In the following pages I will try to answer these questions.

2.2.1 *What is AR?*

In general antibiotics are chemical agents which kill or inhibit the growth of microorganisms, like bacteria, fungi and protozoa. This enables physicians to treat both small infections as well as dangerous life-threatening diseases. Furthermore, antibiotics make many medical procedures, like surgery, organ-transplantations and chemo-therapy, much safer by reducing the risk of infection (Mossialos, Morel, Edwards, Berenson, Gemmill-Toyama, & Brogan, 2010). The origins of antibiotics lie in the 19th century, but its use took an enormous flight after mass-production started during the 1940s. The discovery of the world's most well-known antibiotic, penicillin, by Alexander Fleming facilitated this process (Mossialos et al, 2010, p. 9). According to the World Health Organization [WHO] (2011) the mass-production of antibiotics was one of the most important reasons for the significant fall in mortality by infection diseases. It is not by coincidence then that many leading health care practitioners see antibiotics as the base of modern medicine (van den Brink, 2010).

Antibiotics can be divided into different types and classes. First, this depends on the effect they have on microorganisms, e.g. do they kill or just inhibit growth, and second it depends on the spectrum of usage. Broad-spectrum antibiotics are effective against different types of microorganisms whilst narrow-spectrum antibiotics can only treat one or two specific types. Antibiotics can be naturally isolated, like penicillin, or chemically synthesized. During the 1960s and 1970s new classes of antibiotics were discovered on a regular basis. More and more effective antibiotic therapies were developed and some physicians were convinced that in the future infectious diseases could be eliminated forever (Mossialos et al , 2010, p. 10). Events in the 1980s and 1990s proved them wrong, at least for the coming decennia. First of all, the discoveries of new types of antibiotics slowed down. Hardly any new classes became available in the 1990s and 2000s (European Medicines Agency and the European Centre for Disease Prevention and Control

[ECDC], 2009, p. 2). But what made things even more problematic was the fact that bacteria began to adapt. Over time multidrug-resistant (MDR) bacteria began to appear which were able to resist various types of antibiotics; a development which poses an enormous threat to an important pillar beneath modern medicine.

Bacteria can build up resistance to antibiotics by a spontaneous mutation that occurs during their replication process. Each time antibiotics are used it is possible that they unintentionally select the resistant bacteria within a population. Because all non-resistant competitors are eliminated, resistant bacteria do not only survive, they also have the opportunity to reproduce unhindered. Bacteria can then set out to spread both inside as well as outside a patient. Resistance can also appear through horizontal gene transfer. This means that different types of bacteria pass on their genetic material to one another, resulting in the spread of resistance. In some cases this has already led to outbreaks of bacteria that are resistant to virtually every class of antibiotics. It could thus be stated that the inappropriate use of antibiotics could eventually set us back in the pre-antibiotics phase of medicine. For now, however, it is important to emphasize the negative correlation between the use of antibiotics and the time bacteria need to build up resistance – *i.e. the more antibiotics are used, the faster bacteria become resistant* (European Medicines Agency & the European Centre for Disease Prevention and Control [ECDC/EMA], 2009, p. 1).

2.2.2 *Social and economic burden*

The appearance of MDR-bacteria in health care communities imposes both a social as well as an economic burden on society. Patients that are infected with these types of bacteria show higher rates of morbidity and mortality in combination with an increased number of hospital days (Kraker, Wolkewitz, Davey, & Grundmann, 2011). Research conducted by the European Centre of Disease prevention and Control (ECDC) shows that within the European Union (EU) alone over 25.000 people have already died as a result of an infection with resistant bacteria (ECDC/EMA, 2009, p. 4). Figures provided by the World Health Organization (WHO, 2004) show that worldwide 31% of total burden of disease, as measured in disability-adjusted life years, is already caused by infectious diseases. This makes it the second leading cause of death in the world (Mossialos et al, 2010, p. 10). In the future AR will cause these figures to rise even further.

Next to social costs, increased rates of AR will result in higher medical expenditures due to a longer duration of sickness and treatment and an increased number of hospital days. Costs will increase even further because the organizational infrastructure must be adapted to the rise of MDR-bacteria: surveillance programmes must be set up and infectious disease departments expanded. More indirectly, a loss of potential income and productivity due to increased morbidity and mortality can be seen as non-health externalities of AR (Mossialos et al, 2010; Kraker et al, 2010). Already, estimations of the costs related to AR range from US\$ 378 million to US\$ 18.9 billion in the United States (US) alone. Within the EU the costs are estimated at € 9 billion (Mossialose, et al, 2010, p. 25-26). These assessments do, however, not yet account for the possible future costs. If the presence of MDR-bacteria will continue to increase, the associated costs will also keep on growing.

2.2.3 *Complexities*

The risk of antimicrobial resistance is further complicated by the interregional and intergenerational nature of the problem. First of all, antibiotics are used at a global level. This has

both positive and negative effects. On the up side, it can help to contain an outbreak of a certain disease, preventing it from spreading across the world. However, resistant bacteria, caused by inappropriate use in a certain part of the world, can be exported to other countries. In other words, the prevalence of resistant bacteria within a certain community does not depend on internal practices alone, but also on the practices within other communities. Consequently, in order to effectively combat the risk, policy makers have to address the problem on a global scale. Second, the true consequences of antimicrobial resistance have not yet fully revealed themselves. A large part of the generic antibiotics are still effective today and enable physicians to treat the vast majority of infections. Because of this, the real threat of AR remains hidden. Government officials in most part of the world do not see it as a priority. Moreover, health care professionals¹ and market actors involved in antibiotics development do not perceive, or do not want to acknowledge, the severity of the coming crisis. As a result, the benefits of antibiotic consumption are reaped in the present, whilst its costs have to be paid by future generations.

In the previous pages I have tried to briefly explain the risk of antimicrobial resistance. The second part of this chapter will focus the manifestation of antimicrobial resistance in the Netherlands. I will address both the human medical sector as well as the veterinarian sector.

2.3 Antibiotics in the Low Countries

No country in the world can evade the problem of antimicrobial resistance. The manner in which it contributes to the problem can, however, be influenced. The section below will provide a greater understanding of the antibiotic consumption within the Netherlands, consecutively in the medical health and the veterinary sectors. The presented data was derived from the NethMap and MARAN reports, published annually by respectively the Dutch Foundation of the Working Party on Antibiotic Policy (SWAB) and the Veterinary Antibiotic Usage and Resistance Surveillance Working Group (VANTURES). Their reports provide '... a comprehensive overview of antibiotic usage and resistance trends in The Netherlands in human and in animal husbandry' (SWAB/RIVM, 2011, p. 6). For the international comparison I will also use international research reports (Grave e.a., 2010; ECDC/EMEA, 2009; ESAC, 2009). The used documents provide reliable data over a period of five years, from 2003 until 2009.

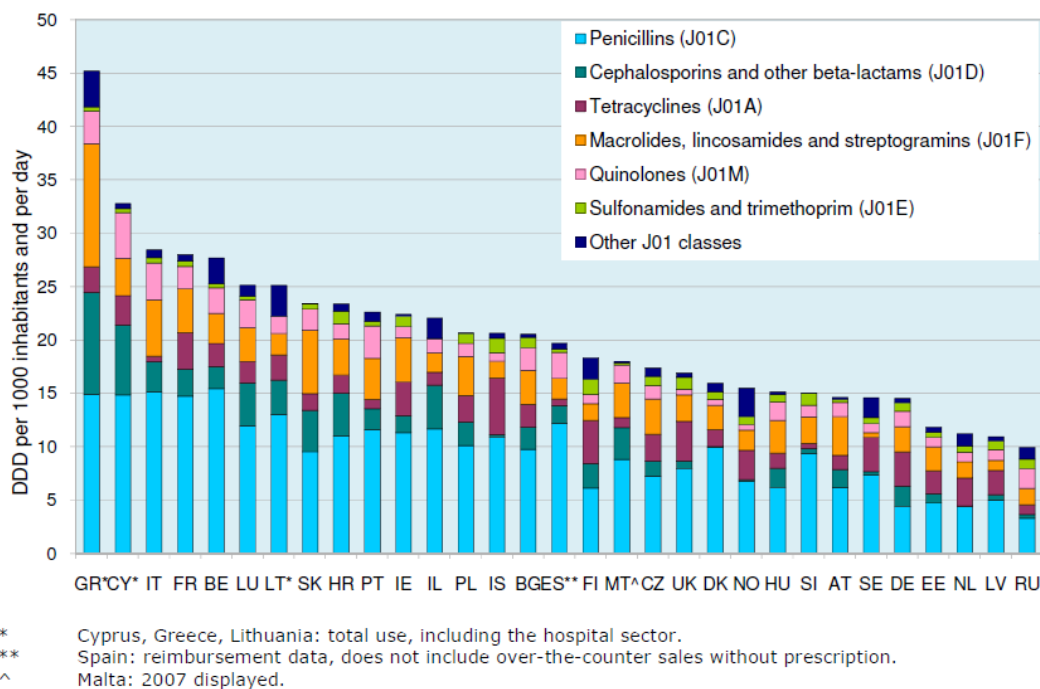
2.3.1 *Medical health*

Following the NethMap report (SWAB/RIVM, 2011), I will present the antibiotic consumption within the medical health sector in two parts. The first part will describe the prescription and use of antibiotics in what is called Ambulatory or Primary Health Care - e.g. the prescription by general practitioners [GPs] (who are responsible for 85% of the total consumption). The second part presents the consumption in hospitals, or acute care. Antibiotics use is depicted in the Defined Daily Dosages (DDDs) that were prescribed per 1000 inhabitants.

When looking at ambulatory care the consumption of antibiotics has increased only slightly over the last years. Until the year 2005 the overall use remained below 10 DDD per 1000 inhabitants. In 2005, however, it went up to 10.5 and in the following years it increased to 11 in 2008.

¹ Apart from e.g. infectious disease specialists and microbiologists.

Figure 1: Antimicrobial consumption in Europe in ambulatory care in 2008 (Source: ESAC, 2009, p. 39)



Use then stabilized in 2009 en 2010. Despite this small increase the Dutch are still doing quite well in comparison with other European countries, as can be seen in figure 1. Within acute care a bigger increase can be seen.

Since 2003 the antibiotics usage has risen with 23 %. In 2009, the total systemic use of antibiotics in hospitals increased to 70.88 DDD per 100 patient-days (+6.2% compared to 2008). The total number of DDD per 100 admissions decreased by 6.8% from 345 DDD in 2008 to 321 DDD in 2009. This means that the administered amount of antibiotics per patients remained more or less stable. Due to an increased number of patients, however, the total amount of consumption grew. Clinical activity and the overall use obviously correlate. Moreover, the increase in antibiotic consumption does not indicate the presence of inappropriate use. Nonetheless, an increased exposition of antibiotics does mean a higher risk of resistance. Therefore, it can still be seen as a negative outcome or trend.

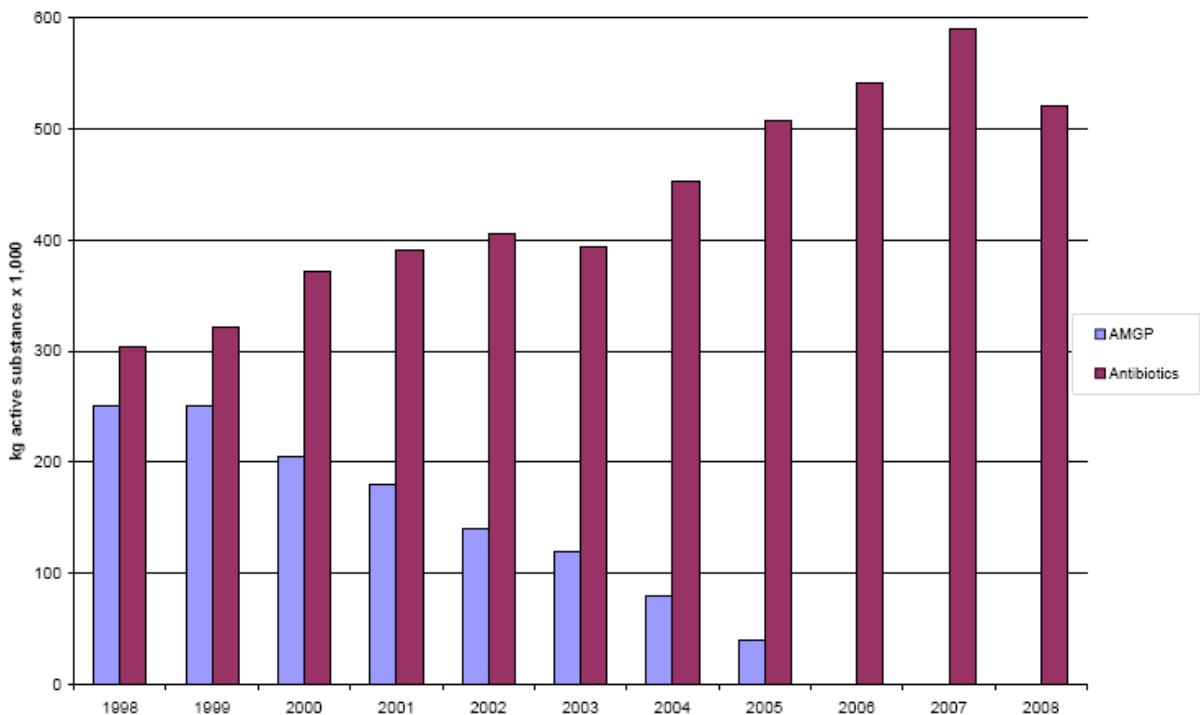
Although, the total antibiotic consumption *per patient* remained relatively stable over the last years, this does not say much about the actual performance of the Dutch. A comparison with other countries would serve this purpose. On an annual basis the European Surveillance of Antimicrobial Consumption (ESAC), an international network of national surveillance systems that is funded and facilitated by the ECDC, collects and compares reliable data on the use of antibiotics within Europe. Their surveillance focuses on human medical care, both ambulatory as well as acute. Concerning the former, the Dutch are performing quite well. As depicted in figure 1, only two countries had a lower consumption in 2008.

In this year outpatient consumption was twice as low as in countries like Belgium or France. In 2002 outpatient usage of antibiotics was even the lowest in all of Europe (Goossens et al, 2006). Strangely enough, the ESAC does not possess reliable data on antibiotics use in Dutch hospitals. An accurate comparison with other European countries can therefore not be made. However, since ambulant care comprises up to 85% of the total antibiotic consumption, it can be concluded that the Dutch have relatively low antimicrobial consumption within human care (Bart & de Neeling, 2001, p. 786).

2.3.2 Veterinary care

Within animal husbandry the use of antibiotics lies on an entirely different level. According to the MARAN report published in 2011, the consumption of therapeutic antibiotics in animal husbandry in 2007 had doubled when compared to 1999, whilst there was no significant growth in livestock (CVI/LEI, 2010). The report is based on the sales data from pharmaceutical companies. In 2005 the Dutch government banned the use of antimicrobial growth promoters (AMGP). As depicted in figure 2, the total consumption of antibiotics was not influenced very much by this event. Instead the decrease of growth promotion was accompanied by a steep increase in therapeutic consumption to 188 ml/kg biomass in 2007.

Figure 2: Total sales of antibiotics in animal husbandry, 1998 to 2008. (Source: CVI/LEI, 2010).



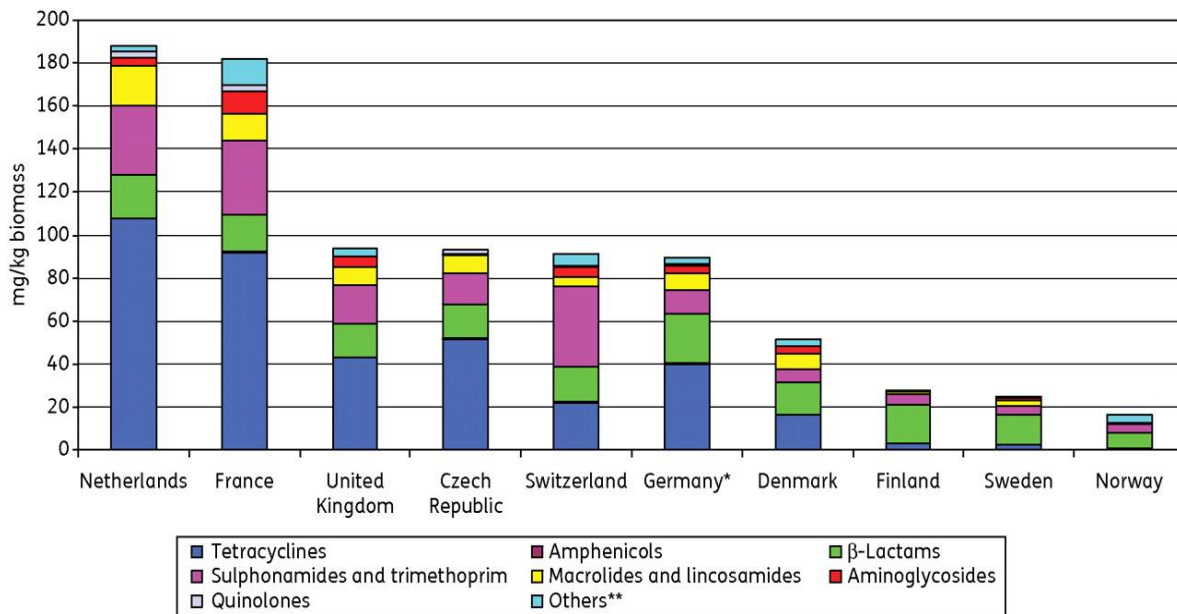


Figure 3: Amounts, in mg, of veterinary antibacterial agents sold in 2007 per kg biomass of pig meat, poultry meat and cattle meat produced plus estimated live weight of dairy cattle. *2005 data. **The substances included vary from country to country (Source: Grave, Torren-Edo & Mackay, 2010, p. 2038)

When comparing the Dutch consumption internationally, it shows an evenly dramatic picture. The antibiotic consumption in the Netherlands is significantly higher than in many other European countries. According to Grave et al (2010) these differences cannot be explained by animal species demographics alone. For example, the highest usage of antibacterial agents among food-producing animals is generally in pigs. This would mean that Denmark, being the biggest pig-meat exporter in the world, would also have the highest antimicrobial consumption per kg biomass. In reality, however, Denmark has relatively low consumption rates (see figure 3). Instead Grave et al (2010) point to differences in prescribing behaviour and dosing practices between countries. It is important to note, however, that these international comparisons are not always reliable. Critics point out that monitoring of usage is far from conclusive in many countries. In this light it would be unfair to label the Netherlands as the sole largest veterinary antibiotics consumer in Europe (de Vries, 2011). Nonetheless, it remains safe to say that the Dutch consumption is *among* the highest on the continent. Furthermore, the latest MARAN-rapport, including data from 2010, shows the beginning of a somewhat more positive trend. According to this rapport the antibiotic usage on prescription decreased in 2008 and again slightly decreased in 2009 and 2010 (CVI/LEI, 2011). Furthermore, sales figure from the past few years confirm a continuation of this trend. So after a period from 1999 to 2007, in which the use of therapeutic use of antibiotics has doubled, the first signs of improvement have surfaced.

In general, the Dutch antimicrobial consumption is relatively low within the human medical care. Although, an increase in consumption within hospitals is seen during the last decade, the average use per patient remained stable. Furthermore, outpatient use remained stable and among the

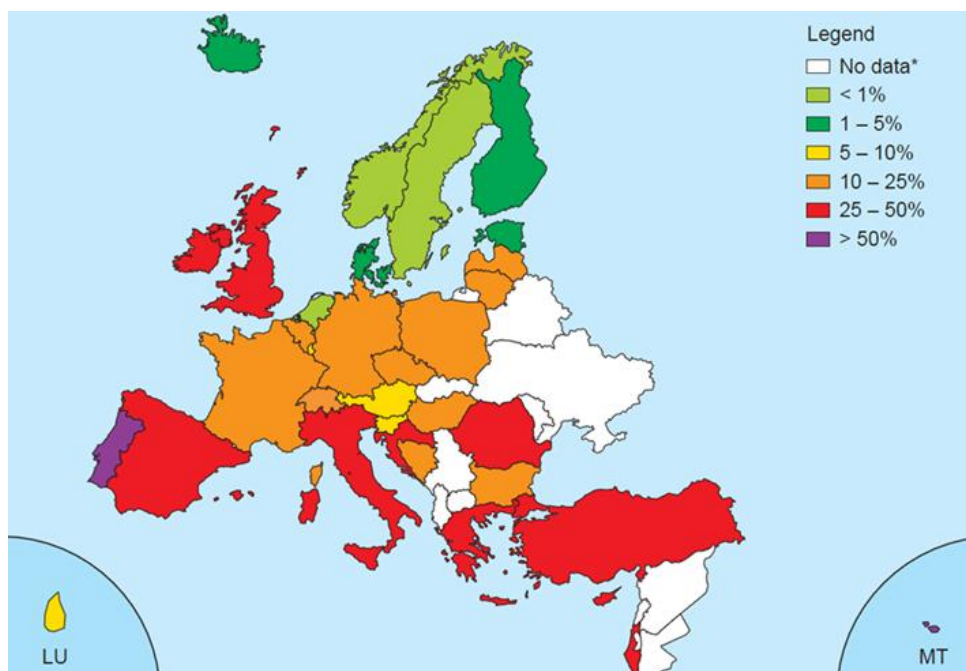
lowest in all of Europe. Within veterinary care, however, the Dutch are far less successful. With a sharp increase during the last decade, usage is among highest within Europe.

2.3.3 Resistance rates

Earlier in this chapter I mentioned the correlation between antibiotics usage and resistance rates: *the more antibiotics are inappropriately used, the faster bacteria become resistant*. When taking this correlation into account one would expect that the differences in antibiotics usage between medical and veterinary care would also be reflected in the prevailing resistance rates. Annual surveillance reports issued by the European Antimicrobial Resistance Surveillance Network (EARSS) traditionally show low overall resistance rates in the Netherlands. One of the most common MDR-bacteria worldwide is Methicillin-resistant *Staphylococcus aureus* (MRSA). As depicted in figure 4, resistant rates of hospital-acquired MRSA within The Netherlands, and other Northern European countries, lie around 1-2% in 2008, whilst the European average lies around the 20-25%. In some countries, like Portugal and Malta, resistance rates even lie above 50% (EARSS, 2009).

Another example is the so-called E.coli bacteria. This microorganism is one of the most common causes of infectious diseases. The percentage of multi-resistant E.coli bacteria in Southern Europe lies around 5-10%. In the Netherlands, however, this percentage does not exceed 2% (EARSS, 2009). Against the background of increasing resistance rate worldwide, the Dutch seem to be able to contain hospital-acquired resistance rates quite well. Of course, there are differences between the numerous bacterial classes, but on average, as the example shows, hospital-acquired resistance rates are among the lowest in Europe. Unfortunately, not all resistant bacteria are acquired in hospitals.

Figure 4: MRSA prevalence in Europe in 2008 (Source: EARSS, 2009, p. 57)



In 2005 multi-resistant bacteria, in this case MRSA, were found among livestock and those in close interaction with infected animals (RIVM, 2009). Follow-up studies showed that over 68% of the Dutch pig farms tested positive for this type of animal-related MRSA. In 2008 this percentage even increased to 75%. When looking at veal farms this percentage was even higher: 88%. In addition, over 16% of the *people* living on farms were infected. According to the Dutch National Institute of Public Health and the Environment (RIVM), community-acquired MRSA-rates are much less common in other countries (RIVM, 2011). Due to the fact that these types of MRSA are not easily transmitted from human to human and that the isolates found in raw animal-food products are relatively low, there is no direct threat to public health. However, the prevailing rates of community acquired MRSA are in line with the high consumption of antibiotics in the veterinary sector.

Next to MRSA, another threat was discovered by Dutch microbiologists: a rapid increase of ESBL's outside hospital communities. ESBL, which stands for Extended-spectrum beta-lactamase, is a type of enzyme produced by bacteria. This enzyme confers resistance to several types of antibiotics. Remarkably, research by Dutch microbiologists showed that over 85% of the chicken meat sold in Dutch supermarkets was infected with ESBL's (Overdeest, Willemsen et al, 2011). The discovery of MRSA and ESBL-producing bacteria in Dutch consumer products for the first time showed the possible consequences of the veterinary use of antibiotics. It is hard to determine the percentage of MDR-bacteria that originates from animal agriculture. Expert estimate that the vast majority of resistant bacteria found in hospitals is still produced in hospital-settings. Still, the inappropriate use veterinary antibiotics opens up entirely new transmission routes, enabling resistant bacteria to spread rapidly within the agricultural supply chain and on to the consumer-market (A.W. van de Giessen, personal communication, 2012).

During the 2000s large discrepancies have existed between the Dutch human medical and veterinarian health care sector when it comes to the use of antibiotics and the prevalence of AR. In order to explain these differences I will first derive the general causes behind increasing resistance rates. The remainder of this chapter will tend to this cause. I will try to find a theoretical explanation for the rise of AR, by describing antimicrobial effectiveness as a common-pool resource.

2.4 Antibiotics as a common-pool resource

Generally there are two factors that aggravate the risk of antimicrobial resistance: First the inappropriate use of antibiotics which leads to increased resistance rates, and secondly, insufficient investment in research and development (R&D) that hinders the discovery of new types of antibiotics. At the heart of the problem of antimicrobial resistance, however, lies the very nature of antibiotics itself.

2.4.1 *A tragedy of the commons*

Within academic literature, antibiotics and their effectiveness are increasingly approached as a man-made *common-pool resource* (Herrmann & Laximanarayan, 2010). This term refers to 'a natural or man-made resource system that is sufficiently large as to make it costly (but not

impossible) to exclude potential beneficiaries from obtaining benefits from its use' (Ostrom, 1990, p. 30). Elinore Ostrom (1990) describes this process by distinguishing a flow of resource units and a resource system. The former can be seen as the units of a certain resource that are being used by individuals. Ostrom (1990) labels these individuals with the term *appropriators* and the withdrawing of a resource unit as *appropriation*. The resource system can be thought of as the stock from which these units are derived. Under favourable conditions, the resource system is able to replenish the flow of units that is consumed from it. An easy example to illustrate this is a fishing ground. The fishing ground can be seen as the resource system, from which flows of fish are harvested. Under favourable conditions, i.e. when appropriation stays below a certain level, the fish stock can replenish itself. So if the rate of withdrawal is not higher than the rate of replenishment, the resource will be sustained over time. However, due to opportunistic behaviour of appropriators and the fact that exclusion is costly, the withdrawal rate might in some cases be higher than the replenishment rate. In that case a situation will manifest itself which Garrett Hardin (1968) described as *the tragedy of the commons*: The common-pool resource is not able to sustain itself and will eventually collapse. In academic literature the concept of CPR is closely related to the prisoner's dilemma (PD) game. This game or metaphor is useful to uncover the conflict between individual rationality and group rationality (Ostrom, Gardner & Walker, 1994, p. 5; Ostrom, 1990, p. 3-4). From an individual's perspective it is rational to appropriate at a utility-maximizing level, even if this leads to a very unfavourable situation from a group-perspective. In other words, when rational individuals are not able or willing to agree on appropriation limiting strategies or rules, and when no other authority is able to effectively enforce such rules, individuals are likely to appropriate on a suboptimal level, which in turn will result in a tragedy of the commons situation.

When applying this theoretical concept to AR, it is self-evident that antibiotic consumption can be seen as the resource-flow. Furthermore, the actual effectiveness of antibiotics can be seen as the resource-system. For example, when consumption is beyond a certain level, encouraged by inappropriate use, the effectiveness of the total stock of antibiotics will suffer from increased resistance rates. So, contrary to the fishery example, there is no physical depletion of the total stock of antibiotics, since more antibiotics can always be produced. Instead, due to increased bacterial resistance, the *effectiveness* of current antibiotics will be depleted (Herrmann & Laxminarayan, 2010). Two kinds of problems lie behind the inability to keep antibiotic consumption on a sustainable level. First, a suboptimal high outflow of units relative to the replenishment rate due to inappropriate use, and second, a lack of investment in the development of new antibiotics, i.e. the long-term sustenance of the resource-system itself.

2.4.2 *Inappropriate use*

In a report to the World Health Organization (WHO), Mossialose et al (2010, p. 139) describe risk aversion, misdiagnosing and preventive use within professional communities as reasons for the existence of inappropriate use. When confronted with a patient, physicians often do not have the time or means to make an accurate assessment of his or hers condition. In order to rule out a bacterial infection they prescribe antibiotics as a preliminary measure. This risk averse behaviour causes a great amount of misuse, but is in many countries common practice within professional communities. Often this even gets aggravated by pressure from patients. Their persistent demands for an 'adequate' treatment force physicians into needless antibiotic prescription. Furthermore, self-medication by patients shows a direct correlation with the prevalence of AR. In

Spain, for example, where over 50% of the households have non-prescriptive antibiotics at home; AR-rates are among the highest in Europe (Grigoryan et al, 2006). Furthermore, the use of antibiotics as a growth promoter within animal agriculture is often also seen as a form of misuse (Kelly, Smith e.a., 2004, p. 7). Within the agricultural sector antibiotics are considered as a means to increase and protect the livelihood of the individual farmer. Existing values and perceptions concerning antibiotics thus increase their misuse. These values have been shaped according to the *positive effects* to (public) health en growth promotion that are inherent to antibiotics use; not only can antibiotics cure an individual patient or animal, they also protect the rest of the population from getting sick. In addition, Mossialose et al (2010) describe a prevailing market failure in the antibiotics market which aggravates inappropriate use even more: a negative AR externality.

An externality arises when an actor's behaviour has positive or negative effects on another person who is not directly involved in a certain transaction. This results in a market failure, since this effect is not calculated into the price of a certain good. In other words: the full costs or benefits in production or consumption of a product are not reflected by its price. In case of a positive externality this will result in under-provision and in case of a negative externality in oversupply (Mossialos et al, 2010: XV). The AR-externality arises when the consumption of antibiotics by one patient produces a small number of resistant bacteria. The patient can then infect other persons how in turn will no longer be able to benefit from a certain antibiotic. The extra costs due to this process are, however, not included in the price of antibiotics. Rational self-interested market actors, like pharmaceutical companies are unhindered by the costs of rising resistant rates and will, therefore, continue to appeal to the uncertainties and existing pro-antibiotics use values within professional communities in order to promote increased use of their antibiotics. When relating this to the CPR-nature of antibiotics, this situation could be characterized as an *appropriation externality* (Ostrom, Gardner, & Walker, 1994, p. 10).

In short, opportunistic behaviour due to existing values, risk averse behaviour and misdiagnosing, combined with a negative appropriation externality, cause a suboptimal appropriation of resource units, which is slowly depleting the system.

2.4.3 *Lack of investment*

In addition to this appropriation problem, insufficient investment in new antimicrobial agents has also resulted in a *provision problem* (Ostrom, Gardner, & Walker, 1994, p. 10). This underinvestment can be explained by the lack of economic incentive for their development. There are several explanations for the absence of this economic incentive. First of all, the majority of antibiotics that are currently on the market are still effective. Companies will rather produce exiting types of antibiotics, than invest in the development of new ones. Second, public health authorities, in both Europe and the US, stress the need for the conservation of important types of antibiotics. They should only be used as a last resort in extreme cases. This makes antibiotic development unattractive for possible investors. Newly discovered antibiotics will be dispensed infrequently, thus generating low returns. Furthermore, antibiotics have a limited live-span. Eventually bacteria will grow resistant, limiting return on investment. Pharmaceutical companies will thus prefer to invest in medicines that are effective for a longer period, with increasing returns (Mossialose e.a., 2010:138). The reasons above are backed by another externality in the antibiotics market. However, this time it concerns a positive public health externality. New

effective antibiotics do not only cure an individual patient's infection; they also prevent bacterial infections to spread and cause harm to other patients and in the end society as a whole. These enormous benefits for society are, however, not reflected by the price of antibiotics. Because market actors do not reap the full benefits of their investment, this will lead to undersupply or underinvestment in antibiotics development (Mossialose e.a., 2010). Although, this supply-side cause also presents us with significant challenges which must be overcome in order to effectively combat the risk of AR, this thesis will focus on inappropriate use of antibiotics and collective action within professional communities. However, it is clear that enormous possibilities for further academic research can also be found on the supply-side of this problem.

Thus far, I have shown that antibiotic effectiveness can be seen as a common-pool resource. Inappropriate use and underinvestment have put the sustainability of this resource at risk. Basically this discussion resulted in both a physical as well as a conceptual problem definition. Only if appropriators are forced, persuaded or lured into collective action, a solution might be found and a tragedy of the commons averted. In the remainder of this chapter I will focus in the institutional conditions which might facilitate the successful and enduring sustainment of CPRs.

2.5 Governing the commons

Until now, I have presented CPRs as an unsolvable collective action dilemma. Rational individual agents always behave opportunistically and therefore appropriate with no regard for the enduring sustainability of the resource-system. Consequently, all appropriators are trapped in a tragedy of the commons. Fortunately, this picture does not always correspond with reality. Countless resource systems exist which have successfully survived over long periods of time (Ostrom, 1990, p. 58). Elinore Ostrom (1990, p. 88) and her colleagues have analysed many of these resource systems and discovered that, despite the differences among CPR-settings, they all share fundamental similarities. Robust CPR-systems are all characterized by the presence of the same set of institutions, which Ostrom translated into eight design principles.

These design principles, which are depicted in Box 1, are defined by Ostrom as '... essential elements or conditions that help to account for the success of these institutions in sustaining the CPRs and gaining the compliance of generation after generation of appropriators to the rules in use'. According to Ostrom (1990), successful resource systems have clearly defined boundaries and a clearly defined set of appropriators. Furthermore, rules have to be adapted to local settings and local appropriators, functioning on an operational tier, must be able to participate in the decision-making process on the collective-choice level. However, even if rules are in sync with local conditions, monitoring activities are needed to prevent opportunistic behaviour from occurring and if rules are broken; graduating sanctions must be used to punish the perpetrator. In addition, these locally organized rules and monitoring institutions must be recognized by a higher authority. This way, local communities will have a form of self-determination which lowers the chance of distorting state interference. In other words: Rules will stay in tune with local interests and conditions. When a resource system has a larger scale, nested enterprises on different societal levels must ensure that individual communities can cooperate on different levels. The creation of appropriating rules and monitoring must thus take place on a higher level, but still on a communitarian basis, without state involvement.

Box 1: Ostrom's Design Principles

- ▶ Clearly defined boundaries (effective exclusion of external unentitled parties);
- ▶ Rules regarding the appropriation and provision of common resources are adapted to local conditions;
- ▶ Collective-choice arrangements allow most resource appropriators to participate in the decision-making process;
- ▶ Effective monitoring by monitors who are part of or accountable to the appropriators;
- ▶ There is a scale of graduated sanctions for resource appropriators who violate community rules;
- ▶ Mechanisms of conflict resolution are cheap and of easy access;
- ▶ The *self-determination* of the community is recognized by higher-level authorities;
- ▶ In the case of larger common-pool resources: organization in the form of multiple layers of nested enterprises, with small local CPRs at the base level.

Source: Ostrom, 1990

Although, Ostrom's design principles have given us an empirical flicker of hope, showing that those dependent on common-pool resources are not forever trapped in situations that will inevitably lead to a tragedy of the commons, it remains unclear how these institutions are best supplied. Basically they only indicate that self-organization is the way to go if one wants to solve a CPR-dilemma. However, due to their local perspective, the fulfilment of the principles seems to require some sort of community based management with a close knit social structure (Rose, 2002, p. 245). In other words: a setting in which trust and reciprocity are already present (or easily created) through regular interaction between the involved individual actors.

2.5.1 *Trust, reciprocity and reputation*

The supply of Ostrom's design institutions is not self-evident. It implies a community with a sufficient level of cooperation. This in turn implies, what Ostrom herself calls, a core relationship between trust, reciprocity and reputation. *Trust* is important in the effective handling of a social dilemma. It affects whether individuals are willing to start contributing or cooperating in the expectation that this effort will be reciprocated by others (Ostrom, 1998, p. 12). *Reciprocity* refers to a set of strategies that is used by individuals when dealing with a social dilemma. It implies that individuals assess the likelihood that others are conditional co-operators. They will initiate cooperation only when they expect others to also cooperate. Furthermore, they refuse to cooperate with others who do not reciprocate and punish those who betray them (Ostrom, 1998, p.10). When many community-members use reciprocity, *reputation* also comes in to play. In order to not be punished, individuals will try to acquire a reputation for keeping promises. By doing this they will perform actions that are beneficial for the entire community. Ostrom (1990, p. 12) neatly summarizes this in the following sentence: ' Trustworthy individuals who trust others with a

reputation for being trustworthy (and try to avoid those who have a reputation for being untrustworthy) can engage in mutually productive social exchange'. Together, Ostrom defines these three concepts as the core relationships behind collective action. Without them, a CPR-community will run into a so-called second-order collective action dilemma when trying to supply the institutions meant to deal with the first one. In other words, individuals will have no incentive to invest substantial energy and resources towards supplying and maintaining the self-regulating, monitoring and sanctioning institutions that are required to sustain a robust and enduring CPR (Ostrom, 2010, p. 660-661).

Unfortunately, the threat of antimicrobial resistance cannot be contained on a local level, within in a closely knit community. It manifests itself on a global scale and even within the sectoral limitations of this thesis; these small scale pre-conditions for CPR sustainment do not seem to hold. For example: although, professional communities do exist in the Dutch health care sector, the sector-wide social structure can be classified as loose at best. Ostrom herself acknowledges that within a community without regular face-to-face communication between appropriators, it is hard to use reciprocity and build trust. See tries to mitigate this drawback by introducing the concept of nested enterprises: the creation of nested community management institutions. According to McCay (2002), the functioning of these nested institutions depends on the extent to which the impact of community behaviour can be observed on an inter-communitarian basis. If this is hard, the resource-related norms will differ a great deal between individual local communities. In other words, local interests will prevail over societal interests. Although, the relation between the (over)use of antibiotics and antimicrobial resistance was already observed decades ago, it still remains hard to link to use of antibiotics in one single hospital or on one single farm to the prevalence resistance rates within society. All this undermines the development of the core relationships behind collective action. In the next chapter I will discuss the possibilities of communitarian self-organisations in greater detail. For now, however, the spontaneous emergence of nested communitarian management institutions might be wishful thinking.

2.6 Conclusion

In this chapter I have explored the risk of antimicrobial resistance in greater detail. First of all, it is important to note that the more antibiotics are inappropriately used, the faster resistance rates will rise. This means that unnecessary or inappropriate use will inevitably lead to higher resistance rates. The prevalence of antimicrobial consumption and resistance within the Netherlands has illustrated this correlation. The Dutch human medical care sector shows a relatively low consumption and an equally low presence of hospital-acquired MDR-bacteria. Within the veterinary sector, however, relatively high usage has, according to both national and international reports, led to a relatively high prevalence of animal-related MRSA.

Furthermore, I have tried to expose antibiotics, or rather their effectiveness, as a common-pool resource. This provided me with a conceptual explanation behind the causes of AR. By exhausting future antibiotic effectiveness, the prevalence of inappropriate use poses a serious threat to the sustainment of the antimicrobial resource system. Basically, this situation presents us with a collective action dilemma. To avoid a tragedy of the commons individuals must be persuaded to act against their own self-interest and in favour of the collective well-being. After an extensive empirical search, Elinore Ostrom and her colleagues have uncovered a set of design principles

which are present in all robust CPR-settings. Unfortunately, the supply of such institutions requires a sound base of trust and reciprocity within a community. This will prevent local appropriators from running into second-order collective action dilemmas. Since AR manifests itself on a societal scale and within a loose structure of interdependent professional communities, the spontaneous supply of Ostrom's design principles remains far from self-evident.

The differences between the Dutch human medical and veterinarian care, however, suggest that some sectors are better in dealing with this collective action problem than others. The medical health care sector, for example, is relatively successful in keeping inappropriate use of antibiotics to a minimum. How can this difference be explained? In the next chapter I will take a step back and try to find a conceptual answer to this question by focussing on different models of social order. These models can be described as ideal-typical institutional configurations which enable actors to deal with collective action dilemmas on a societal scale. By exploring these models I will derive the institutional conditions which enable individuals to overcome both the first and second-order collective action dilemmas affiliated with the sustainment of a CPR.

3 Institutional complementarity in face of a CPR-dilemma

3.1 Introduction

As the previous chapter has shown, the common-pool resource nature of antibiotic effectiveness presents society with an enormous collective action dilemma. The global and intergenerational nature of the problem makes it hard for a single government to solve this problem, or even to make an accurate risk assessment. In addition, the numerous societal actors that are involved within the supply and consumption of antibiotics make matters even more complex. The threat of antimicrobial resistance manifests itself within a field of social norms and values, economic incentives and hierarchical control. To solve such a collective action dilemma on societal scale seems to be an almost impossible task. Yet, somehow in different but equally complex situations, large groups of seemingly independent actors are able to produce lasting solutions to collective action dilemmas. Streeck and Schmitter (1984) try to grasp the workings of these solutions in so-called models of social order. These models basically reduce the complexities by grouping the variety of actors that exist in society to a few ideal-types on an abstract level. Each ideal-typical actor is then assigned a restricted set of interests and is allowed to co-operate and fight within a set framework of rules and patterns. In the end this results in what Streeck and Schmitter call a state of equilibrium in which '...the actual behaviour of persons and collectivities is both mutually adjusted and predictably variable' (p. 1).

In this chapter I will explore these 'models of social order'. The next section will present the three pure types of social order that are most dominant in academic literature: state, market and community. I will then argue whether or not these types might be successful in dealing with CPR-dilemmas. In the second part of this chapter I will discuss a fourth type of social order put forth by Streeck and Schmitter (1984): the association. Finally, in the last section of this chapter, I will define the institutional rules of the game within each model.

3.2 Pure models of social order

Due to the CPR-nature of antibiotic effectiveness, a collective action problem has arisen. In order to solve this problem, the individuals involved have to be persuaded or coerced into choosing group or collective rational strategies above individual rational action. According to dominant views within social science and philosophical speculation, collective action problems within a society can be dealt with by a mix of three pure types of social coordination or governance, identified by their central institution: state, market and community (Streeck & Schmitter, 1984, p. 1). Streeck and Schmitter (1985) describe these ideal-typical governance arrangements by their coordinating principles, respectively hierarchical control, spontaneous solidarity, and dispersed competition (see figure 5). Each of these models of social order will be discussed in greater detail.

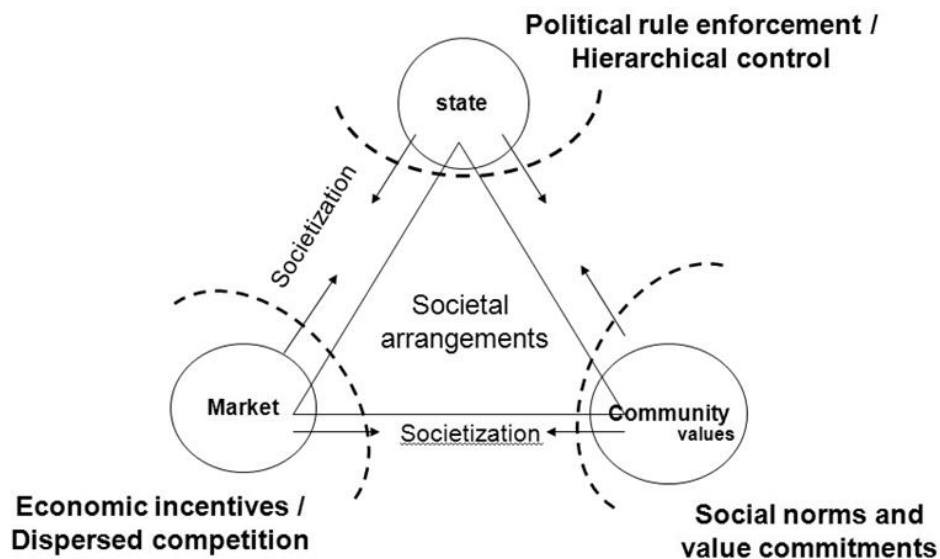


Figure 5: Coping with social problems by means of politics (Based on: Helderman, 2007)

3.2.1 The State: Rule enforcement and hierarchical control

Within a state model, allocation decisions are made through public policies. These decisions are then enforced by civil servants, whose basic interest is career advancement within a stable bureaucratic environment. Enforcement is ultimately backed by the state monopoly on legitimate coercion. Those who are subject to policy decisions, e.g. tax-payers, law abiders or conscripts, basically strive to avoid punishment. Both civil servants and policy subjects satisfy their interests by minimizing risks and maximizing predictability by following agreed-upon procedures and regulations (Streeck & Schmitter, 1984, p. 7). Though the guiding principle of command and control, equilibrium is reached in which external security, equitable and predictable treatment and an efficient mobilization of resources prevail.

According to Hardin (1963), from whom the tragedy of the commons model originated, state coercion is an excellent way to solve CPR-dilemmas; simply centralize its management to government actors which will assure a sustainable appropriation and allocation of common-pool resources. Basically, his solution relies on exogenously imposed state institutions to prevent overexploitation (McGinnis & Walker, 2010, p. 296). State institutions are able to coerce individuals into behaving or appropriating in a collectively optimal manner. Government actors, public agencies or even international authorities must first determine at which level appropriation is optimal, and then monitor and, when necessary, sanction all individual appropriators involved. According to Ostrom (1990, p. 10), however, this *étatiste* perspective is based on the assumptions that information is a hundred percent accurate, government monitoring and sanctioning capabilities are infallible and administration costs are zero. If these conditions are absent, which in most cases they are, a central agency could make several errors and e.g. overlook defection or punish law-abiding appropriators (Sandler, 2010, pp. 317-318).

When applied to antibiotic effectiveness, one can see various difficulties that arise when enforcing through strict centralized control. First of all, it is hard to centrally determine the optimal usage of antibiotics. Conserving antibiotic effectiveness is not just a matter of limiting the number of antibiotic dosages prescribed. Apart from the various ethical questions this might raise, like who gets antibiotics and who doesn't, limiting use might sometimes even cause antibiotic effectiveness to deteriorate. An antibiotics treatment which is too short, gives bacteria the chance to survive and even to adapt, reducing future antibiotic effectiveness². Regulation should therefore emphasize *appropriate use*, which is hard to determine on a central level. Second, government actors lack the knowledge to effectively monitor and enforce rules on appropriation. One can think of professional knowledge, which must be acquired at great expense, but also of local knowledge. Every patient in every hospital, GP's office or cattle-shack must be diagnosed individually; every case is special. Third, strict regulation has consequences for the provision of new antimicrobial agents. They discourage market actors from investing in antimicrobial research. By limiting the use of antibiotics, the message is sent to the pharmaceutical industry, that antibiotics are not a very profitable type of medicine. This way, strict regulation will only delay the rise of AR, instead of truly preventing it.

3.2.2 *The market: privatization*

Within the perfect market, allocation is determined by economic incentives. Entrepreneurs strive to maximize their personal profits and thereby provide consumers with material benefits arising from competition. This arrangement is legitimated by the fact that it produces a higher economic welfare than otherwise would be possible (Streeck & Schmitter, 1984, p. 2). Next to the economic market, Streeck and Schmitter (1984, p. 6) also distinguish an electoral market in which politicians seek to maximize their electoral support. In exchange voters acquire the benefits arising from the impact of electoral 'voice' on public policy. In this case legitimacy arises from the increased accountability of governing elites. It is important to note that the market order is based on the assumption that agents will behave more rationally when they are free to pursue their own personal interests. In the end these maximizing strategies of individuals will provide benefits for society as a whole. To assure the functioning of a competitive market, a minimal set of government enforced agreements regarding property rights and contracts is required. Nonetheless, through a mechanism of dispersed competition among market-participants, like firms and economic entrepreneurs on the supply side and consumers on the demand side, co-ordination is achieved. This results in material prosperity and citizen accountability (Streeck & Schmitter, 1984, p. 5).

Besides exogenously imposed state institutions, Hardin (1963) also suggests the development of market institutions as a possible solution to CPR-dilemmas. A process of privatization and the implementation of private rights to a common property resource basically impose market institutions in an area where they had not existed previously. According to its proponents, this will realize the advantages of efficient market exchange of private property (McGinnis & Walker, 2010, p. 296). It will in other words lead to higher material prosperity. But what is exactly meant by the privatization of a CPR? In case of a stationary resource, e.g. farm land, one can imagine its division into separate parcels. Individual rights are then assigned to hold, use and sell these

² The reason why every doctor stresses the importance of completing an antibiotics treatment, even when all symptoms of infection are long gone.

parcels as the owner desires (Ostrom, 1990, p. 13). Antibiotic effectiveness, however, is far from stationary and the establishment of individual property rights is virtually impossible. One could think of some sorts of tradable consumption quota for antibiotics, but these centrally imposed market mechanisms suffer from the same practical and ethical shortcomings as other centralized regulation. Moreover, the resource-system itself, will always remain common property. Even if private property rights could be allocated among the appropriators, unregulated interaction between self-interested parties is unlikely to result in an optimal use of antibiotics (Streeck and Schmitter, 1985, p. 133). Chapter 2 already described both positive and negative externalities, which cause overconsumption within the antibiotics market (Mossialose, et al, 2010). Opportunistic entrepreneurs and consumers, both seeking to maximize their utility, will thus inevitably cause a sub-optimal usage of antibiotics and eventually a collapse of the entire resource system. The market failures inherent to the antibiotics market, basically rule out privatization as a possible solution to this collective action problem. This can be illustrated by a simple game theoretical example: the farmer’s dilemma.

On a competitive market, consumers choose the highest quality for the lowest price. Antibiotics make it possible for farmers to produce faster growing and healthier livestock with relatively low extra costs. Consequently, a farmer would have an edge over his competition if he would be the only one using antibiotics on a structural basis. Furthermore, he would be competed out of the market if he is the only one *not* using antibiotics. In absence of government regulation or community norms and pressure, it would thus be irrational for farmers to not use antibiotics (Anomalie, 2009, pp. 481-482). Hence they are confronted with a collective action problem with a prisoner’s dilemma structure, as depicted in figure 6. Based on this simple game it can be concluded that rational behaviour of individuals within the antibiotics market, does not automatically coincide with what is best for society.

		Them	
		Don't Treat	Treat
You	Don't Treat	2 nd , 2 nd	4 th , 3 rd
	Treat	1 st , 2 nd	3 rd , 3 rd

Figure 6: The Farmer's Dilemma (source: Anomalie, 2009, p. 482)

Since both state and market institutions are not able to provide a satisfactory solution to a CPR-problem in general and AR in specific, I will now shift my focus to the possibilities of collective-action within professional communities themselves.

3.2.3 *The community as an alternative*

Within a community, needs are met by spontaneous solidarity among its members (Streeck and Schmitter, 1985, p. 121; Ostrom, 2010). The community gives identity and belonging to certain

individuals through shared norms and values. Community leaders or notables desire the esteem of their followers, who in turn receive a sense of belonging by participating in a group as such. Within a community decisions are taken on the basis of unanimous agreement and common consent (Streeck and Schmitter, 1985). This implies, as already discussed in the previous chapter, that the presence of trust, reciprocity and reputation or status is crucial for the effective functioning of the community model of social order. So what does this mean for the containment of collective action problems? Self-coordination might be easy to achieve in small communities where commitment and reciprocity are relatively easy to obtain and the actions of individual members are easy to monitor. In the previous chapter I already explained that the spontaneous development of communitarian self-coordination on a societal scale is far from self-evident. Still, its possibilities are not entirely negligible. Helderman (2007), for example, describes the formation of new communities within modern welfare states, such as policy communities or professional communities. Members of these communities do not live in close proximity of one another and their relationships are not based on frequent face-to-face interaction. Instead these collegial communities consist out of professionals operating within their professional associations. They are typically characterized by the norms of peer quality and peer-group identification (Helderman, 2007, p. 111). Finally, for a (professional) communitarian order to function, it is essential that communitarian values are sufficiently in line with what would be best for society as a whole. Just as in the market model, the devolution of state functions to communities is basically an attempt to marshal private interests for social purposes. Whether these interests are in line with the societal-interest, however, depends on the rational behaviour of individuals, given the shared community values and identities or the professional consensus (Streeck and Schmitter, 1985, p. 128-129).

Within the field of antibiotics there exists one distinct and dominant community whose members prescribe antimicrobial agents. These professional communities consist out of physicians, pharmacists and/or veterinarians. Their behaviour is for a great extent shaped through their education, professional oaths and interactions with other professionals. However, it still matters to what extent the individuals within these professional communities are able to solve re-distributive issues and maintain voluntary solidarity in a more heterogeneous community. In other words: to what extent might these actors be able to self-organize and limit the inappropriate use of antibiotics? In the next section of this chapter I will look at the possible merits, conditions and limitations of community self-organization. First, I will therefore take a short sidestep to explain what is exactly meant by community self-organization.

3.3 Self-regulation within professional communities

In recent decades, self-regulatory regimes have been introduced in sectors and industries around the advanced world as a means for social control. Gunningham & Rees (1997: 364-365) describe self-regulation as a 'regulatory process whereby an industry-level (as opposed to a governmental or firm-level) organization sets rules and standards (codes of practice) relating to the conduct of firms in the industry.' Together, these rules and standards produce so-called normative orders of professional communities. Self-regulation can be further defined along several dimensions. First of all, a distinction must be made between economic and social self-regulation. The former concentrates on the control of markets, the latter 'aims to protect people or the environment from the damaging consequences of industrialisation.' (Gunningham & Rees, 1997: 365). In other words, self-regulatory mechanisms protect, for example, employees, consumers or/and the

environment for the unacceptable effects that might arise due to a sectors activities (Helderman & Honingh, 2009).

According to Rees and Gunningham (1997) three forms of self-regulation can be distinguished by the degree of government involvement. They identify these three main forms by aligning them along a continuum. On one side of this continuum there is pure voluntary self-regulation. In this form state actors are totally absent. Instead both the rule-making as well as the enforcement is done by the professional community or industry itself. A bit further along the continuum you will find mandated full self-regulation. In this form rule-making and enforcement are still fully in the hands of the sector itself. State actors, however, have sanctioned the self-regulatory program and monitor it. They will also intervene when self-regulation does not produce the expected results. Basically, this form can be described as self-regulation in the shadow of hierarchy (Börzel, 2010). The next step on the continuum is partial self-regulation. This form has two basic approaches: either private enforcement of publicly written rules *or* the public enforcement of privately written rules. At the far end of the continuum you will then ultimately find direct government regulation. In practice, however, these pure forms of self-regulation are rarely encountered. Instead self-regulatory mechanisms take in a certain point on the continuum, between the various ideal-types.

3.3.1 Why self-regulation?

The use of self-regulation is far from universally accepted. Its proponents argue that the self-regulation adds increased speed, flexibility and sensitivity to market or professional circumstances when comparing it with governmental regulation. Because of their detailed knowledge, practitioners are able to set standards and monitor compliance effectively, circumventing the principal-agent problems in a sector (Ostrom, 1990; Sandler, 2010, p. 319). Moreover, the potential for utilizing peer pressure within professional communities exists and resistance within professional communities against outside interference is no longer an issue. Instead internalizing responsibility and the setting ethical standards, which extent beyond 'the letter of the law', raises behavioural standards from the inside out (Gunningham & Rees, 1997, p. 366; Michael, 1995). Lastly, self-regulation results in governmental costs savings, since fewer resources have to be spent on direct rule-making and enforcement (Michael, 1995, p. 185). Critics, however, accuse self-regulation of being nothing more than a charade. In their eyes, it tries to give interested parties the appearance of regulation, whilst in practise it is nothing more than a means to fend off direct government intervention. In other words: it provides a way by which an irresponsible sector can keep up the appearance of responsibility and an 'excuse for a government for not doing its job' (Braithwaite, 1993, p.91). As a result, imposed standards are often weak and compliance is hardly monitored. Furthermore, sanctions are often absent or very lenient (Gunningham & Rees, 1997, p. 370). When looking at the real-world implementation of self-regulation, both critics as well as the proponents seem to have a point. The effectiveness of self-regulatory regimes differs greatly between sectors and industries (Helderman & Honingh, 2009; Gunningham & Rees, 1997). Even Elinore Ostrom herself argues that self-regulation or organizing is by no means self-evidently effective, especially when dealing with a CPR-dilemma. She described a set of serious barriers which have to be broken down before effective self-organization can occur.

3.3.2 The problems of communitarian self-regulation

As already discussed at the end of Chapter 2, the emergence of spontaneous self-organization is far from self-evident. Professional communities often suffer from the same deficiencies as their

more traditional equivalents. Especially, when dealing with a CPR-situation. Ostrom (1990, p. 42-43) distinguishes three major problems that undermine a sector's self-regulatory capacity. These problems concern the supply of institutions (1), the making of credible commitments (2) and mutual monitoring (3).

The implementation of self-regulatory institutions requires time, energy and resources from the individuals involved. The supply of these institutions can, however, be seen as a public good. This means no appropriator can be excluded from reaping the benefits that self-imposed rules provide. Hence, participants have an incentive to free ride on the time, energy and resources of others. Ostrom (1990, p. 42) describes the supply of self-regulatory institutions as a second-order collective action dilemma (the first-order being the CPR-problem itself). The second problem, credible commitment, concerns the effectiveness of the rules once they have been established. When appropriators have collectively decided on a set of rules that constrain the actions from which they may choose, it still remains to be seen if they are able to abide by them. Especially on the long-run, the immediate returns on breaking the rules might be high. For example, it might save a hospital a lot of resources to ignore strict hygiene protocols when dealing with resistant bacteria. In the long run, however, this may lead to an increased rate of AR within not only the hospital, but also in its environment. Furthermore, Ostrom (1990, p. 44) remarks that nobody 'wants to be a sucker' by keeping a promise that everyone else is breaking. In the case of self-regulation, there is no external enforcer who can ensure compliance. Instead the participants themselves must find a way to guarantee credible commitment. One way of doing this is by mutual monitoring: each participant monitors the behaviour of the others. When non-compliance is discovered, the participant must then be willing to impose sanctions and thus keep high rate of conformance (Ostrom, 1990, p. 44). In this situation, however, one is confronted with yet another second-order collective action dilemma. Monitoring and punishing is again a costly business. Furthermore, everybody will benefit from the one participant punishing another. This means participants will be inclined to free-ride on the sanctioning activities of others.

To what extent are the professional communities in the field of antimicrobial resistance able to deal with these second-order collective action problems? To answer this question we need to look at the characteristics of the professional communities in the Dutch medical and veterinarian care sectors. First of all, the communities are large. They consist out of a great number of actors spread out over a relatively large geographical space. Community bonds are thus relatively weak which makes it harder to jointly supply regulatory institutions. Furthermore, it is easier for individual members to free-ride, since monitoring and sanctioning becomes a costly business. Second, it is hard to speak of one single community. Within each sector wide community, numerous sub-communities can be distinguished, each with its own professional background. Knowledge and interests can differ a great deal between professions. An infection-disease specialist might, for example, be far more concerned with rising resistance rates, than a general practitioner. Third, the communities within both sectors might be classified as *extrinsic* communities. Extrinsic communities can be seen as instrumental arrangements, often installed to solve ad hoc coordination problems among individuals sharing the same geographical or functional space (Marks & Hooghe, 2004, p. 28). Membership of these communities is voluntary; this allows individual professionals to exit when the community does no longer serve their needs. The heterogeneous structure of the professional health care communities makes it hard to reach a general consensus on appropriate self-regulatory institutions. Even if these institutions are

installed, the voluntary nature of the communities undermines credible commitment. Streeck and Schmitter (1985, p. 133) describe this as follows: 'community action lacks the authoritative means to mobilize resources above and beyond what can be obtained on a voluntary basis'.

After this extensive discussion on the functioning of the communitarian order, it can be concluded that just as in their more traditional counterparts, collective action within professional communities depends on the presence of Ostrom's core relationship between trust, reciprocity and reputation. This relationship lies at the heart of a functioning communitarian social order, since it facilitates the possibility of spontaneous solidarity; the guiding principle of interaction within communities. Without it there is no way to guarantee voluntary cooperation within and between communities.

So where does this leave us? Both the state and market model seem inadequate approaches towards overcoming a CPR-dilemmas. The third communitarian model heavily depends on the presence of trust and reciprocity to overcome second-order collective action problems; characteristics of a community not obviously present in modern day societies. Fortunately, Streeck and Schmitter (1984), distinguish a distinct fourth model of social order through which the behaviour of social actors in advanced industrialist/capitalist societies can be made both reciprocally adjustive and predictable: the associative order. Within this order, a possible absence of trust and reciprocity is compensated by the presence of so-called complementary institutions. In other words, the shortcomings of one model can be compensated by another. In the next section I will first discuss the co-existence of several types of social order by means of institutional complementarity and institutional hierarchy. I will then introduce this fourth model of collective action as a possible approach towards CPR-dilemmas.

3.4 Linking arrangements

Hitherto, I considered the three pure types of social order, market, state and community, as if functioning independently in isolation from each other. Most policy regimes, however, are embedded in multiple institutional orders (Helderman, 2007, p.112). Although, one social order may be dominant, all three might influence the interactions of the involved actors by facilitating some modes of co-ordination and by constraining others (Helderman, 2007, p.112). To describe this I will use the concepts of institutional complementarity and hierarchy. Institutions might be complementary in a sense that they can correct or complement each other's deficiencies. According to Amable (2000, p. 655) several institutions reinforce each other so they form a coherent and stable structure. As was mentioned before, institutions help to solve collective action dilemmas (Helderman, 2007, p. 104). The concept of complementarity implies that particular institutions functions better or more efficient when some other institutions are also present. Basically, the efficient functioning of the institutional architecture as a whole depends on the presence of several complementary institutions. For example, communities provide the trust and mutual confidence necessary for the functioning of market processes. Similarly, state institutions uphold private property rights and enforce contracts in an authoritarian manner; which in turn facilitates market mechanisms of allocation (Streeck & Schmitter, 1985, p. 119). Combining the different attributes of certain institutions is a necessity when governing complex economic, political and social systems (Helderman, 2007, p. 104). However, this does not imply that institutions are automatically complementary. Often, different institutions can be in conflict with

At the core of the associational order lies interaction and allocation among a privileged set of actors. These actors are organizations which defend commonly defined interests, like class, sectoral and professional associations (Streeck and Schmitter, 2007, p. 124). Through negotiations and deliberation these associations try to search for common ground in order to reach and implement relatively stable compromises in the pursuit of their interest (Streeck and Schmitter, 2007, p. 124; Baccaro, 2005). Next to these primary interactions among interdependent organizations, a second set of interactions takes place between the associations and their members, and between the associations and interlocutors. These interlocutors might be actors whose support and resources are required, often state-agencies or market actors, but also those who are indirectly affected by the achieved compromises, like social movements or politicians. Within an associational model, it is important that each actor recognizes each other's status and entitlements. This recognition is what Streeck and Schmitter (1985) call the medium or currency of the model. Although, satisficing interests still remains the ultimate goal within an associational order, repeated interaction, deliberate mutual recognition and adjustment prevent individual privileged actors from exploiting momentary advantages. Prisoner dilemmas are thus avoided through inter-organizational trust (Streeck and Schmitter, 1985, p. 13).

The arrangements in which interactions take place are referred to by Streeck and Schmitter (1985) in terms of private interest governance. Basically, this concept can be seen as an attempt to guide self-interested collective action in such a way that it contributes to realization of public policy objectives (Helderman, 2007, p. 114). 'In generic terms, this is the case where it is in the interest of an organized group to strive for a 'categorical good' which is partially compatible or identical with a "collective good" for the society as a whole' (Helderman, 2007, p. 114). The concept of private interest governance is based on the premise that organizations function as transforming agents of individual interest. The extent to which categorical and collective goods overlap depends on the way in which group interests are organized into associational structures and processes (1) and the complex bargaining process between organized group interest and the state (2).

Streeck and Schmitter (1985, p. 9) list a number of resources that greatly enhance an associative actors' efficacy in the attainment of policy objectives:

- ▶ Guaranteed access of relevant parties
- ▶ Compulsory membership and/or contributions
- ▶ Institutionalized forums of representation
- ▶ Centralized co-ordination
- ▶ Comprehensive scope
- ▶ Jurisdiction and control over member behaviour
- ▶ Delegated tasks of policy implementation.

The attainment of these resources depends for a large extent on the state. It must recognize private interest governments as the transforming agents of individual interest, legitimate it's, at least partial, control over member behaviour and promote or protect its organizational development. Even more important, however, the state must be willing to *share political space* (Helderman, 2007, p. 114). Decisions on certain sector-specific issues must be delegated to associative actors. In return these actors must be willing to mobilize and deliver constituent membership (Helderman, 2007, p 115). Politically, this is a delicate matter, since these delegated

policy decisions could affect the society as a whole. The sharing of political space distinguishes an associational system from a pluralist system; in which a state might be captured by a number of fragmented interest groups, but never actually shares its decision-making responsibilities. Next to recognition and the sharing of political space, state institutions also have another important role to play. The state must function as a Sword of Damocles hanging above the associations (Helderman, 2007, p. 116). Although, state intervention must be kept to a minimum in an ideal-typical associative order, a strong state might still come in handy to keep associative interest in check with the public policy goals. The state can, for example, prevent unequal representation from occurring. State resources can be used to mend organizational asymmetries, so that all sectoral interests are expressed within an associational structure (Baccaro, 2005, p. 188). The state also prevents one well organized sub-group from capturing the entire policy process. Moreover, the threat of hierarchal intervention alone may curb organizational rent-seeking and the chance of negotiation or deliberation deadlocks. In other words, state pressure boosts the self-regulatory capacity of interest associations.

Finally, it is important to discuss the lines of cleavage between an ideal-typical associative order and the other pure institutional models. Streeck and Schmitter (1985, p. 127) note that the associational model is basically stuck in between the other models. First, associational leaders have to deal with the state-agencies, as was already discussed earlier. These dealings can be cumbersome since there always is a chance that state-leaders, growing weary of the continuous infringement of their authority, might try to push associations out of the political space. On the other side of the institutional spectrum, a professional association or private interest government finds his own members, whose interest and behaviour have been strongly conditioned by both economic market forces and community values and traditions. Furthermore, electoral competition in the political 'market' might bring down the associative order when it is not in line with the interests of the electorate. An associational order might thus be threatened by, as Streeck and Schmitter (1985, p. 127) themselves put it: 'opportunistic capitalists, radically mobilized workers, outraged voters, offended civil servants and/or strict constructionist judges.' As is the case with all institutional configurations, however, associative governance must be supplemented by other types of institutional arrangements in order to be effective. First of all, as was mentioned earlier, it needs a strong state to keep associative interest in line with public policy goals. Furthermore, associations are built on social collectivities with some prior identity and existence. And finally, although associations try to confine self-interested market behaviour, the use of private contracts and rent-seeking behaviour is not entirely ruled out (Streeck and Schmitter, 1985; Helderman, 2007).

3.5 Associative governance of common-pool resources

The previous section of this chapter has described associative governance as more or less hybrid model of social order. This implies a high degree of institutional complementarity between the three pure types: state, market and community. By complementing community self-organization with state-like hierarchal supervision, one basically creates a knife that cuts two ways. First, the limited information processing capabilities of the state are complemented by communitarian self-regulation. Secondly, the voluntary character of self-organization within communities is being restricted by a shadow of state hierarchy, which creates a more solid base for communitarian cooperation. Until now, however, the associative order has yet been explicitly related with the

solution of collective action problems in the face of CPR-dilemmas. In general, one can say that the institutional complementarity affiliated with this type of governance fills the institutional holes that were left open when approaching a CPR-dilemma with only one of the pure-type governance arrangements. In the case of a CPR, regulation or even goal setting by state actors alone is impractical because the object of regulation is so complicated and multifaceted. In addition, because of the fact that implementation must be determined case by case, effective monitoring is near to impossible. This is exactly the reason why a government would be willing to share political space with a private interest government (Baccaro, 2005). Community actors, on the other hand need some sort of state pressure in order to overcome opportunistic behaviour of individuals. More specific, however, the institutional outcomes of associative governance, corresponds to a great extent with Ostrom's empirically derived design principles for successfully sustainable common-pool resources, as discussed in the previous chapter. The spontaneous fulfilment of these design principles is far from self-evident, especially in large scale communities, with a loose social structure. However, by incorporating this loose social structure into an associative governance system, the chance of fulfilment is greatly increased.

First, the boundaries of the system are clearly denominated through a process of community and state negotiation. Once it is clear which organizations are empowered to represent their member's interest, and when all societal groups are represented in these organizations, they receive some policy prerogatives from the state. In other words, rule-making, monitoring and sanctioning activities are delegated to a nested enterprise on a sectoral level. Although, the state recognizes the self-determination of the community, it also ensures that sectoral interests stay in line with societal interest. Representative organizations, or private interest governments, are also in continuous dialogue with their own members. This has two positive results: first or all, since appropriators are basically participating in the decision-making, rules regarding appropriation and provision will stay in tune with local conditions. Second, the monitoring organizations remain to some extent accountable to the appropriators themselves. Finally, by definition, the private interest governments function as a form of conflict resolution between members and/or member communities.

Although, associative or private interest governance provides many if not all of Ostrom's design principles for a successful CPR-governance system, one important deviation of Ostrom's line of reasoning must be mentioned: the role of the state. Where, Ostrom (1990) sees the mere presence of the state as a distorting factor, the functioning of an associative governance system is critically dependent on state cooperation and funding. In other words, were Ostrom promotes the community as a dominant form of governance, private interest governance relies on the strengths of institutional complementary, were both state and community institutions re-enforce each other.

3.6 Institutional configurations of social order

Within academic literature the three main social orders, state, market and community, are presented as possible means to solve collective action dilemmas. Extensive research on common-pool resource-systems around the world, conducted by Elinore Ostrom and her colleagues, has, however, showed that state and market institutions alone are in general not able to sustain long-term CPR-systems. Instead they propose community self-organization as an alternative. Through mechanisms like peer-pressure and the internalization of responsibility, self-organization might be

able to solve collective action problems, whilst at the same time avoiding principal-agent problems and professional resistance.

Communitarian self-organization is, however, by no means self-evidently effective. Especially in the case of large scale communities, the realization of self-regulatory mechanisms is itself plagued by collective action dilemmas. Three general problems were mentioned: the supply of institutions, credible commitment to self-enforced rules and the facilitation of monitoring activities. I have presented the concept of associative or private interest governance, as developed by Streeck and Schmitter (1985), as a means to overcome these problems of collective action. Instead of relying on market, community or state institutions, the associative model presents functionally defined private interest organisations as crucial in the provision of social order. When complemented by community and state institutions, these organizations are able to achieve the sustainable appropriation of a complex CPR like antimicrobial effectiveness.

What consequences does this intermediate conclusion have for the central question of this thesis? Based on the findings in this chapter, I can make three theoretical assumptions: First, sectors that are dominated by state and market types of social order are not able to sustain robust and durable CPR-systems. Second, societal sectors which are dominated by communitarian types of social order will only be able to sustain robust and durable CPR-systems if the underlying core-conditions of trust, reciprocity and reputation are sufficiently present. And third, sectors in which the associative type of social order is present will most likely be able to sustain robust and durable CPRs.

Unfortunately, reality is much more complicated than the models I described in this chapter. Social order is rarely the result of a coherent set of institutions. Instead institutional orders are built upon many social compromises, years of political bargaining and long learning processes (Helderman, 2007, p. 120; Amable, 2003). As result, collective action problems will never be dealt with within one single model. So when examining the consumption of antimicrobial agents within the Dutch human health and veterinary care sectors, I will need to derive how the involved actors react to the opportunities and constraints that are offered by the institutional *rules of the game*.

3.6.1 *Institutional rules*

Rules can be defined as '...shared understandings among those involved that refer to enforced prescriptions about what actions (or states of the world) are required, prohibited, or permitted.' (Ostrom, 2007, p. 36). The ultimate goal of all rules is to achieve order and predictability among the individuals involved. Through rules, persons are given a position in which they are then required, permitted, or forbidden to take certain actions. Together, rules form an institutional configuration which guides and influences the choices and actions of all actors within society. In addition, Streeck and Thelen (2005, p.10) note that what defines an *institutional* rule is that individuals are expected to conform to it, regardless of what they would want to do on their own. Moreover, not only the individuals directly affected by these rules have these expectations, but they are shared by society as a whole. I deliberately use a rather broad definition of the concept of rules: it does not only comprise formal laws, which are the result of a legislative process, but also the norms, values and assumptions that lie at the base of human action.

It is important to note that rules can be analysed on different levels. On an operational tier, rules affect practical decisions that in turn directly affect real world outcomes (Ostrom, 2011, McGinnis, 2011, p. 173). However, rules also exist on the collective-choice or policy tier. On this level decisions are made on policy and institutional arrangements that restrict the options of those operating at the operational tier. Who is authorized to participate within these collective-choice processes and how these processes are structured, is then determined on constitutional choice tier. Finally, Ostrom (1990) distinguishes the meta-constitutional level. This highly abstract level encompasses '... long-lasting and often subtle constraints on the forms of constitutional, collective, or operational choice processes that are considered legitimate within an existing culture.' (McGinnis, 2011, p. 173). When analysing models of collective action, focussing on the collective-choice tier seems to be the most obvious choice. State, community, market and associative institutions all try to guide individual behaviour within a given constitutional and metaphysical framework. Deriving every single collective-choice rule, however, would be a complex, if not impossible task. Instead I will try to classify them along the core properties of the different models of social order.

3.6.2 *Institutional rule-configurations*

Ostrom (2011, p. 11) classifies rules according to their effects on an action situation: a theoretical concept that she describes as '... the social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas.' Her rule-classification can be seen as a way to distillate those rules that are important for institutional analysis. Within the empirical part of my thesis I will use a similar approach. I will dissect each model of social order along the rules that define its core properties and functioning. These different classes of rules are the:

- ▶ Boundary rules
- ▶ Position rules
- ▶ Choice rules
- ▶ Aggregation rules
- ▶ Payoff rules
- ▶ Scope rules

Obviously, the labelling of these different types of rules is inspired by the work of Elinor Ostrom (2010). However, my interpretation of these labels differs somewhat. The classification is mainly based on Streeck and Schmitter's (1985) work on social order. First off all, *Boundary rules* determine who can participate on the collective-choice level. Within a state model, individuals need legal authorization from a government agency, whilst within a market model anyone with sufficient financial means can participate. Within a communitarian order, participation is bounded by inscriptive membership status. So it is predetermined by the individual's ethnicity, family structure or educational requirements. Finally within an associative order actors are strategically interdependent. This means that one organized group of actors can have a positive or negative effect on the satisfaction of the other (Streeck and Schmitter, 1985). Participation within the associative model is thus automatically determined by the actor's capacity to disrupt the decision-making process.

Second, *position rules* classify the dominant actor-types within a social policy regime. Within a state model, state-agencies and the civil servants working within them obviously are the dominant actors. Other actors can be regarded as policy subjects, like taxpayers, law abiders and conscripts. The market model is dominated by the dynamic interaction between consumers and entrepreneurs. Traditionally, families, clans and localities are the most important actors within a communitarian model. Although these relationships might still exist on a local or household level, their role within modern-day societies is limited. So when it comes to dealing with collective action problems on a sectoral scale, they have been replaced by professional associations, characterized by the norms of peer-equality and peer-group identification (Helderman, 2007, p. 111). Finally, an associative order is dominated by functionally defined interest associations, representing the interests of their members, e.g. firms, social groupings or producers.

Third, *choice rules* form the institutional border in which the pursuit of individual interest is confined. Within a state model these interests must be in line with state policy objectives. These objectives are formed by the political process on the one hand and by the private interests of bureaucratic agencies on the other. The market order is characterized by the virtual absence of choice rules. All individuals are free to pursue their own self-interest without limits. Individuals within a communitarian order are guided by a framework of shared norms and values and, finally, within an associative order, individual interest is confined by aggregated organizational interest, which is the result of inter-organizational negotiation and compromising.

Fourth, in addition to choice rules, *aggregation rules* shape how decisions concerning allocation are made. They basically determine how interests are pursued within a given order. Within a state model this process is characterized by authoritative formal adjudication and imperative certification. In market regimes consumer preferences determine how allocation of resources is organized. Allocation decisions within a communitarian order on the other hand are based on common consent and unanimous agreement. Finally, in an associative order decisions are made through *concurrent* consent and proportional adjustment.

Fifth, the *payoff rules* determine the main benefits actors within a given model receive. Payoff rules within a state model are set at external security and an equal treatment for all. The main benefits within a market model, however, come from material prosperity through an efficient allocation of resources. Members of a communitarian order strive for peer recognition and a common identity. Finally, the rewards of an associative order are a more symmetric distribution of benefits, greater predictability and stability of socio-economic outcomes. However, for these pay-offs to be realized, a final set of rules must be in place: scope rules.

The sixth and last set of rules, the *scope rules*, refers to the limitations on the effectiveness of each model. In other words: to what extent are the enabling conditions for solving CA-dilemmas present? Within a state order this depends on the legitimate control over the means of coercion. Without it state institutions are unable to effectively steer subject behaviour. Furthermore, if state agencies lack the administrative and legal expertise to set up a functioning legal framework, the regulation will most likely miss its target. The functioning of a market order is based on the assumption of economic entrepreneurship and the calculative rationality of individuals. So individuals conceive economic opportunities, evaluate them rationally and adjust their behaviour accordingly. As was already discussed earlier, a functioning communitarian order is based on trust,

reciprocity and reputation. Finally, the effectiveness of an associative order depends on the control each representative organization has over its member's behaviour. Furthermore, it is important all involved actors are sufficiently represented within the organization elite. In addition, the presence of inter-organizational trust is necessary to assure fruitful negotiations.

3.7 Conclusion

In this chapter I have discussed four types of social order which enable societies to deal with collective action dilemmas: the state, market, community and association. Ostrom (1990) basically saw the communitarian order as the most promising model for the creation of durable and sustainable common-pool resource-systems. On large scale however, individuals might risk getting trapped in so-called second-order dilemmas when supplying and maintaining the required institutions. I therefore presented the associative order, as developed by Streeck and Schmitter (1985), as a possible alternative. Private interest associations, under a shadow of state hierarchy, can overcome second-order collective action dilemmas and supply the necessary institutions, which in turn guarantee a socially optimal level of appropriation.

In the final part of this chapter I discussed the institutional rule-configuration that lies on the base of each model of social order. This approach cuts two ways: First, Streeck and Schmitter's models are dissected along their defining institutional rules, and second, Ostrom's individual rules are merged into a single configuration of social order. In the empirical part of my chapter I will use this classification, as depicted in table 1, to analyse the Dutch veterinary and human medical health care sectors. By doing so I hope to find out whether the dominant institutions that are present in each sector can explain the differences concerning the supply of self-regulatory institutions and use of antibiotics.

Table 1: The institutional rule-configurations of social order (Based on: Ostrom, 2007; Streeck & Schmitter, 1984)

Rules	State	Market	Community	Association
Boundary Rules	Legal authorization	Ability to pay	Member status	Capacity to mutual disruption
Position Rules	Bureaucratic agencies (civil servants Subjects (taxpayers, law abiders)	Entrepreneurs/ politicians Consumers/voters	Families, localities, professional communities	Functionally defined interest associations
Choice Rules	State policy objectives	Individual rational interests	Community norms and values	Aggregated organizational interests.
Aggregation Rules	Authoritative formal adjudication, imperative certification	Consumer/ majority preference	Common consent, unanimous agreement	Parity representation, proportional adjustment, concurrent consent
Payoff Rules	External security/ equitability and predictable treatment	Material prosperity/citizen accountability	Mutual affection, peer recognition	Symmetric distribution of benefits; greater predictability and stability of socio-economic outcomes
Scope/ Default Rules	Legitimate control over the means of coercion; administrative and & legal expertise	Economic entrepreneurship and calculative rationality	Trust, reciprocity & reputation	Control over member behaviour; inter-organizational trust.

4 Methodology

4.1 Introduction

As already mentioned, this chapter will function as a bridge between the theoretical and empirical part of my thesis. Up until now, most of my activities were aimed at acquiring theoretical answers to my research question. Now, these conceptual answers will be put to the test. Before doing so, however, I will first outline the technical research design of my thesis. In other words, I will present the choices I have made in terms of case selection, research strategy and data collection. Furthermore, the theoretical concepts will be operationalized. This will enable me to recognize them in practise.

4.2 Research Design & Case Selection

In the introductory chapter I already formulated the central research question of my thesis:

In what way has the institutional configuration within both the veterinary and human healthcare sectors affected their collective action capacity concerning the sustainable appropriation of antimicrobial agents?

In order to find an answer to this question I will have to analyse the institutional rule-configuration that lies at the base of each sector. An institutional rule-configuration can consist out of a combination of market, community, state and associative building blocks and affects the incentives and constraints faced by public and private actors in policy making and provision processes (Helderman, 2007, p. 38). Analysing institutional rule-configurations is no simple task. It requires a sound research design and a careful operationalization of the institutional building blocks

4.2.1 *A most similar design*

When analysing institutional structures you inevitably end up within a complex web of nested and adaptive systems (Ostrom & Basurto, 2011). A policy analyst has no control whatsoever on outcomes or behaviour within these systems. In order to do justice to the complexity of the research subject it is important to choose an appropriate research design. To empirically derive the institutional rule-configurations I conducted a controlled *comparative case study*.

George and Bennet (2005, p. 19) identify four strong advantages of case studies which make them useful for both hypothesis testing and theory development. First, case studies make it possible for a researcher to achieve a high level of conceptual validity. Theoretical concepts like institutional rule-configurations are often very difficult to measure. By carrying out a contextual comparison within a comparative case study, however, I am able to search for analytically equivalent phenomena across different contexts (George & Bennet, 2005, p. 19).

Second, a case study is a useful means to examine causal mechanisms. It allows a researcher to take into account a large number of possibly variables within a single case and helps to identify the conditions that activate the intervening variable. This heuristic identification of variables within a single case also leads to a third advantage of a case study: the formulation of new hypotheses through the discovery of new, not yet considered, variables demanding to be heard. Fourth, case studies are ideal strategies to accommodate complex causal relations. Although case studies might

allow for equifinality, they still enable a researcher to produce relatively narrow or more contingent generalizations (George & Bennet, 2005, p. 21).

The obvious cases that were selected are the antibiotics policies within both the Dutch veterinary and human health care sectors. Within human health care I will limited myself to primary care. There are several reasons behind this decision. First of all, the bulk van the antibiotics (over 85%) are prescribed within primary care (Baart & de Neeling, 2001, p. 786). Secondly, data on the extramural use of antibiotics is more readily available and finally, the institutions within Dutch primary medicine are more easily comparable with those in the veterinary sector.

Because veterinary antibiotics use lies at the heart of many public, political and academic discussions within the Netherlands (cf. chapter 2), it will form the central case of this thesis. It will be contrasted to the institutional context within human medicine. The Dutch primary care sector will therefore function as a so-called 'mirror' case, to which the institutional developments in animal agriculture can be compared and contrasted. This approach will enable me to pay an appropriate amount of attention to the institutional developments and changes within the animal agriculture during the last decades. Both cases are similar in many respects. First, the structures of both sectors in terms of representative organizations are largely the same. As was already roughly sketched in the introductory chapter, human health care professionals as well as veterinarians are represented through very similar organizations. Furthermore, both sectors are overlooked by governmental agencies and scientific institutes. Second, it is in the interest of all actors in both sectors to keep antimicrobial consumption on a sustainable level. At the same time, individual appropriators might have an incentive to behave opportunistically in his or hers day to day dealings with antibiotics. Furthermore, appropriation occurs by a relatively large group of individuals in both sectors. Also, this group of appropriators is dispersed over the same geographical region. Although, some appropriators within the human care are concentrated in hospitals, most of the antimicrobial prescriptions originate from the ambulant sector.

Off course, when looking in more detail on an operational level, numerous differences can be distinguished. In general, however, a comparison between the two cases can be made on a *most similar* basis. Not unimportantly, this comparison is given relevance through the fact that the cases vary with respect one crucial variable: the presence of effective self-regulatory mechanisms, i.e. its self-governing capacity. The external validity of this thesis would be increased a great deal by including more cases, e.g. by conducting an international comparison. Unfortunately, limitations on time and resources kept me from such an approach. The exploration of the institutional structure of just the two presented cases already presented me with a challenging and time-consuming task. An in-depth study, nevertheless, enables me to identify a both reliable and internally valid answer to my research question and promises to provide me with new theoretical and practical insights.

The comparative case study will be carried out in a hierarchical fashion. The research project will be divided into two stages. In the first stage the selected case will be examined as if they belong to a series of single case studies. In the second stage the results of these separate studies will then be compared in order to obtain a complete overall picture. Verschuren and Doorewaard (2010, p. 179) call this strategy the *hierarchic comparative case study*. It will be conducted in a qualitative manner, mainly based on non-numerical data and the opinions and beliefs of the

involved actors. The choice for this strategy enables me to study the sectors as an integrated whole and also lets me take into account the context in which it is embedded (Verschuren and Doorewaard, 2010, p. 179). In the following part I will focus on the methods which were used to collect this qualitative data.

4.3 Data collection methods

Within this thesis I used two main data sources: individual actors and relevant documents. These data sources were 'appropriated' through respectively a series of semi-structured interviews and intensive content analysis. In an ideal-typical qualitative case study these methods would be supplemented by observation data (Verschuren en Doorewaard, 2010). Unfortunately, because of limitations on time and resources this was not feasible. Furthermore, the analysis took place on the rather conceptual collective-choice level, which made it hard for me to determine relevant events for observation. Moreover, the decision-making process, which resulted in the current institutional configuration, took place in the past, which made the analysis of policy documents and interviews with involved actors a more promising endeavour. Through a process of triangulation, both within as between the two methods of data-collection, I tried to increase the internal validity and reliability of my findings.

4.3.1 *Content analysis*

A wide range of documents and reports on the prescription and consumption of antibiotics and the control of antimicrobial resistance within the Netherlands were subjected to content analysis. These documents took various forms: from formal government policy documents and advisory reports to scientific publications and newspaper articles. The organizations from which these documents originated can roughly be divided into three categories:

- Public organizations
- Representative organizations and interest groups
- Research and advisory institutions

The first group contains a rather broad range of publicly funded organizations. On one side of this spectrum, there are parliamentary and policy documents issued by the Dutch ministries of Health and Agriculture. On the other side are annual reports and other publications by what I defined in the previous chapter as private interest governments; publicly funded organizations consisting out of health care and agricultural professionals from both the human and veterinary sectors. The second group consists out of organizations that represent the collective interests of the various actors involved, e.g. farmers, veterinarians, general practitioners, pharmaceutical companies etc. I do not consider these organizations as private interest governments, because they only represent the interests of their members and have no focus towards the collective good. Furthermore, they are not funded by public means, hence state pressure remains absent. Third, advisory reports and scientific publications from several more or less independent research and advisory agencies will be used, e.g. from the Dutch Health Council and Central Veterinary Institute. Through a process of triangulation I tried to ensure the objectivity of the used data. Finally, relevant articles and interviews in Dutch national newspapers complete the list of used written material. A complete overview of the used rapports can be found in the appendix.

4.3.2 *Interviews*

The interviews were held in a semi-structured way. This means that there was no pre-set list of questions. Instead I used a topic-list to guide the interview and at the same time provide the respondent with enough opportunity to express his or hers beliefs. This way of interviewing enabled me to cover all the relevant topics and gave me the flexibility to dive deeper in certain issues that were brought up.

Most of the interviews were face-to-face. This enabled me to also interpret body language and made it easier for me to steer towards topics of special interest that might arise. The respondents can again be divided into several categories: specialist and opinion-leaders in the field of antimicrobial resistance, governmental policy officials and spokesman or board-members of representative/interest organizations. They were chosen on the basis of their formal involvement within the selected cases. During the process of data collection I hoped to create a sort of snowball effect, by asking respondents about who they saw as important figures within the field of antimicrobial resistance. This way I distilled a group of elite specialists, policy officials and opinion leaders. A list of these respondents can be found in the appendix. In general, the topics lists I used were tailored towards each individual respondent, but all were designed according to the operationalization that will follow in the final part of this chapter. A basic topic list is included in the appendix.

4.4 Operationalization

Next to a sound research design, a proper operationalization is needed to derive the institutional configurations behind the Dutch human medical and veterinary sectors. A start was already made in the previous chapter, in which I classified the different types of rules that together form the building blocks of an institutional order. Now I will further specify the empirical application of these rules. In addition, it is important to note that institutional rule-configurations cannot be regarded as static entities. In an ever changing world they too have to continuously adapt. In the second part of this section I will therefore pay special attention to the concept, Ostrom and Basurto (2011) refer to as; institutional evolution.

4.4.1 *Institutional rule-configurations*

In the theoretical part of my thesis I dissected state, community, market and associative models of social order along the rules that define their core properties and functioning. These rules also lay at the basis of the operationalization in this chapter. Each in their own way, they determine the workings of a collective-choice arena. This arena can be defined as the institutional environment in which appropriation decisions are made, monitored and enforced (McGinnis, 2011, p. 173; Ostrom, 2005). The rule-classification is presented in table 2, along with its guiding empirical questions. Based on my empirical findings, each rule within the analysed collective-choice arenas will be labelled State (S), Market (M), Community (C) or Associative (A), depending on to which type of social order they contribute. Theoretically an institutional configuration could comprise out of every combination of rules. In practise, however, many configurations would seem unlikely to be sustainable. For example, if individual interest is only formed through individual rational calculation, it would be impossible to make appropriation decisions on common consent (or it would mean that appropriation is automatically based on consumer preference). I will further specify the operationalization of rule-configurations along the four ideal types.

► *Ideal-typical State-configuration = (S1,S2,S3,S4,S5,S6)*

Who is allowed to participate in the decision-making is narrowly defined by formal state rules and legislation. The decisions-making actors are *explicitly* authorized by the state (S1). Furthermore, in a state configuration the collective-choice arena is dominated by state agencies. They are responsible for decision-making as well as for monitoring and enforcement (S2). In addition, the individual interest of actors within a collective-choice arena is confined by narrowly defined policy objectives, produced by state institutions (S3). The decision-making process is characterized by a hierarchical structure, with little *formal* space for negation and bargaining. Instead, decisions are formally adjudicated in an authoritarian fashion (S4). Finally, decision makers within the collective-choice arena hope to achieve an equitable and predictable treatment to all who are affected by their decisions (S5).

► *Ideal-typical Market-configuration= (M1,M2,M3,M4,M5)*

A collective-choice arena based on a market-configuration is somewhat paradoxical, since a market-configuration basically implies the complete absence of a collective-choice arena to begin with. Instead the collective-choice arena can be seen as an aggregated outcome of individual appropriation-decisions. Whether an actor *can* participate in decision-making, i.e. is able to influence the allocation of resources, depends entirely on his or her ability to pay (M1). Furthermore, the dominant positions within the collective-choice arena are taken by individual entrepreneurs and consumers competing within the market (M2). These individuals calculate their private interests in a rational manner and are allowed to pursue them unhindered. This situation is characterized by the virtual absence of rules or norms on appropriation (M3). The actual allocation of resources is then determined by consumer preferences and the rational calculation of entrepreneurs (M4). Through these processes the dominant actors try to achieve the highest possible level of individual and/or material prosperity (M5).

► *Ideal-typical Communitarian-configuration = (C1,C2,C3,C4,C5)*

Membership of a particular professional community is crucial for gaining access to the collective-choice arena. Furthermore, individual members within a professional community can become more influential by acquiring more esteem among their fellow members (C1). The dominant position within the decision-making process is filled by professional organizations. These organizations are formed by different types of professionals, who share a common set of norms on peer-equality and peer-group identification. Basically, they are a part of the physical manifestation of professional *communities* (C2). Individual interest is formed according to the norms, values and traditions within a professional community. So even if it is rational for an individual to behave opportunistically, existing norms and values will deter him or her from doing so. Even in absence of active monitoring and enforcement, norms and values guide the actions of both decision makers and appropriators (C3). In addition, decisions within the collective-choice arena are made on common consent and unanimous agreement. Although discussion on the practical implementation of decisions is encouraged, the underlying norms and values are never questioned and shared by every participant (C4).

Table 2: Rules within a collective-choice arena

Rules within a collective-choice arena.	
1. Boundary Rules	
<i>How is access to the policy process determined?</i>	
S1:	Legal authorization
M1:	Ability to pay
C1:	Member status
A1:	Capacity to mutual disruption
2. Position Rules	
<i>Which type of actors have a dominate position within the policy process?</i>	
S2:	State agencies
M2:	Entrepreneurs/consumers
C2:	Professional organizations
A2:	Functionally defined interest associations
3. Choice Rules	
<i>How is the perusal of individual interest confined/formed?</i>	
S3:	State formulated policy objectives
M3:	Rational individual calculation
C3:	Professional ethics and standards
A3:	Aggregated organizational interest
4. Aggregation Rules	
<i>How are decisions concerning allocation made?</i>	
S4:	Authoritative formal adjudication
M4:	Consumer preference
C4:	Common consent
A4:	Concurrent consent
5. Payoff Rules	
<i>What are the principal benefits that are expected by the decision makers?</i>	
S5:	External security and predictable treatment
M5:	Material/individual prosperity
C5:	Peer recognition/Professional development
A5:	Greater predictability of socio-economic outcomes

Individual members participating in the decision-making process expect two types of benefits. First, a collective pay-off in the form of professional development and, second, on a more individual level, they hope to acquire peer-recognition and the esteem of followers within the community (C5).

► *Ideal-typical Associative-configuration = (A1,A2,A3,A4,A5)*

The key towards acquiring access to the collective-choice arena is an actor's capacity for mutual disruption. This means that other stake holders cannot satisfy their own interests without including this actor in the decisions-making process (A1). As a result the decision-making process is dominated by a fixed set of functionally defined interest associations. These could be representing professional communities, but also sectoral or market interests (A2). Through a process of bargaining and negotiation an aggregated organizational interest will arise; a compromise that allocates the costs and benefits of the decisions in an equal manner. This organizational interest will guide and form the individual interests of the separate representative associations (A3). Streeck and Schmitter (1984, p. 127) describe the decision-making process in three steps: first the association start with parity representation, in the second stage differences are overcome by either 'package-dealing' or 'splitting the differences'. Finally, after this process of mutual adjustment, the final pact is ratified by concurrent consent (A4). The participants in the collective-choice arena hope to achieve a more symmetric distribution of benefits and stability of socio-economic outcomes (Streeck and Schmitter, 1984, p. 125) (A5).

4.4.2 *Default conditions for collective action*

Collective-choice arenas, dominated by whatever kind of institutional configuration, are by no means self-evidently effective in the supply of self-organizing mechanisms. Therefore, a sixth set of rules must be introduced which contributes to the effective functioning of each institutional configuration. They are the oil that prevents an engine from coming to a squeaking standstill. Basically these rules can be seen as the default conditions for social order, because without them each model would disintegrate.

A state model can only solve collective action problems if state agencies have legitimate control over the means of coercion. Furthermore, they must be able and willing to deploy these means when necessary. In addition, state agencies must have sufficient administrative expertise to ensure that state-action does not miss its target (S6). The effective functioning of a market model on the other hand depends on calculative rationality of individual economic agents. Efficient allocation is based on the presence of free competition and a functioning system of property rights (M6). Communitarian institutions function on the basis of Ostrom's core relationship: trust, reciprocity and reputation, as was already explained to a great extent in the previous chapters (C6). Finally, an associative order mainly depends on the presence of inter-organizational trust and the ability of representative organizations to control their member's behaviour (A6) (Streeck and Schmitter, 1984).

Table 3: The default conditions of social order

Default conditions of social order
<p>6. Scope Rules</p> <p><i>To what extent are the enabling conditions for each model of social order met?</i></p> <p>S6: Legitimate control over the means of coercion and administrative and legal expertise M6: Economic entrepreneurship & calculative rationality of individuals C6: Trust, reciprocity & reputation A6: Inter-organizational trust & Control over member behaviour</p>

The measurement of default conditions is based on the opinions of the involved stakeholders. The extent to which the concepts of state control and expertise are present in a collective-choice arena is determined through how stakeholders view the activities of state agencies. For example, does state regulation contribute to the reduction of inappropriate use of antibiotics? To what extent do appropriators comply with state regulation? And is the state able and willing to uphold its own regulation? Economic entrepreneurship and calculative rationality of individuals is measured by determining to what extent individuals are viewed to be free to compete within the antibiotics market (1) and whether there is a free flow of information between entrepreneurs and consumers (2). Third, the presence of trust, reciprocity and reputation is measured by opinions on the effectiveness of bench-marking activities and peer-monitoring and perceived compliance to professional guidelines. Finally, control over member behaviour is measured by stakeholder opinions on compliance to inter-organizational agreements and on the effectiveness of the monitoring and sanctioning capacities of the organized interest parties.

4.4.3 Institutional evolution

As I mentioned before, rule-configurations cannot be viewed as static systems. Ostrom and Basurto (2011, p. 325) compare the structures within rule-systems with the concepts of genotype and phenotype in biological systems. A genotypic structure can basically be seen as a set of instructions encoded within an organism's DNA that produce a certain phenotypic structure. This phenotypic structure in turn determines how an organism develops and functions in a particular environment. Similarly, rules are also a set of instructions that form the relationships between individuals. The functioning of these relationships in turn depends on the biophysical conditions and culture in which they are located. Consequently, just as a genotype must sometimes adapt in order to let an organism survive or flourish within a given environment, rule-configurations can also evolve.

Both institutional and biological evolutionary processes involve the three basic steps. First, the generation of new alternatives, followed by the selection of a combination of new and old structural attributes and third, the retention of the most successful combination in a given environment. Within biological processes, structures change either through blind or directed variation (e.g. within breeding programs). Similarly, mechanisms for change in rule-configurations can also be divided in unconscious and conscious processes. The former can be the result of gradual overtime changes in the environment, which for example cause community-ties to erode, enabling individual entrepreneurs to take over a dominant position. In other cases professional

communities might still be strong players, but certain norms and values might simply be forgotten, influencing the way they confine or form the perusal of individual interest. In addition, the inherent ambiguity of language can lead to unconscious changes in rules through misinterpretation by different actors over time. Finally, unconscious change can occur through a process of what Ostrom and Bosurto (2011, p. 326) call institutional epistasis. In this situation changes in one rule automatically invoke changes in other rules. This might, e.g. be the case when community norms gradually erode away; without these norms it will be hard to achieve common consent among individuals, forcing existing choice rules to adapt as well.

Self-conscious change can on the other hand occur by a process of imitation in which decision makers copy rules that have been proven successful in other fields. Rules can, however, also be changed by outside intervention. For example, when the IMF demands that a country must give up dominant state-positions in certain economic areas in exchange for financial aid or loans. Furthermore, rapid changes in biophysical conditions of a certain resource can usher in self-conscious changes. It might provide policy makers with an incentive to reform the rule-systems and organize them in line with the new conditions. Finally, self-conscious change can be the result of competition between two types of institutional arrangements.

Table 4: Institutional evolution (Source: Ostrom & Bosurto, 2011)

Labelling Institutional Change		
Institutional evolution	Unconscious	Gradual erosion of norms
		Epistasis
		Ambiguity of language
	Self-conscious	Rapid change of Biophysical environment
		Imitation
		Competition

Ostrom’s and Bosurto’s (2011) classification of institutional evolution, depicted in table 4, will help me interpret and analyse the possible overtime changes in that I might encounter in the empirical part of my thesis.

4.5 Conclusion

In this methodological chapter I have explained my choices concerning the case selection, research strategy and data collection. To find an answer to my research question I will conduct an in-depth comparative case study of two cases: the antibiotic policy within both the Dutch veterinary and human medical sectors. The former will serve as the central case, whilst the latter will be used as a so-called mirror-case. The data I used in my analysis was acquired through a mix of content analysis and qualitative interviews with key stake-holders.

In the second part of this chapter I presented the operationalization of the theoretical concepts in my thesis. I explained how I will recognize individual rules in practise and have shown how these rules together form the institutional configuration through which collective action is supposed to be achieved. In addition, I have argued that institutional rule-configurations cannot be perceived as static entities. Instead they must be seen as dynamic ever-changing systems. Ostrom and Bosurto's classification of institutional change will help me interpret these changes when encountered.

In the next chapter the empirical part of my thesis will start with an introduction of the first case: the Dutch primary health care sector.

5 Outpatient antibiotics use and policy in the Netherlands

5.1 Introduction

Health care in the Netherlands is organized through a rather complex set of interdependent institutions. Within my thesis I have decided to limit this case to extramural or primary medicine. There are several reasons behind this choice. First of all, over 85% of the total antibiotic prescriptions originate from this sector (Baart & de Neeling, 2001, p. 786). Furthermore, as was already discussed in the second chapter, data on antibiotics use in extramural care is more precise and readily available. Finally, and not unimportantly, the institutions within Dutch primary medicine are more easily comparable with those in the veterinary sector.

Within the Netherlands General Practitioners (GPs) are positioned at a critical junction of the health care system. Not only do they provide primary care to their patients, GPs also function as a gatekeeper to secondary care. Dutch patients, for example, can only consult a specialist if they have been referred by a GP. Consequently, GPs play an important role in keeping the entire Dutch health care system both workable and cost-effective. In addition, they perform a critical signalling function with respect to possible public health threats. Because they literally work with and among the general population, GPs are the first to notice certain uncommon trends in symptoms that could be related to for example viral or bacterial infections (J. van de Velden, personal communication, 2012).

The next section of this chapter will provide a brief overview of the principle actors within Dutch primary care and their relation to antibiotics use. In the third part I will then discuss the policy activities concerning the surveillance of resistance, the monitoring of consumption and the promotion of prudent use.

5.2 Actors and interests

The central actor on the supply side of the extramural provision of human antibiotics is of course the *GP*. If a patient has acquired a prescription the antibiotics can be physically bought at a *pharmacist*. A pharmacist, in turn receives his antibiotics from *pharmaceutical companies*. The central actors on the demand side are of course the *patients*. They consult GPs and want to receive care that lives up to their expectations. In addition, after the 2006 Dutch Health care reform discussed in box 1, *health care insurers* became a more dominant actor within the health care system. As an important purchaser of care, they have a large stake in both quality and cost-containment. Finally, several government institutions are involved in Dutch primary care.

5.2.1 *General Practitioners*

As was already mentioned; GPs play a crucial role within the Dutch Health care system. They provide general health care, but also act as gatekeepers and have a signalling function when it comes to possible public health risks. Every Dutch individual must register him or herself with a GP. The GP-density in the Netherlands, however, is quite low. In 2010 there was an average of one GP per 2.340 inhabitants, spread out relatively evenly across the country (Hingstman & Kenens, 2009). Furthermore, Dutch primary care is financed through a system of private health insurers and government regulators. GPs receive a standard capitation fee for every registered

patient, complemented by payments for individual consultations. In addition, they can receive extra funds for Modernization and Innovation (M&I) activities and so-called Practise Support (POH). The latter provides an additional standard fee for patients that, for example, have a specific chronic affliction like diabetes or suffer from mental illnesses (NZA, 2011, p. 17).

GPs are responsible for the vast majority of the antibiotic prescriptions. This is mainly because of the simple fact that the number of patients that pass through a GP's office is much larger than the average hospital population (A.J. de Neeling, personal communication, 2012). The various incentives a GP has to prescribe antibiotics at a suboptimal level were already mentioned in chapter 2. Above all, antibiotics are an important instrument to rule out infections an early stage. Especially within the Netherlands this could be a clear incentive to prescribe. Being a gatekeeper with the explicit responsibility to control costs by limiting specialist referrals, a GP might be inclined to turn to antibiotics as a means to rule out potential risks. This is even more the case when he or she lacks the tools necessary for a proper diagnosis. Furthermore, GPs could be pressured into prescribing antibiotics by patients. Within the Netherlands, however, this seems to play only a minor role. This can partly be explained by the general attitude of Dutch patients, which will be further discussed later on, but also because of the relative tin spread of GPs among the Dutch population. Already having 2340 registered patients, a Dutch GP has no real economic incentive to give in to patient expectations. Because of the abundance of patients, i.e. demand, competitive pressure is virtually absent in Dutch primary health care (A. Olde Loohuis, personal communication, 2012). The heavy work-load generally experienced by GPs, could, however, also present a positive incentive for antibiotic prescription. In order not to lose time through extensive discussions with patients, GPs might decide to simple write out a perception and get done with it (Verbrugh, 2003).

5.2.2 *Patients*

Patients clearly have a direct stake in receiving the best quality of care at the lowest costs. Their influence on the prescription of antibiotics cannot be underestimated. Lack of knowledge on for example the difference between viral and bacterial infections or on the problem of AR in general, forms their expectations regarding a GP's prescription. The fact that antibiotics usage in Belgium declined with 26% after a public information campaign in 2001-2002, underlines the importance of patient knowledge (Hulscher, van der Meer & Grol, 2010, p. 353). Furthermore, antibiotics can also have a clear symbolic meaning for the patient. It shows that their health troubles are taken seriously by the attending physician (Hulscher e.a, 2010, p. 353).

Based on an anthropological comparative case study between Belgium and the Netherlands, Deschepper (2002) points out that the expectations of a patient are also formed by their cultural background. Cultural factors explain how people label their ailments and which strategy they adopt to cope with them (Hulscher e.a, 2010, p. 354). According to Deschepper (2002), the Calvinist tradition within the Netherlands explains why, in general, the Dutch primarily visit their GP for medical advice, and not necessarily for acquiring medicine. In Catholic Belgium, on the other hand, patients more readily expect a medicine prescription. The role of the patient has nevertheless changed in recent decades. The introduction of new media through which individuals inform themselves as led to a new type of consumerism in the demand for care. Pressure from patients could force a GP to act on patient wishes and expectations, instead of on medical grounds (Raad voor de Volksgezondheid, 1998, p 6).

Box 2: Reforms in Dutch Health care

It is important to note that the implementation of antibiotic prescription guidelines has taken place within a context of extensive changes in the Dutch Health care system. Prior to 2006 Dutch health care was financed through a two-tier system in which persons with an income above a certain level were covered by a private system of health insurance and those below this level by a government run Health fund. The lack of patient/demand focus within this system led to lengthy waiting lists; moreover the increasing health care costs moved the Dutch government to look for reform possibilities.

In 2006 a new health care system was introduced. Within this new system private health insurers have a central role. Every Dutch citizen is obligated to purchase a basic health care package at a private health insurer. These Insurers in turn must offer reasonable prices and are not allowed to select their clientele on possible health risks. The government compensates low-income earners by offering a healthcare allowance in the form of monthly tax credits. In addition, health insurers are compensating for excessive health risks through the Health Insurance Fund (CVZ), which is funded by income-related payments. The Dutch are still free to purchase supplementary insurance for care that is not covered by the basic package, like dentistry or extra physiotherapy. Health insurers are, however, also free to select on risk when supplying this supplementary coverage.

The health care reform also had effects on the financing of primary care. Prior to 2006 GPs received a standard capitation fee per registered patient. This fee still exists in the new system, although substantially lower. This difference is compensated through additional payments for each individual consultation. Where the old system encouraged GPs to limit consultations to some extent, the new systems adds an incentive to reverse this effect.

(Source: Daley, Gubb & Clarke, 2011)

5.2.3 *Pharmacists*

Community-pharmacists are responsible for selling antibiotics to patients which have acquired a GP's prescription. Given their professional background, pharmacists deliver a crucial contribution to the prudent use of antibiotics. Their knowledge on the effects of specific antibiotics, make them an important advisor of both patients as well as other health care professionals. With regard to the patient, they provide information on how to properly use their medication: e.g. how often, how many and for how long. On the other hand they also advise GPs, on which antibiotic would be most suitable to treat which infection (Zichtbare Zorg, 2009).

Besides being an advisor, pharmacists also have an economic incentive to sell antibiotics. This is mitigated somewhat by the heavily regulated structure of the Dutch pharmaceutical market (Raad voor de Volksgezondheid & Zorg [RVZ], 1998, p. 19). First off all, prices are determined by a government agency: The Dutch Healthcare Authority (NZA). Furthermore, the majority of antibiotics prescribed in Dutch primary health care are generic. Consequently, their profit margins are relatively low.

5.2.4 *The Pharmaceutical industry*

As the developers of antibiotics, pharmaceutical companies naturally have an important stake in their consumption. A wide variety of both national and international pharmaceutical companies is active on the Dutch market. Obviously, the Pharmaceutical Industry has an economic incentive to sell as much of their products as possible. On the other hand, they also have a societal responsibility to supply effective medicine to the right patients (Verbrugh, 2003).

It is hard to measure the exact influence of the pharmaceutical industry. They basically operate on three levels (Deschepper, 2002, p. 33). On a macro level, advocacy organizations try to influence or counter national or EU-legislation that can have negative effects on pharmaceutical sales. On a meso-level, advertisements, sponsorship of conferences and other academic activities are tools that can be deployed to influence the professional community and/or the general public. Finally on a micro-level, individual health care professionals are approached by industry sales representatives. They provide GPs with information on innovations within pharmaceutical products (Deschepper, 2002, p. 33). These activities on both a meso- and micro-level are, however, also used to provide information and guidance with regard to prudent and effective use. Pharmaceutical companies, therefore, also contribute to the appropriate use of antibiotics. However, the difference between advertising and informing is often hard to notice.

Industry influence on both the meso- and micro-level is limited through government legislation and communitarian codes of conduct. The Dutch Medicine act (*geneesmiddelenwet*) prohibits all advertising of prescription-based medicine to the general public. It is not forbidden, however, for pharmaceutical companies to promote their products among health care professionals. To offset this, the professional community and industry have agreed on a set of behavioural standards. These codes of conducts must guarantee a responsible interaction between health care professionals and pharmaceutical companies (Deschepper, 2002, p. 34). They include rules concerning advertisement and sponsoring activities, as well as requirements on their academic foundation. More importantly, on a macro-level the pharmaceutical industry has lost a great deal of its interest in the mass promotion of antibiotics. Because most antibiotics used in human medicine are generic and are only prescribed for relatively short periods, the margins are relatively low (J. Kluytmans, personal communication, 2012).

Although, this seems to be a positive development in terms of limiting usage and health care costs, it also provides pharmaceutical companies with a disincentive, deterring them from investing in innovative new types of antibiotics. Slow innovation, will leave the public dependant on existing antibiotics, in which case prudent use will only postpone the inevitable (Mossielos, 2010).

5.2.5 *Health care insurers*

Since the health care reform of 2006, health care insurers, being the main sponsor, have become an important player in Dutch primary care. In general health care insurers have two main incentives: the highest possible quality of care (1) in combination with the lowest possible costs (2). Their direct interest in the reduction of antibiotics is relatively limited. Again the generic status of most antibiotics in primary care ensures that their prescription has only limited consequences for the total costs. Indirectly, however, antibiotic prescription of individual GPs is

used as one of the indicators for the quality of the provided care (A. Olde Loohuis, personal communication, 2012).

5.2.6 *State actors and regulation*

The production, prescription and supply of medical drugs within the Netherlands is governed by the Medicines Act (GW). In addition, provided health care must be in line with several laws like the Kwaliteitswet Zorginstellingen (KWZ) and de Wet Beroepen in de Individuele Gezondheidszorg (BIG). Both laws function to assure the quality of health care institutions and the individuals working within them (Homepage IGZ, 2012). The practical implementation of these laws is however based on norms, standards and ethics produced by the professional community itself (Zichtbare Zorg, 2009 p. 7).

As a consequence, the role of state agencies within the use of registered antibiotics is fairly limited. The Ministry of Health, Welfare and Sports (VWS) is responsible for the quality, safety and efficiency within the health care system. However, the supply and implementation of norms that serve to achieve these objectives, is delegated to the professional community itself. Instead, the Ministry takes on the role of facilitator, providing the communities with the means for effective evidence-based decision-making (J.M.E. van de Kamp & E.J. de Boer, personal communication, 2012).

Another important government actor is the Health care Inspectorate (IGZ). The IGZ 'promotes public health through effective enforcement of the quality of health services, prevention measures and medical products.' (Homepage IGZ, 2012). Through continuous investigations the IGZ determines whether the various institutions in the Dutch health care sector live up to their own norms and standards. If misconduct is identified the Inspectorate has various enforcement measures at his disposal, ranging from enhanced supervision to administrative penalties and disciplinary proceedings. These measures must, however, be seen as last-resort options, for generally the IGZ strives to change behaviour through advice and encouragement (M.F.M. Langelaar, personal communication, 2012).

Up until recently, the IGZ was not specifically involved in the monitoring of antibiotics usage. In light of national and international discussions on rising resistance rates and inappropriate use, the IGZ has, however, decided to launch a large theme based monitoring programme to gather insight in the development of resistance, hygiene protocols and the prescription of antibiotics. The programme will first focus on intramural care, but will eventually also address primary health care. The indicators that will be used within the programme will again be based on professional standards regarding the use of antibiotics (M.F.M. Langelaar, personal communication, 2012). The IGZ therefore has an important role in monitoring and enhancing compliance to guidelines.

5.3 Antibiotic policy

Antibiotic policy within Dutch primary care can roughly be divided into three essential pillars: Monitoring and surveillance of both use and resistance (1); The supply of evidence-based professional guidelines and standards (2); and finally the implementation of these guidelines (3). In this section I will briefly discuss Dutch activities within each of these three pillars.

5.3.1 *Surveillance*

The Dutch have been actively gathering information on both use and resistance for decades. The principle organizations involved in these activities are the Dutch Foundation of the Working Party on Antibiotic policy (SWAB) and the Center for Infectious disease control (CIb) of the RIVM, the National Institute for Public Health and the Environment. The former was founded in 1996 as an initiative of the Society of Infectious Diseases and the professional societies of medical microbiologists and hospital pharmacists (Homepage SWAB, 2010). SWAB is mainly funded by the Dutch Ministry of VWS and consists of a wide range of experts and professionals within the field of medicine and microbiology. The latter organization, the RIVM, functions as an advisor to the Dutch government on a broad range of matters regarding public health. Within the CIb special attention is paid to infection disease control and the containment of antimicrobial resistance. Together these two organizations maintain various surveillance systems of resistance to antimicrobial agents (A.W. van de Giessen, personal communication, 2012).

In addition, the SWAB also monitors antibiotics *use* in both intra- and extramural care. Through cooperation with the Foundation for Pharmaceutical Statistics (SFK), a rather comprehensive picture on the use of extramural antibiotics is available. The SFK directly gathers information about the drugs supplied, the dispensing pharmacy, the health insurance company that does or does not reimburse the remedy, the prescribing doctor and the patient for whom the prescription is issued. This information is gathered directly from Dutch pharmacies and is published anonymously (Homepage SFK, 2012). This way, individual GPs can compare their own prescription behaviour with national figures (Westerhuis & Eimers, 2009, p. 109). Strangely enough such a central and comprehensive database is not available in intramural care. Although the SWAB monitors intramural usage on a structural basis, this can only be viewed as a general assessment by requesting prescription data from Dutch hospital pharmacies. There are no real automated monitoring activities or central databases available for hospital use (A.J. de Neeling, personal communication). Data on both resistance and usage are published annually within the so-called Nethmap-rapports.

5.3.2 *Supply of guidelines*

Various organizations within the Netherlands are involved in the provision of professional guidelines concerning the prudent prescription of antibiotics. The dominant actor within extramural care is, however, the Dutch Society of General Practitioners (NHG) (RGO, 2000, p. 33). Although this association cooperates closely with the SWAB, it sends out its own guidelines concerning the use of antibiotics in GP practices. Guidelines come in different forms. Some only indicate which type of antibiotic is best suited to deal with which type of infection, while others provide holistic treatment protocols, including recommendations on diagnosis, treatment and follow-up procedures (Deschepper, 2002, p. 35). Importantly, guidelines also provide information on which antibiotics may only be used as a last resort. Guidelines are developed within case-specific working parties, composed out of academic researchers, medical specialists, pharmacists as well as GPs. Continuous re-evaluation, based on international academic literature, ensures the supply of up-to-date evidence-based professional standards (NHG, 2010).

5.3.3 *Implementation*

The simple supply of guidelines does not guarantee their effectiveness. Only by proper implementation can professional guidelines encourage a more rational use of antibiotics. Research

shows that guidelines are generally upheld by general practitioners, but that deviation, without clear medical foundation, still occurs on a frequent basis. In practice, guidelines are used as a reference point and provide a means for self-reflection. This way, GPs become aware of the possible consequences of prescription and can adjust their behaviour accordingly (A. Olde Loohuis, personal communication). Compliance to guidelines is further encouraged through a set of communitarian initiatives. Next to general promotion by the NHG, the institutionalization of the regional cooperation between GPs, pharmacists and other primary health care providers within so-called Pharma-Therapeutic Consultations (FTO) greatly encourages the implementation of guidelines. Within these consultations between local health-care professionals, NHG-standards and the possibilities for their practical implementation are discussed (Zichtbare Zorg, 2009, p. 13; LHV, 2011). Over 90% of Dutch GPs are involved in FTOs (Deschepper, 2002, p. 36). Furthermore, the need for transparency concerning the quality of primary care has also led to a wave of accreditation initiatives within the sector. Within the NHG-accreditation program, for example, certified GP practices must meet a broad range of medical as well as organizational quality standards, developed by the NHG in cooperation with the representative organizations of patients, health insurers and the Health Care Inspectorate. The main advantages of accreditation are an improved reputation, increased trust among patients and the possibility for bench-marking (NPA, 2011). Participation, however, remains voluntary.

Due to the fundamental changes within the Dutch health care system, discussed earlier, a new actor has taken on a special interest in compliance to NHG-guidelines: private health insurers. The proper use of antibiotics and the adherence to professional standards in general, is used by Dutch health insurers as an indicator for the quality of primary health care provision (van Doorn, Bouma & Braspenning, 2009). They use information on prescription behaviour to both assess the quality of the health care they purchase, as well as an extra form of service towards their clients. Furthermore, health care insurers actively promote GP-participation in accreditation programs, by covering the costs through M&I-funds (NPA, 2011). GPs are therefore provided with an economic incentive to participate in accreditation-programs.

5.4 In summary: Professional self-governance in primary Care

Various actors are present within the Dutch primary care environment. All interests are, however, centred on a single purpose: the provision of the highest quality of care at the lowest possible costs. General Practitioners within the Netherlands, however, have several incentives to prescribe antibiotics on an inappropriate level, varying from patient pressure to erroneous diagnoses. In order to ensure the appropriate use of antibiotics, professional associations like the SWAB and the NHG supply and promote guidelines and professional standards. These community norms are also upheld by government agencies and market actors, like private health insurers. The practical implementation of guidelines is discussed on a local level in regional FTOs. In addition, compliance is monitored through voluntary certification programmes, but also by the National Health Inspectorate and individual health insurers. The Dutch government mainly acts as a facilitator within antibiotic policy, entrusting both formulation and implementation of norms and standards to the professional community.

It remains important to note that the success of these professional self-organization efforts remains a relative one. Overall antibiotic consumption has traditionally been low in comparison

with neighbouring countries. This does, however, not mean that professional standards and guidelines are necessarily followed to the letter. Several academic publications note that on an individual level improvement is still possible (Westerhuis & Eimers, 2009; Hulscher, van der Meer, Grol, 2010, p. 352; Welschen, Kuyvenhoven, Hoes & Verheij, 2005). General Practitioners, e.g. often still prescribe on the wrong indication or do not choose the right drug of first choice. This differs greatly between various infections as well as between individual GP practices (Hulscher, van der Meer, Grol, 2010, p. 352). So although the bulk of the antibiotic prescription is low, steps might still be necessary to improve the appropriate use of antibiotics (M.F.M. Langelaar, personal communication, 2012).

6 The Dutch veterinary sector and antibiotic policy

6.1 Introduction

The Dutch animal husbandry sector is positioned in the midst of a broad range of actors which together form the Dutch agro-food industry. Although the Netherlands are a relatively small country, its agro-food sector is one of the largest of the world and annually generates € 29.1 billion in added value (Topsector Agro & food, 2011, p. 23). The Netherlands is one of the biggest agro-foods exporters in the world, second only to the United States. In addition, the Dutch are also important exporters of the innovative technology and production methods needed for the efficient and sustainable production of food. It is therefore evident that the agro-food industry is considered as not only an important engine behind the Dutch economy, but also a showcase to the rest of the world.

Next to the strategic importance of the animal food-production sector as a primary supplier food, there are therefore also international economic interests involved. In the second half of the twentieth century livestock farming has become more and more globalized. Dutch farmers continually try to keep up with foreign competition. They mainly accomplish this by relying on economies of scale (B. Hutten, personal communication, 2012). As a result the Dutch animal agricultural sector is characterized by an ever declining, but individually expanding, number of farms. Small farmers are simply not able to cover their costs with the ever shrinking margins, and are eventually either forced to grow or leave the market. In addition to economic interests, this increase in scale has introduced several societal interests within the Dutch animal food-production. First, there is the issue of public health. Over the years the general public has been alarmed by the possibility of animal diseases spreading to humans. For example, Bovine spongiform encephalopathy (BSE), Avian Influenza and more recently Queensland fever (Q-koorts). Next to these public health issues, the increased intensity of animal husbandry has raised questions on animal health and wellbeing, food safety and the environment, e.g. CO₂-emission and the physical appearance of the Dutch countryside (Beemer, van Velzen, van den Berg, Zunderdorp, Lambrechts, de Gler & Oud, 2010, p. 9-10; Commissie van Doorn, 2011).

It is within this framework of economic and societal interests that my institutional analysis of the Dutch animal food-production sector starts. In the next section of this chapter I will introduce the various actors that are present in the Dutch animal food-production sector and explain their interests concerning the use of antibiotics. As was already mentioned in previous chapters the use of antibiotics has been at the centre of many discussions within the Dutch veterinary sector. Especially the discovery of animal-related MRSA in 2006 and later ESBL in 2009 has been a real turning point in this respect. In recent years several steps have been made towards reducing usage to a sustainable level. These changes will be addressed in the third part of this chapter. It will outline the evolution of veterinary antibiotic policy over the last decades.

6.2 Actors and interests

Figure 8 depicts a graphical representation of the antibiotics supply within the Dutch meat, dairy and egg production chain. It contains the principle actors that are present in the sector as well as the flows of meat, animal feed and Veterinary Medical Products (VMP), including antibiotics. At the centre of the sector are the livestock farmers who receive antibiotics from their veterinarians and

animal feed from feed suppliers. These two actors are labelled with the Dutch-term *erfbetreders* which refers to their physical presence on farms. Livestock farmers supply livestock to slaughterhouses or dairy-processors which process the meat/milk and make it ready for the consumer market. Consumers ultimately acquire meat and/or dairy products either directly from retailers or via a short detour past wholesalers and restaurants. Obviously, this representation gives only a crude reflection of reality, but it enables me to identify the main stakeholders with respect comes to the use of antibiotics.

6.2.1 *The Livestock farmer*

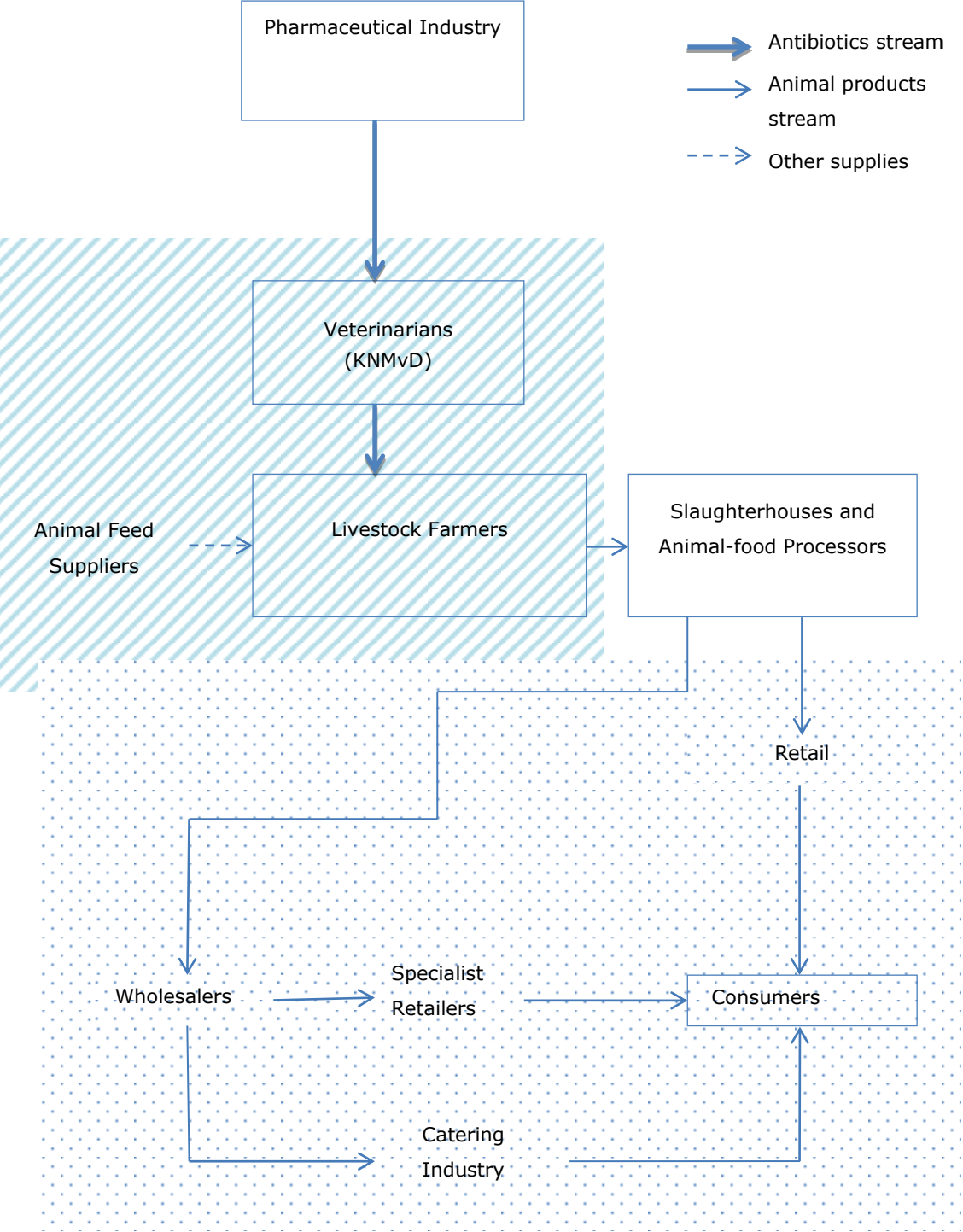
Livestock farmers play a central role within the animal food-production sector. It is important to note, however, that this is no uniform group of individuals. They can be subdivided along various animal sectors. Most livestock farmers in the Netherlands are involved in cattle/milk production, pig production, poultry production and/or veal calf production. Although antibiotics usage differs greatly between these various sectors due to biophysical conditions³, the main incentives pro and contra the use of antibiotics are basically the same.

First of all, livestock farmers have a strong economic incentive for using antibiotics. Due to international market pressure Dutch farmers are forced to look for the most cost-effective means of production possible. Virtually all persons interviewed confirm that antibiotics are perceived as such a means. Not only do they rid animals from infections almost overnight, they also have positive effects on animal growth and are relatively cheap to acquire (Beemer et al, 2010, p. 20). Other management tools that also reduce the chance of infection among farm animals, like the improvement housing facilities, better quality feed and drinking water, the introduction of vaccination programmes and minimizing the mixing of animals with different origins, are often much more expensive and require large investments (D.J. Mevius, personal communication, 2012). Many farmers, who are struggling to survive within a competitive market, are not able to make such investments and are forced to fall back on the use of antibiotics. Several respondents therefore referred to antibiotics as an effective way to cover up failing management (B. Hutten; J. van de Sande; D.J. Mevius, personal communication, 2012).

In addition, it is important to note that from the perspective of the individual farmer it is much easier to perceive the positive growth and health effects of antibiotics use, than then it is to see the negative resistance externality it produces for society. Several respondents, however, also mentioned a change in attitude towards antibiotics. As one respondent formulated this: *'People were simply not aware of the risk of antibiotics use, just as they provided their animals with water and feed, they also administered antibiotics... In recent years, however, awareness among live-stock farmers is practically a hundred percent.'* (A. van Hoof, personal communication, 2012). The public discussion on the emergence of antimicrobial resistance has raised awareness among livestock farmers. After they, together with their families and employees, were labelled as a possible risk group by hospital authorities due to their exposure to MRSA, the risks of inappropriate antibiotics use became visible on a rather personal level (B. Hutten, personal

³ Preventive use of antibiotics in poultry production is common because it is hard to single out an individual sick chicken within the entire population. Furthermore, as is also the case in for example veal production, antibiotics are essential in supplementing the immune system of young, but fast growing, animals.

Figure 8: Schematic overview of the principle actors within the Dutch animal-food production chain (Adapted from: Beemer et al, 2010, p. 18)



communication, 2012). In a way it was an important *'eye-opener'* for many farmers, *'...changing their mind-set towards antibiotic consumption.'* (B.G.M. Eussen, personal communication, 2012). These developments, in combination with the more widespread discussion on animal welfare and sustainable animal food-production, forced farmers to consider alternatives to the use of antibiotics (D.J. Mevius, personal communication, 2012).

6.2.2 Veterinarians

Another group of professionals that are at the heart of the antibiotics discussion are the veterinarians. Farmers are only able to acquire antibiotics through a licensed veterinarian, which means this group effectively functions as gatekeepers within the veterinary antibiotics stream (NVWA, 2011, p. 4). Veterinarians also take on two other roles. On the one hand they are medical professionals trained to assure animal welfare, public health and environmental issues and on the other, veterinarians operate as entrepreneurs in a competitive environment, selling their services to their clientele. Both roles provide incentives to prescribe antibiotics.

Often antibiotics are an essential tool to guarantee animal health and wellbeing. Just like in human medicine, veterinarians might be inclined to use antibiotics to rule out infection without first making a proper, but (time-) expensive, diagnosis. There is a great deal of tension between appropriate use and qualitatively good veterinary care. Sometimes, from the viewpoint of animal health, a veterinarian simply does not have a choice but to prescribe antibiotics. Furthermore, the norms on what exactly is *'appropriate use'* are not always clear. Preventive use, for example, *'...might not be appropriate, since you are treating an infection that might not even be there, but it does prevent a lot of problems that are bound to come'* (D. Speksnijder, personal communication, 2012). Apart for a veterinarian's own professional considerations, he is often also dependent on the actions of his clientele. If a farmer, for example, refuses or is not able to implement certain management tools, this might cause his livestock to get sick over and over again. Just to ensure animal health, a veterinarian is then forced to prescribe antibiotics relatively often as well. (Beemer, Zunderdorp, Wesselink, van der Rijken, Oud, Krauss, Schoneveld & Blaay, 2011, p. 32). Furthermore, he can be confronted with a situation in which the individual treatment of animals is simply not practically feasible, e.g. in poultry farming. So were prescription might be inappropriate when looking at the possible risk of resistance, it can at the same time be appropriate in terms of animal health and welfare.

Next to these so-called health incentives, veterinarians as entrepreneurs also have an economic incentive to prescribe antibiotics. Unlike their colleagues in human medicine, they also act as pharmacists, being able to sell antibiotics themselves. It is estimated that veterinary practises generates 30% to 70% of their income through the sales of medicine, including antibiotics (Beemer et al, 2010). They therefore possess an incentive to sell antibiotics. In addition, due to increases in scale and the declining number of livestock farmers in the Netherlands, Dutch veterinarians have fewer clients. This weakens the position of veterinarians and makes them more dependent on their remaining clientele. Within this competitive environment veterinarians are therefore more susceptible to their demand. For the farmer on the other hand, it is easy to go shopping for antibiotics, trying to find those veterinarians how are willing to prescribe and sell at the lowest price (D.J. Mevius, personal communication, 2012).

Of course these economic incentives in favour of antibiotics use are also offset by professional codes of conduct and a growing awareness on the risk of inappropriate use. Within the education of veterinarians, limited use of antibiotics is emphasized (D. Speksnijder, personal communication, 2012). Furthermore, awareness on the societal consequences is believed to be increasing, making them more inclined to limit their prescription (Beemer et al, 2010, p. 20). The fact remains, however, that veterinarians are trapped in a web of economic considerations. Apart from the fact that they actually receive a part of their income out of selling medicine, antibiotics are also a cost-effective means of production for their clientele. In addition, veterinarians have to deal with pharmaceutical companies who are trying to promote their own products (Beemer et al, 2011).

6.2.3 *Pharmaceutical industry*

One respondent referred to the pharmaceutical industry as *'the most transparent actor in the field'* (J. Kluytmans, personal communication, 2012). Unlike most others they are much less thorn between economic and societal interests. By definition the pharmaceutical industry benefits from the sale of large quantities of antibiotics. All antibiotics used in the veterinary sector are generics, originally developed for use in human medicine. Because of their generic status, margins on the sale of antibiotics are relatively low. In order to maintain a steady profit the pharmaceutical industry will want to sell antibiotics in bulk. As a consequence, reducing antibiotics use by cutting back on preventive therapeutic use will be bad for business. This can also explain why the pharmaceutical industry lobbied fanatically against the prohibition of antibiotics use as a means for growth promotion. Respondents active within human medicine also criticize the relatively close ties between the pharmaceutical companies and veterinarians. These close bounds give the pharmaceutical companies a direct opportunity to influence the prescription behaviour of their clients. By advertising in agricultural magazines they also exercised indirect influence by playing on farmer sentiment (Beemer et al, 2010, p.20).

However, according to their own spokesman it would be unwise for the pharmaceutical industry to ignore the professional and public discussions on the use of antibiotics. In the light of corporate responsibility, the industry also needs to maintain a certain reputation (B.G.M. Eussen, personal communication, 2012). The FIDIN therefore tries to spread awareness on the risks of inappropriate use among their clientele. Furthermore, through their representative organization, the FIDIN, the industry provides a transparent overview on the sales of antibiotics, published annually in the MARAN-rapports. Pharmaceutical companies are also trying to find new investment opportunities in the wake of the antibiotics discussion. They are very much aware of the fact that the use of antibiotics in large quantities within agriculture will eventually lead to a dead-end. Vaccine programs which substitute for the use of antibiotics might for example offer much higher margins for the industry on the long-run (B.G.M. Eussen, personal communication, 2012). Furthermore, pharmaceutical companies are also shifting their focus to non-medical products, like for example diagnosis tools or veterinary training programmes (J. Jansen, personal communication, 2012).

6.2.4 *Slaughterhouses and animal-food processors*

Being a link between livestock farmers and the consumer market, the food processing industry has a strong incentive to produce meat at the lowest possible price. Dutch meat and dairy processors operate on an international market and export a large part of their total production. Over the years large players have appeared within this industry. Companies like the VION-food group

(pigs), the VanDrie group (veal calves) and FrieslandCampina (dairy) dominate the domestic market. This has both positive as well as negative consequences for antibiotics use. First, these large corporations can basically set the prices that livestock farmers receive for their product. In light of international competition on the one hand and retailers demanding the cheapest products possible on the other, animal-food processors are obviously inclined to also offer a low price, forcing livestock farmers to increase the use of antibiotics for reasons mentioned above (Beemer et al, 2010, p. 21).

Other market incentives, however, let the animal-food processing industry aspire lower levels of antibiotics use. Their products must meet certain legal and quality standards. The presence of resistant bacteria in Dutch animal agricultural products causes significant reputational damage and negatively influences sales and export possibilities. Furthermore, firms like to advertise their corporate responsibility to the rest of the society. In light of the increasing discussion on the use of antibiotics, corporate responsible behaviour naturally dictates a pro-active stance towards the reduction of antibiotics use (S. Korver, personal communication, 2012). Because of their dominant market position, the animal-food processing industry is able to force and support farmers into using fewer antibiotics, e.g. by introducing or demanding quality standards. This can be seen as the strength of this part of the supply chain.

6.2.5 *Consumers*

Finally, consumers have an indirect interest in the use of antibiotics. Their preferences determine the demand for different types of meat throughout the supply chain. Preferences are shaped in different ways. First consumers would like to buy their products as cheaply as possible. Through retailers this would put pressure on the supply chain to produce at the lowest costs possible. If not, demand will shift to imports, and the domestic industry will be put out of business. Consumers, however, also have other interests, e.g. in terms of food safety, animal welfare and the environment. If these issues are guaranteed, they might be willing to pay a higher price for their meat, dairy products or eggs (J. van de Sande, personal communication, 2012). In other words, demand is directed towards products that are produced in a more sustainable way. In addition, consumers are also becoming more and more aware of the negative public health externalities of antibiotics use in agriculture. These worries can again be voiced through retailers. Pressure from retailers for example, was an important motivation for the veal calf sector to organize reduction efforts at a relatively early stage (H.W.A. Swinkels, personal communication, 2012).

When looking at the interests of the principle actors involved, it can be concluded that they all share a strong economic interest in the use of antibiotics. At the same time, however, some are concerned with their public reputation in light of the recent discussions on antibiotics use. This loss of reputation could in turn harm economic interests involved. Lastly, societal interests play a role. This type of interest can be subdivided into professional ethics (veterinarians), concerns on the sustainability of the supply chain (mainly animal-food processors and livestock farmers), animal welfare, environmental degradation and food safety (virtually every actor).

Before continuing to the various policy initiatives in Dutch animal agriculture, I will first pay attention to the formal legal framework concerning the use of antibiotics in the Netherlands and the main governmental actors involved.

6.2.6 *State actors and regulation*

The use of antibiotics within the Netherlands is regulated through three laws (NVWA, 2011, p. 7):

- The law on the practice of veterinary medicine 1990 (WUD);
- The Veterinary Medicines act;
- The law on animal health and welfare (GWWD).

The first law dictates who is eligible to practise veterinary medicine. It provides that licensed veterinarians are responsible for curing and preventing sickness among animals. In addition, it can be expected of them that they will perform this function adequately in all circumstances. Secondly, the Veterinary Medicines act regulates the production, packaging, registering, selling, stock piling and use of veterinary drugs, including antibiotics. Furthermore, it obligates both veterinarians as well as livestock farmers to keep an administration on the drugs they prescribe, buy and deploy. Finally, the GWWD provides livestock farmers with regulation concerning the health and welfare of their animals, including proper housing and timely veterinary consults (NVWA, 2011; Beemer et al, 2011).

Before 2012 compliance was monitored and enforced by the General Inspection Service (AID). On January the 1st 2012 this service merged with four other monitoring agencies into the Netherlands Food and Consumer Product Safety Authority (NVWA). If a violation is observed the NVWA can impose a fine on farmers and/or veterinarians. Furthermore, in case of the latter, the NVWA can file a complaint at the Veterinary Disciplinary Council (VTC). This council can address the prescription methods of veterinarians based on guidelines from the KNMvD. This is, however, not one of the main tasks of the VTC (Beemer et al, 2010, p. 32).

In practice it is hard for the NVWA to tackle inappropriate use of antibiotics. As long as veterinarians and farmers follow the legal requirements on perception, usage and registration all medicine sanctioned for veterinary use can be administered. Imposing norms on volumes could possibly hinder a veterinarian in his task to uphold animal health. Such a norm could therefore pose a risk for animal health and welfare. In addition, the NVWA only enforces the GWWD when livestock is seriously neglected. There is no clear relationship between animal neglect and the use of antibiotics. Overall, it can be stated that historically, the legal instruments that Dutch state agencies can use to control antibiotic consumption are limited (C.J.M. Bruschke, personal communication, 2012). It is important to note, however, that the Dutch government is currently in the process of expanding the NVWA's enforcement capabilities. These efforts will be discussed later on. I will, however, first turn to the trends in veterinary antibiotic policy in recent decades.

6.3 Changes within antibiotic policy

Now all actors and interests in the Dutch veterinary sector have been discussed, I will turn to the actual antibiotic policy within the Netherlands. The dynamic character of the policy process and the numerous actors involved, makes it difficult to go into too much detail, instead I will outline the main trends within veterinary antibiotic policy.

6.3.1 Preliminary initiatives

The discussion on the use of veterinary antibiotics in the Netherlands is not a new one. In the beginning of the 1990s awareness began to spread on risks for public health. For the first time scientific studies showed that use of certain antibiotics in poultry production resulted in the presence of resistant bacteria not only in chicken populations but also among humans. Although there was still no clear consensus on the risks, these events ushered in the first veterinary antibiotic policy initiatives in the Netherlands (D.J. Mevius, personal communication, 2012).

Early antibiotic policy was based on two defining pillars: Surveillance of both use and resistance (i) and the promotion of prudent use (ii). The former was mainly formed by a process that unravelled in scientific communities. Although several monitoring activities concerning the use of antibiotics were set up it took a relatively long time for a systematic surveillance programme to take form. Finally, from 2002 onwards the MARAN-reports annually provided an aggregate overview of the use of antimicrobial agents in animal husbandry and the development of resistance in bacteria of animal origin. The data within these reports, which were already mentioned in chapter 2, were acquired by combining antibiotics sales-data as provided by the FIDIN and a collation of several on-going resistance surveillance systems (B.G.M. Eussen, personal communication, 2012). The whole project was, and still is, financed by the Dutch Ministry of Agriculture (EL&I), and lay at the base of many European monitoring initiatives that followed. Despite the fact that the total amount of usage was being monitored, however, more exact monitoring on an individual level did not yet materialize. Currently, the Centre for Infectious Disease Control (CIb), part of the RIVM, has the lead on the surveillance of resistance in the veterinary sector. Although, the CIb has been working on monitoring AR for several decades, surveillance on veterinary transmission routes only started a few years ago. Since then a set of comprehensive research programmes has been set up to access the spread of veterinary AR and its risk for human health (A.W. van de Giessen, personal communication, 2012).

The second pillar, the promotion of prudent use, was entrusted to the professional association of Dutch veterinarians: KNMvD. In 1994 the KNMvD founded the Working party of Veterinary Antibiotic policy (WVAB), whose main purpose it was to supply guidelines on the restrictive and selective use of antibiotics. The guidelines were set up with the combined effort of animal specialists, pharmacists, microbiologists and practitioners. In the years that followed, however, it became clear that they had little or no effect on actual prescription. Since the introduction of the guidelines, sales figures showed that *therapeutic* antibiotics sales increased with 83% from 1997 to 2007 (Bondt, Puister, Bergevoet, 2009, p. 7).

Several reasons for the failure of this early initiative were mentioned by the respondents. First and foremost, the positive health and animal growth externalities dominated the mind-set of both veterinarians and live-stock framers. Not only were antibiotics a cost-effective means of production, it also gave farmers a way to cope with the on-going intensification process and its effects on animal welfare and the environment (B. Hutten, personal communication, 2012). By using antibiotics both farmers and veterinarians were presented with healthier animals which needed less feed to grow, hence forming a lower burden on the in environment⁴. In a time that

⁴ It is not a coincidence that antimicrobial growth promoters were also present as 'feed-saving' antibiotics (B. Hutten, personal communication, 2012).

the correlation between use and resistance was far from obvious, antibiotics did not only serve economic interest, but were also compatible with animal welfare and environmental issues. This mind-set, combined with the obvious economic interests mentioned earlier, made it hard for the WVAB to find support for and compliance to their guidelines. Secondly, state pressure slowly decreased over time, making the active promotion and enforcement of the guidelines by the various sector parties more and more voluntary (D.J. Mevius, personal communication, 2012). Although the WVAB continued to produce and adapt their guidelines, practical appropriation decisions by individual veterinarians hardly seemed to be influenced.

6.3.2 *Political pressure and associative consensus*

During the 2000s the public health risks related to antibiotics use in agriculture slowly got back on the political agenda. An important step was the prohibition of antimicrobial growth promoters within the European Union in 2006. Interestingly, there was no hard scientific evidence that substantiated the possible public health risks of AMGPs (B.G.M. Eussen, personal communication, 2012). Instead, decision-making was based on precautionary principles. In light of rising resistance rates in human care, it just did not seem right to use antibiotics as a means for growth promotion (D.J. Mevius, personal communication, 2012). The effect on total use, however, remained limited since the growth promoters were replaced by therapeutic antibiotics (cf. figure 2).

Still, the use of antibiotics in animal-agriculture remained on the political agenda. The main reason was the discovery of animal-related MRSA in 2006. According to prof. Dik Mevius, (personal communication, 2012), this made the consequences and risks affiliated with mass antibiotics use in agriculture tangible for the first time. Where early initiatives in the 1990s were mainly taken as a precaution for what *may* happen, this time around, veterinary antibiotics use really resulted in higher economic costs within human health care. It changed the impact of the problem. Increasing societal and political pressure forced the Ministry of Agriculture to take action. Again, however, it refrained from direct state intervention. Instead the Taskforce Antimicrobial Resistance was installed in late 2007. This Taskforce consisted out of a steer committee and four working parties each representing their own animal sector: cattle/milk production, pig production, poultry production and veal calf production. The working parties in turn consisted out of representatives from the Dutch Federation of Agriculture and Horticulture (LTO), the KNMvD and the various farmers unions within the Netherlands. In addition, the animal-food processing and animal feed industries were represented by their affiliated advocacy organizations (A. van Hoof, personal communication, 2012).

The combined efforts of these sector partners, led to the signing of a covenant agreement in late 2008. By signing the covenant all involved actors committed themselves to realize '*a more responsible and transparent use of antibiotics*' (A. van Hoof, personal communication 2012). The policy measures as were described in the covenant agreement were implemented in the years that followed. Efforts were focused on strengthening the ties between veterinarians and livestock farmers by introducing so-called farm-specific treatment plans concerning antibiotics. Within these plans, both veterinarians and farmers, agreed to deploy antibiotics-treatments only in accordance to the KNMvD guidelines. Furthermore, all prescription, supply and usage activities were to be registered in these treatment plans. With the appearance of ESBLs within the national antibiotics discussion, however, the efforts by the covenant-partners were not perceived to a sufficient. The

Ministry of Agriculture therefore decided to add a set of quantitative reduction objectives to the qualitative measures that were already agreed upon. The sector should realize a reduction of 20% in 2011 and a further reduction of 50% in 2013 relative to 2009 (C.J.M. Brusckke, personal communication, 2012). Although these objectives were clearly perceived as political, the covenant-partners decided to take these targets as leading for their own efforts.

6.3.3 *Self-organization under a shadow of hierarchy*

In order to achieve the qualitative and quantitative objectives, the covenant-partners for a large part relied on the institutional infrastructure that was already at hand. Since the 1990s the various animal husbandry sectors in the Netherlands were used to work with so-called Integrated Chain Management (IKB-) systems to ensure product quality throughout the supply chain. The different actors operating within these systems, e.g. livestock farmers, slaughterhouses and animal-food processors, commit themselves to uphold certain standards regarding animal health and welfare, stable management, hygiene, transportation, animal feed and the use of medicine. Certification and monitoring is carried out by independent private organizations. Since the signing of the first covenant-agreements, the various IKB-systems have been seen as a valuable means to combat inappropriate antibiotics use. Livestock farmers, operating in one of the various IKB-systems, are obligated to register their use of antibiotics in a central database. In practice this registration is done by the prescribing veterinarian, creating insight in both use and prescription behaviour (Ministry of EL&I/Ministry of VWS, 2011, p. 5).

Although coverage by the IKB-systems is large, participation remains voluntary. In order to overcome possible free riding problems the IKB-standards regarding antibiotics use have also been included in so-called Product Board regulation. Product Boards are public law organizations which represent the interests of an entire production column, from primary production to retailers. In the Netherlands, however, they also function as a co-legislator. Their regulation is binding to all individuals and firms within the production chain (Neelen & Rutgers, 2005). From 2011 onwards product board regulation makes it mandatory for Dutch livestock farmers to register their supply of antibiotics together with their unique farm number and the registration number of their veterinarian in a central database. Product board-regulation can therefore be seen as a '*fast substitute for conventional government legislation*' (S. Korver, personal communication, 2012).

In order to analyse and assess this data, a new and independent organization was called into being: Veterinary Drug Authority (SDa). The expert panel of the SDa, consisting out of leading microbiologists, an epidemiologist and a pharmacist, focuses on the creation of measurement and bench-marking tools and on determining appropriate levels of antibiotics use (D.J. Mevius, personal communication, 2012). By analysing data from the involved animal sectors, the SDa hopes to create insights in the geographical spread and trends in usage. Furthermore, the SDa has produced so-called target, signal and action values operationalized in daily defined dosages per animal year to evaluate the use of antibiotics on a specific farm (SDa, 2011). These values naturally differ per animal sector. The norms and critical values function as a tool for evaluating the supply of antibiotics. Most IKB-systems use these norms as guidelines for proper use. If a farmer structurally exceeds the action values, he risks losing his IKB-certification. In addition, those frequent users that are not operating within a IKB-system are reported to the NVWA by the product boards. This government law-enforcer can then include this information in its customary enforcement activities. Furthermore, it can publish the names of individual transgressors. In

addition, the Dutch government is currently in the process of expanding the NVWA's enforcement abilities. Veterinary antibiotics have e.g. obtained a so-called UDD-status. This means they must not only be prescribed, but also administered by a licenced veterinarian. Furthermore, new legislation will make it possible for the NVWA to enforce prudent antibiotics use, based on KNMvD-standards. The NVWA will thus follow the example of the National Health Inspectorate (Ministry of EL&I/Ministry of VWS, 2012, p. 6). Figure 9 provides a schematic overview of these self-organizational mechanisms.

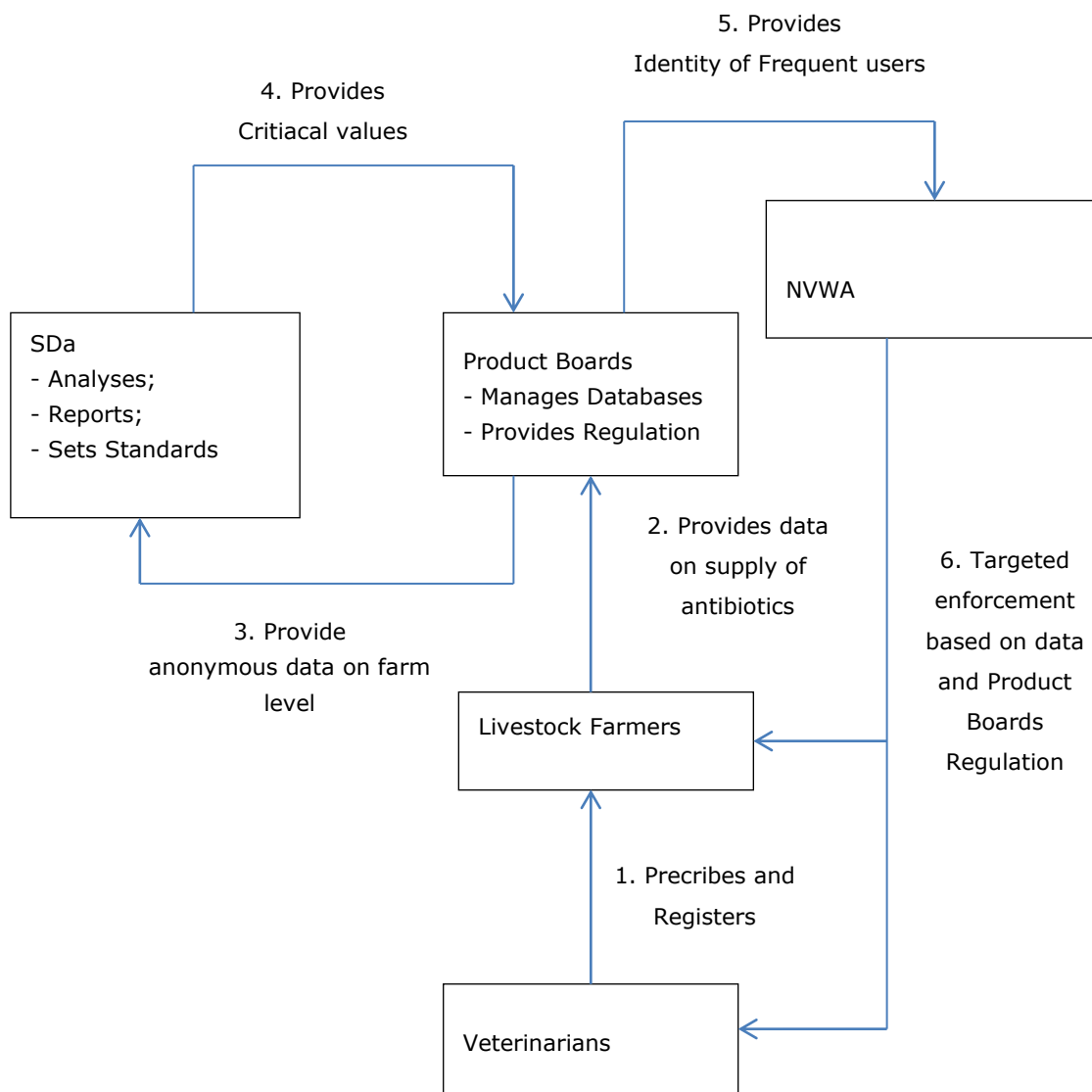


Figure 9: Self-organization within Veterinary antibiotic policy (Source: Ministry of EL&I/Ministry of VWS, 2011, p. 6)

6.3.4 Institutionalizing Professional Standards

The measures discussed so far, were mainly focused on livestock farmers. A distinct set of efforts are, however, also aimed at strengthening the professional position of veterinarians. First of all,

the farm-specific treatment plans demand an exclusive relation between a veterinarian and farmer. Although, it is still possible for a farmer to switch, he is only allowed to do business with one veterinarian at a time. Not only does this prevent 'shopping' behaviour of farmers, it also becomes possible to hold one veterinarian responsible for all antibiotic prescription on an individual farm (Ministry of EL&I/Ministry of VWS, 2011, p. 10-11).

Secondly, a self-organizing quality-system is being set up within the professional community. This has resulted in the emergence of the *geborgde dierenarts*, which roughly translates as a veterinarian from whom the quality is guaranteed. In the future, each animal sector will receive its own *geborgde dierenarts* which has to meet demands in terms of training and the use of professional standards. These veterinarians are again certified by private organizations and the exact requirements they must meet are determined by a college in which the KNMvD and the specific sector-partners take session (Homepage SGD, 2012). The *geborgde dierenarts* is already a prerequisite in some of the quality-systems in animal husbandry. Within the dairy sector for example, livestock farmers are only allowed to do business with certified veterinarians, so-called 'geborgde Rundveedierenartsen'. In addition, veterinarians from whom more than 10% of their clientele exceeds the action values of the SDa, risk losing their certification. Since this certification is a prerequisite for working within this animal sector, they are effectively excluded from the market (A. van Hoof, personal communication, 2012). Veterinarians are therefore given a direct economic incentive to uphold professional standards. Through this system of self-organization WVAB guidelines are effectively implemented in the various animal sectors.

On the supply side, the KNMvD and pharmaceutical industry have agreed on codes of conduct with regard to the promotion of medicine towards veterinarians and livestock farmers. Although, it is legally possible for the pharmaceutical industry to promote prescription medicine like antibiotics towards agricultural professionals, these self-imposed norms must control the economic relationship between pharmaceutical companies on the one side and veterinarians and livestock farmers on the other. Although they have a voluntary basis, individual pharmaceutical companies keep a close watch on each other's advertising activities (B.G.M. Eussen, personal communication, 2012).

6.4 In summary: A sectoral mixed method approach

A broad range of actors are involved in Dutch veterinary antibiotic policy. Most of the relationships between these actors are economic in nature. As one respondent put it: '*Agro food in the Netherlands is a free market activity, so eventually economic considerations will always be decisive...*' (R.J. Wessels, personal communication, 2012). Initially the costs of the AR-externality were simply not visible. From an economic perspective the structural use of antibiotics within agriculture therefore seemed the rational way to go. Recent antibiotic policy within the sector aims at building in barriers to unchecked usage. Since antibiotics are both economically and culturally embedded within Dutch livestock breeding, changing the behaviour of farmers and veterinarians is no simple task. A combination of policy measures are therefore implemented, including state regulation, the institutionalizing of professional norms and ethics, benchmarking activities and market pressure through possible exclusion from IKB-systems. This mixed method approach ultimately aims at '*resetting the mind-set*' of individual farmers and veterinarians concerning the use of antibiotics (R.J. Wessels & J. Jansen, personal communication, 2012).

The success of all these self-organizational efforts remains to be seen. The system still does not formally address some key-issues like the links between the pharmaceutical companies and veterinarians. Furthermore, veterinarians still have an economic incentive to prescribe antibiotics. Still, a change in the mind-set of most involved actors has been observed. Furthermore, the Dutch state does not seem to back down this time around. Continued political pressure forces government officials to keep monitoring and boost the self-organizational process in the sector. In addition, it is trying to expand the legal instruments available to the NVWA to enforce proper use (C.J.M. Bruschke, personal communication, 2012). Although important, the effectiveness of these self-organizational efforts is not the main concern within my thesis. Instead I will address the institutional evolution within Dutch veterinary antibiotic policy in light of the changes in the collective-choice arena. In other words, have changes in the institutional configuration affected the sector's capacity for self-organizing a sustainable appropriation of antibiotics?

7 Collective-choice within antibiotic policy

7.1 Introduction

Now that all actors and interests involved in both human and veterinary antibiotics use have been discussed, I will turn to the institutional rule-configurations through which the appropriation of antibiotics is determined, monitored and enforced. Each institutional configuration will be analysed based on the rule-classification that was already introduced and operationalized in the theoretical and methodological parts of my thesis. The collective-choice arenas in both human primary and veterinary agricultural care will be identified based on the types of boundary rules (7.2), position rules (7.3), choice rules (7.4) and payoff rules (7.5) present.

As was already mentioned in previous chapters, the use of antibiotics has been at the centre of many discussions within the Dutch veterinary sector. Especially the discovery of animal-related MRSA in 2006 and later ESBL in 2009 has been a real turning point in this respect. In recent years several steps have been made towards reducing usage to a sustainable level. In order to account for the dynamic nature of antibiotic policy within Dutch animal agriculture I will discuss the institutional rule-configuration both before and after 2006. Due to the discovery of animal-related MRSA and its possible transmission to humans, this year is seen by most involved actors as a turning point in the perception of the use of veterinary antibiotics in relation to AR (A.W. van der Giessen, personal communication, 2012). In the final part of this chapter I will discuss the consequences of my findings in relation to the collective action capacity of both sectors. In other words: To what extent do the institutional rule-configurations present in both sectors affect their capabilities for overcoming the antibiotics CPR-dilemma?

7.2 Boundary rules

These first set of rules determine how access to the decision-making arena is organized or limited.

7.2.1 *Human primary care*

Dutch law explicitly states that in human care only licensed physicians are authorized to prescribe antibiotics. Individual decision-making on an operational level is thus limited by formal state rules and legislation. On a collective-choice level, however, the state is much less involved. Although, state agencies facilitate a large part of the collective-choice arena, the actual decision-making on surveillance and the content of guidelines is informally delegated to the professional community (J.M.E. van der Kamp & E.J. de Boer, personal communication, 2012). Gaining access to the collective-choice arena therefore requires membership of a professional community. Guidelines from the NHG, for example, are prepared, created and evaluated by various health care professionals, from medical specialists, microbiologists to pharmacists (NHG, 2010). Access to decision-making is clearly granted to those with *membership status* of a professional community.

7.2.2 *Veterinary care*

Initially, collective-choice on the appropriation and allocation of antibiotics was virtually absent. Decisions within this respect were made by individual veterinarians. Veterinarians were legally sanctioned as the only set of actors that are allowed to prescribe antibiotics. In effect they were authorized by the Dutch state to make decisions on the prescription of antibiotics. In addition, these legal requirements are based on educational and professional requirements which

automatically classify an individual into a professional veterinarian community. Membership to a professional association, however, remains voluntary. The supply of antibiotics takes place within 'an open market structure' (Bremer et al, 2010, p. 22). Within this competitive environment, as was mentioned in the previous chapter, veterinarians are exposed to market forces. Boundaries were thus set through both *legal authorization* as well as the *ability to pay*.

When the various sector partners were pressured into taking action by the Dutch government, this led to the emergence of a new collective-choice arena concerning antibiotic policy. Access to this arena was open to all parties that were a part of the animal-food production chain. These actors were seen as stake holders within the field of antibiotics use. Furthermore, their participation was perceived as essential in the realization of a more transparent and responsible use of antibiotics. The members of all representing and/or professional organizations involved, were needed to achieve a more appropriate and transparent use of veterinary antibiotics (H.W.A. Swinkels, personal communication, 2012). The only stakeholder that was virtually left out of the collective-choice arena was the pharmaceutical industry.

Initially, decisions were made on an individual level, the collective-choice arena basically consisted out an aggregated whole of individual decision makers. Access to this arena was limited to those who were *legally authorized*. From 2007 onwards a new collective-choice arena was created. Although participants in this arena were given a mandate by the state, access to was not explicitly authorized. Instead participants were allowed to enter based on their *capacity to mutual disruption*.

Table 5: Boundary rules

Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Membership Status (C1)	Legal Authorization (S1) Ability to Pay (M1)	Capacity to Mutual Disruption (A1)

7.3 Position rules

Were boundary rules allow access; the positions rules determine whether or not actors can acquire a dominant position within the decision-making process.

7.3.1 Human primary care

A broad range of actors are involved in antibiotic policy. From state agencies like the Health Inspectorate and the RIVM to market actors like health insurers. These market and state organizations are, however, generally involved in monitoring activities. Appropriations decisions on when, how much and which type of antibiotic to choose are purely made by professional organizations. Within primary care this is the NHG. The primary goal of this college is to increase the 'Quality in Practice by the development of Evidence Based Practice Guidelines' (Homepage NHG, 2012). The majority of the 120 employees of the NHG combine their job with a post in General Practice (Homepage NHG, 2012). Furthermore, the NHG acquires most of its funds through its member base, which composes out of 95% of all the GPs in the Netherlands.

Within Dutch Health care in general, the promotion of appropriate antibiotics use is organized by professional associations. Within hospital care, for example, the SWAB has this function. Although, the Ministry of VWS remains responsible, it mainly operates as a facilitator. One respondent described the foundation of the SWAB as follows: *'Professionals play a central role within the Netherlands... These professionals, in this case medical microbiologists, clinical infectologists, and pharmacists, at a certain moment decided to organize themselves to monitor resistance and use on a structural basis. Furthermore, we try improving it by issuing guidelines and tests'*. (J. Kluytmans, personal communication, 2012). In addition to professional associations, the Health Inspectorate sporadically monitors antibiotic consumption in hospitals, ambulant and primary care. These inspections are again based on the professional guidelines of the NHG (M.F.M. Langelaar, personal communication, 2012). The same goes for health insurers, who also monitor antibiotics usage as a means to assess to what extent a GP lives up to the professional standards that are set out by the professional community at large (A. Olde Loohuis, personal communication, 2012).

Professional organizations also play a crucial role within monitoring and surveillance systems. For example: The organization responsible for gathering data on extramural medicine use, the SFK, has been called in to being primarily to promote and facilitate pharmaceutical services and the scientific practice of pharmacy. In addition, the SFK promotes the interests of community pharmacists in the Netherlands (Homepage SFK, 2012). *State agencies*, like the National Health Inspectorate, and *market actors*, like private health insurance companies, also play an important role in the monitoring and enforcement of prudent use. In the case of the IGZ, for example: *'The professional community provides the norms and we monitor if these are upheld...'* (M.F.M. Langelaar, personal communication, 2012).

Overall, professional organizations have a dominant role in decision-making. In term of monitoring and enforcement activities they are, however, complemented by state and market actors.

7.3.2 *Veterinary care*

Within the Dutch veterinary sector various actors are present. First of all, state agencies like the Ministry of Agriculture (EL&I) and the NVWA have the ability to respectively introduce and monitor/enforce regulation on the use of antibiotics. Secondly, with the right prescription, livestock farmers can buy antimicrobial agents on the market freely. Third, the KNMvD, through the WVAB, produces guidelines on the appropriate use of antibiotics. So which actor dominated the antibiotics decision-making process before 2006?

Starting off, it is evident that state agencies had little or no direct involvement in the formation of antibiotic policy. Although they facilitate monitoring activities and encouraged the KNMvD into producing guidelines, their position was far from dominant (D.J. Mevius, personal communication, 2012). In turn, the KNMvD was involved as a professional association, but their influence on prescription was limited (S.J. de Groot, personal communication). Although, the WVAB continued to produce guidelines and promote prudent use, there was no real consensus and sense of urgency within the rest of the organization, let alone among its members (A. van Hoof, personal communication, 2012). In practice, usage of antibiotics was determined by market forces. In this hardly regulated antibiotics market, livestock farmers provided the demand and veterinarians the supply. Competition within the veterinary market is strong (Beemer et al, 2011, p. 22). Because of the continuing intensification process in Dutch agriculture, the clientele of veterinarians is shrinking. As was mentioned before, this environment encourages veterinarians to satisfy the

demand for antibiotics to the best of their abilities. 'A veterinarian must serve his clientele. He never received any backing from others...' (B.G.M. Eussen, personal communication 2012). Their role as entrepreneur simply became dominant. Together, these *consumers and entrepreneurs* basically dominated the collective-choice arena.

Since 2007, however, significant changes in position rules can be noticed. A set of interest organizations has stepped in to retract the market forces present in the supply of veterinary antibiotics. Self-organization was initiated through a number of umbrella organizations representing the relevant parties involved, namely livestock farmers, the processing industry, the animal-feed industry and the KNMvD (Convenant Antibiotieresistentie dierhouderijen, 2008). Although the Dutch government became and remained an important interlocutor, state agencies are never *directly* involved in decision-making. Instead they explicitly delegated the reduction of antibiotics use to the various sector partners. The Ministries of EL&I and VWS themselves describe this arrangement as: 'A governance philosophy based on self-organization in combination with extensive government supervision'. (Ministry of EL&I/Ministry of VWS, 2011, p. 1). Functionally defined interest organizations can therefore be seen as the dominant actors within the newly formed collective-choice arena.

It is interesting to note, that within the Dutch agricultural sector, it is difficult to really distinguish between professional and interest organizations. In human medicine, the NHG, for example, is purely focused on the development of general practice (Homepage, NHG, 2012). The interests of GPs are represented by other organizations like the National Association for General Practitioners (LHV). Within animal agriculture both roles are combined in single organizations: for example the KNMvD for veterinarians and the (Z)LTO for farmers⁵ (S.J. de Groot, personal communications 2012; A. van Hoof, personal communication, 2012). With respect to antibiotic use, these two roles can conflict; which might explain the need for external pressure, both from the state and other interest parties.

Table 6: Position rules

Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Professional Organizations (C2)	Entrepreneurs/ consumers (M2)	Functionally Defined Interest Associations (A2)

7.4 Choice rules

Even though an actor might obtain a dominant position within the collective-choice arena, the perusal of its individual or aggregated interest might still be confined by the existing choice rules.

7.4.1 Human primary care

As was mentioned before, state policy objectives are virtually absent within human antibiotic policy. Although prudent use is certainly on the agenda of the Dutch government, the supply of

⁵ In addition, farmers also have their own animal sector specific unions as a means of representation.

substantive policy objectives is left to the medical community itself. The formulation of professional standards is a delicate and complex process with frequent interplay between academic and practicing professionals. This interaction might be labelled as inter-organizational bargaining with the hope of obtaining a fit between academic findings and practical implementation. It can, however, also be seen as a means to conform practical policy initiatives to existing norms on the appropriate use of antibiotics. The notion of prudent use is widely accepted throughout the professional community, both in academic circles as well as among practising GPs (A. Olde Loohuis, personal communication, 2012). On a collective-choice level the decision-making primarily concerns measures through which this notion can be upheld within everyday medical situations. The perusal of individual interest is therefore mainly confined by *professional ethics and standards*.

7.4.2 *Veterinary care*

In the initial situation clear state policy objectives were virtually absent. Although there was a general concern regarding the possible consequences of the mass use of veterinary antibiotics, this never resulted in the formulation of clear policy directives. Instead, antibiotics had become an integral component of livestock farming. It was seen as a cost-effective means to maintain animal welfare and growth. So even when AMGPs were officially abolished through European regulation, livestock farmers and veterinarians simply expanded therapeutic use (CVI/LEI, 2011). This went up until the point that antibiotics use was back at its initial level, prior to the change in regulation. At that point antibiotics were again used on a structural basis, not only to assure animal health and wellbeing but also to *'...enhance the technical performance of the farm.'* (B. Hutten, personal communication, 2012). It can thus be said that individual interest was not confined; instead it was based on *individual rational calculations*.

The choice rules within veterinary antibiotic decision-making have, however, changed significantly since 2007. First of all, the various sector parties have committed to a set of measures to achieve a more transparent and responsible use of antibiotics. This means that the interest of those operating on a collective-choice level is now bound to *aggregated organizational interest*. Organizational interest was formulated as follows (Convenant Antibioticsresistantie dierhouderijen, 2008, p.1):

- ▶ Clear responsibilities concerning the prescription, supply and administration;
- ▶ Transparency concerning the use of antibiotics;
- ▶ The enhancement of the appropriate use of antibiotics.

In addition, state agencies have added quantitative objectives to these qualitative ones. Based on a report of the Dutch Health Council, the Ministry of Agriculture (ELI) has put forth more substantive demands concerning the use of antibiotics that are critical for human care and the phasing out of preventive use (C.J.M. Brusckke, personal communication, 2012; Health Council of the Netherlands, 2011). As an important interlocutor of the responsible organizations, state agencies can exercise a substantial amount of influence. *State policy objectives* can therefore be seen as a driving force behind organizational interest.

It is important to note that professional ethics and standards also play an important role in confining the perusal of individual interest by veterinarians. However, they do not guide individual

interest within collective-choice. Instead, they are used as one of the policy instruments, which aim at confining interest on an operational level, i.e. the interest of individual veterinarians.

Table 7: Choice rules

Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Professional ethics and standards (C3)	Individual Rational Calculations (M3)	Aggregated Organized interest (A3) State formulated policy (S3)

7.5 Aggregation rules

Aggregation rules determine how decisions concerning allocation are being made. In other words, through what kind of mechanisms do the actors within a collective-choice arena reach an agreement on the appropriation of a certain resource?

7.5.1 Human Primary care

The collective-choice arena within primary care mainly focusses on the supply and implementation of guidelines by professional associations. The content of these guidelines is based on scientific evidence and is formed through repeated feedback from practicing professionals. Decisions are therefore primarily made through *common consent*. The professional standards and ethics, that form individual interest, give way to relatively high degree of consensus within professional communities. Within local professional communities '*...guidelines are used as a reference point*' (A. Olde Loohuis, personal communication, 2012). Within FTOs community pharmacists and GPs discuss their content and determine how to best conform them to their everyday workings. Guidelines are therefore not hierarchically implemented on a local level. Verbrugh (2003, p. 49) labels this type of decision-making as the 'consensus-model', in which all individuals agree on the chosen course of action. Actual decisions on appropriation are thus made on a local level, through a process of common consent.

7.5.2 Veterinary care

Since the use of antibiotics initially occurred within a virtually unregulated market, and professional standards did not seem to influence the behaviour of individual appropriators, it is obvious that decisions were not made through a process of authoritative adjudication or common professional consent. Furthermore, there were no agreements, prior to 2008, on the use of antibiotics. Instead the allocation was determined by market mechanisms. It can thus be concluded that within this environment decisions were made based on aggregated *consumer preference*.

Up until now, the Dutch government remained reluctant to directly take control of allocation decisions. Although, quantitative objectives have been imposed, the state does not make decisions on *how* the allocation must be altered. Instead a mandate was given to the involved sectoral parties to devise a way to achieve a more sustainable allocation of veterinary antibiotics. As one high-ranking policy official put it: '*The sector still has to do it itself; we have only narrowed down*

the scope'. (C.J.M. Bruschke, personal communication, 2012). Together, the various interest organizations signed a convent, in which they agree on taking certain policy measures regarding the use of antibiotics. A clear shift can therefore be seen from aggregated consumer preferences towards *concurrent consent*. The representative organizations of all involved actors simultaneously agree that inappropriate veterinary antibiotics use is a problem and that appropriation must be reduced to a sustainable level. 'We came to a point that all leaders of the various animal sectors said: We are going the deal with this together... we saw the necessity of making this problem controllable and transparent instead of just pointing at the possible wrongdoers.' (H.W.A. Swinkels, personal communication, 2012).

Table 8: Aggregation rules

Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Common Consent (C4)	Consumer Preference (M4)	Concurrent consent (A4) Common consent (C4)

7.6 Payoff Rules

Finally, Payoff Rules form the principal benefits that are expected by the decision makers.

7.6.1 Human primary care

It is not hard to pin-point the principal benefits of decision makers in primary care. The effects of optimal appropriation are directly felt within the community. If resistance levels decrease, antibiotics will remain to function as an important base under modern medicine. Decision makers on a collective-choice level, somewhat removed from everyday concerns, are clearly aware of the fact that prudent use will help control future social as well as economic costs on a sectoral level (J. Kluytmans, personal communications, 2012). The appropriate use of antibiotics will contribute to effective use. Hence, the principal benefit clearly is the development of the profession. On an operational level, other motivations also become important. Through professional accreditation programmes and the possibility of bench-marking, individual GPs are made aware of their prescription behaviour in comparison to their colleagues (Homepage NPA, 2012). These developments open up possibilities for more or less direct peer pressure to occur.

7.6.2 Veterinary care

Initially, the focus was mainly on the cost-effective nature of antibiotics. Were antibiotics in human medicine are used on an individual basis to *cure* a patient, they are often deployed in animal agriculture to *prevent* livestock from becoming sick (J. van de Velden, personal communication). In addition, the positive effects on animal-growth provided farmers with a means to raise fatter and healthier livestock at a relatively low price. In a time that awareness on the negative attributes of antibiotic consumption was low, antibiotics provided a means to increase production, without doing damage to animal health and wellbeing. As some respondents remarked: 'Antibiotics are just cost-effective management tools' (D.J. Mevius, personal communication, 2012) or 'a means to uphold animal performance' (B. Hutten, personal

communication 2012). The concern of individual appropriators was not peer recognition, external security or a greater predictability of socio-economic outcomes, but individual *material prosperity*, both in terms of increased production and animal welfare. The usage of antibiotics had become an integral part of everyday business on Dutch farms. Since it was not perceived as a risk, peer recognition did not really play a role. Furthermore, there were no real concerns about the socio-economic consequences of antibiotics use.

After the signing of the 2008 covenant, expectations changed. Although external state-pressure was the initial facilitator for cooperation on an organizational level, each sector party also reported their own specific intrinsic motivation. With the consequences of excessive antibiotics use becoming more and more tangible, sector parties became convinced that antibiotics as an integral method of production would not be sustainable. Measures should therefore be taken to turn antibiotics into last-resort means to ensure animal health, instead a structural cost-effective means of production. This would on the one hand create a more sustainable base for Dutch agriculture and on the other reduce the public health risk in terms of antimicrobial resistance. In other words: *a greater predictability of socio-economic outcomes*. In addition, many respondents mention another intrinsic motivation for the joint reduction efforts: corporate reputation. As one respondent put it: *'we had two reasons that made us see the necessity of reduction: On the one hand, the development of resistance and, on the other, satisfying the demand from supermarkets for quality assurance.'* (H.W.A. Swinkels, personal communication, 2012). The continuous emphasis on the excessive use of antibiotics and the presence of resistant bacteria in agricultural products is perceived to be bad the sector's reputation. For the individual farmer, trying to make ends meet, this might not be a direct issue. Other interest parties, however, e.g. the food processing industry, are much more concerned with their corporate image. This gives them a direct economic incentive to actively try to bring down antibiotics use. In addition to a greater predictability of socio-economic outcomes, corporate and sector reputation, also make *material prosperity* part of the expected benefits.

On an operational level, emphasis is put on the creation of transparency concerning the use of antibiotics. One of the principle benefits of this approach is that it enables bench-marking activities between both veterinarians and livestock farmers. An individual farmer is able to see how his own usage compares to that of his neighbouring colleagues. The same goes for veterinarians: they can relate their own prescription behaviour to that of their peers. Combined with the introduction of stricter professional standards and greater awareness of the societal risk affiliated with high antibiotic consumption, this will hopefully create a solid base for more prudent use on the basis of peer recognition.

Table 9: Pay-off rules

Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Professional development & Peer Recognition (C5)	Material/Individual Prosperity (M5)	Greater Predictability of socio economic outcomes (A5) Material Prosperity (M5)

Table 10 provides an overview of the various rules that dominate the institutional rule-configurations within both the human primary and veterinary sectors. In the final part of this chapter I will discuss in what way the collective action capabilities in each sector are affected by these outcomes.

Table 10: Institutional rule-configurations in human primary and veterinary antibiotic policy

Rule-type	Human Primary Care	Veterinary Care (Initial)	Veterinary Care (Current)
Boundary Rules	C1: Membership Status	S2: Legal Authorization M1: Ability to Pay	A1: Capacity to Mutual Disruption
Position Rules	C2: Professional Associations	M2: Entrepreneurs/ consumers	A2: Functionally Defined Interest Associations
Choice Rules	C3: Professional Standards and Ethics	M3: Rational Individual Calculation	A3: Aggregated Organized interest S3 State formulated policy
Aggregation Rules	C4: Common Consent	M4: Consumer Preference	A4: Concurrent consent C4: Common consent
Payoff Rules	C5: Professional Development & Peer Recognition	M5: Material Prosperity	A5: Greater Predictability of socio economic outcomes M5: Material/Individual Prosperity

7.7 Institutional complementary in antibiotic policy

The institutional rule-configurations within both sectors differ a great deal. Within human primary care communitarian institutions play a dominant role. The veterinary sector on the other hand was initially characterized by a market-configuration. In recent years, however, a shift can be observed towards a more associative type of collective action. On an operational level, this has resulted in the introduction of both community and state-type institutions in addition to the existing market

structure. In the final part of this chapter I will further discuss the observed institutional-rule configurations and their effects on sectoral collective action, i.e. the sector's capabilities to achieve a sustainable level of antibiotics appropriation.

7.7.1 *Human primary care: Communitarian hierarchy in a non-competitive environment*

Within Dutch primary health care, professional communities play a dominant role in upholding quality and effectiveness. These communities exist on both a national and a local level. On a national level, professional organizations like the NHG and the SWAB produce evidence based guidelines on prudent use and organise monitoring activities. In addition, state and market actors also engage in monitoring and enforcement activities. Their standards are, however, purely based on professional guidelines. So, although these actors have an important facilitating role and provide state pressure as well as economic market incentives, the collective-choice arena remains dominated by professional organizations and individual interest is formed through community norms and standards. On a local level, GPs and pharmacists are organized in smaller communitarian initiatives, e.g. FTOs. These FTOs can be seen as what Ostrom (2002, p. 1332) describes as 'base institutions in which face-to face communications can be utilized for solving day-to-day problems in smaller groups'. They provide an arena in which individual GPs and other local health professionals can discuss central guidelines and their practical implementation. The institutions of the professional community are therefore nested on different levels. This way, externalities that are produced within local communities can easily be observed and addressed on a larger organizational level (Ostrom, 2002, p. 1333)

The communitarian arrangements within Dutch Primary care correspond to a great extent with Ostrom's Design principles for long-enduring common-pool resources. Professional guidelines provide clearly defined boundaries on antibiotic prescription. Furthermore, professional associations on various levels facilitate collective-choice arenas in which operational rules can be adapted to new biophysical developments as well as to local circumstances. These institutions are *nested* on both local and national levels. In addition, appropriation is monitored within the professional community itself. Enforcement, however, is in the hands of state and market actors, but is based on and in accordance to professional guidelines. More importantly, government authorities do not only recognize the right of appropriators to devise their own institutions, they explicitly authorize them to keep appropriation on a sustainable level.

Although the communitarian setting within primary care clearly paved the way for a relatively sustainable appropriation of antibiotics, this does not yet explain how this type of order came into being in the first place. Within the series of interviews I conducted, virtually every actor referred to the non-competitive environment in which the average GP operates. The structure of Dutch primary care, with a relatively high amount of patients per GP and a standard capitation fee per registered patient, takes away an important economic incentive to 'please' patients. It gives GPs the space to contemplate on the necessity of antibiotic prescription, both in medical terms but also in light of the possible externalities it might produce. Furthermore, the relatively tight bond between patients and GPs in the Netherlands, makes it easier for a GP to convince his or hers patient that antibiotics are not always a necessary cure. As a GP, one respondent put it: '*I am free to think about public health and general interest, without any financial pressure.*' (A. Olde Loohuis, personal communication, 2012).

In addition, the Netherlands historically has an internationally active and organized academic community, in which microbiologists and infection disease specialists are well represented (J. van de Sande, personal communication, 2012). The importance of such a community must not be underestimated. Next to their professional knowledge, the emotional detachment of e.g. microbiologists, enables them to better weigh the positive effects for an individual patient against possible negative effects for others (J. Kluytmans, personal communication, 2012). So apart from their academic work, these actors also have a crucial advisory function within individual hospitals, but also in professional organizations and towards government agencies. An emotionally detached and highly developed academic community, in combination with a relatively economically detached practicing community, therefore creates a solid base for effective communitarian action and self-organization.

Throughout this thesis I have always labelled antibiotic policy within human medical care as *relatively* successful. Overall, Dutch GPs are responsible for one of the lowest levels of antibiotic prescription in Europe. It is important to note, however, that this success remains a relative one. Many improvements can still be made in compliance to guidelines and the monitoring of use on an individual level (MF.M. Langelaar, personal communication, 2012). The presence of communitarian institutions provides transparency through monitoring activities and awareness on appropriate antibiotics usage through guidelines. Combined with the *absence* of market institutions they form important instruments to create voluntary shared norms on antibiotic prescription. To ensure enforcement, the communitarian order is *complemented* by state agencies like the Health Inspectorate and market actors like health insurers, both with their own motivations to ensure the quality of health care in general. Recently, the Health Inspectorate announced a new monitoring programme on what they call 'antibiotics stewardship'. Within this programme the Inspectorate will monitor usage in Dutch hospitals, GP practices and other health care organizations. Although monitoring is still based on community guidelines and protocols, this does show a growing interest of state agencies in the effectiveness of communitarian institutions. According to Merel Langelaar, programme director at the Dutch Health Inspection, the intensification of the national and international discussion on the risks of antimicrobial resistance forced the health inspectorate to re-evaluate national policy to further ensure both the safety and quality of Dutch health care (personal communication, 2012). In addition, some private health insurers offer financial compensation to GPs that participate in NHG-certification programmes. This way, state and market actors help professional communities to overcome second-order collective action dilemmas.

Similar to the veterinary sector, a process of institutional evolution is also taking place in human antibiotic policy. Changes in the risk-perception of AR have resulted into a more obvious presence of state institutions, complementing the communitarian hierarchy in human primary care.

7.7.2 *Veterinary care: Institutional layering through an associative order*

The collective-choice arena in veterinary antibiotic policy has changed quite a bit in recent years. An associative order replaced the market hierarchy that had been characteristic of antibiotics decision-making in the sector. This switch from market to associative model of social order took place in a rather self-conscious manner. Rapid changes in the biophysical environment made the initial situation untenable. The discussion on community-acquired MRSA and ESBLs made the public health risks of excessive veterinary antibiotics use tangible for the first time. Basically, the

costs of the negative resistance externality became visible for individual livestock farmers, veterinarians, government officials and the public at large. With it, the inherent market failures within the Dutch veterinary antibiotics market emerged. Without awareness on these market failures, initial measures to bring appropriation back to a sustainable level failed. These initial changes, that took place in the 1990s, could be classified as the imitation of rules that were already successfully used in human medicine: the supply of guidelines through professional communities. These communitarian measurers did, however, not prove to be effective in light of a rapidly changing risk-prescription concerning veterinary antibiotics use.

Institutional evolution took place on both a collective-choice and an operational level. Currently, the core of the collective-choice arena is formed by a distinct set of associative institutions. This rule-configuration is, however, complemented by both state, market and communitarian institutions. The perusal of associative interest is, e.g. confined by state formulated policy objectives. In addition, decisions on appropriate levels of appropriation are made by an independent group of veterinary health care professionals. Finally, reputational considerations give individual operation on the collective-choice level a direct economic incentive to establish effective reduction methods. The associative model that emerged therefore functions under a shadow of state, community and market.

These changes within the collective-choice arena had several effects and the operational level. First of all, product board regulation has provided state-type instruments concerning the registration of use. This in turn facilitated the possibilities of bench-marking activities and peer-pressure. Furthermore, self-regulatory mechanisms within IKB-systems have led to the institutionalization of professional standards and the possibilities to identify and to exclude, i.e. punish, free-riders. In other words, the initial market mechanisms have been complemented with state, associative and communitarian type of institutions, facilitating the way towards a more sustainable level of antibiotic appropriation. These changes in the institutional environment of veterinary antibiotic policy can be labelled with a theoretical concept called *institutional layering*; a situation in which 'barriers to internal change are high so that, instead of abolishing or dismantling old institutions, new institutions are simply added to the old ones' (Helderman, 2007, p. 119). So instead of dismantling the market mechanisms within the veterinary sector, new communitarian, state and market institutions are introduced to change the societal outcomes. '*...a free market inherently does not have any morality; it does not have any built in barriers. So now, these barriers are being built, by regulation, covenants... this way things will change.*' (R.J. Wessels, personal communication, 2012).

A striking example of this is the discussion on taking away the pharmacist role from veterinarians. By severing the relation between the seller and prescriber of antibiotics, an important economic incentive for the prescription of antibiotics would be taken away. Although the Dutch government repeatedly threatened to take this drastic action, it never happened. Apart from resistance from the veterinary community, the costs of such a reform were seen as too high. A completely new system of veterinarian pharmacists would have to be set up and veterinarians would have to be compensated for their loss of income. A financial and administrative burden that all involved actors would prefer to avoid. Instead, veterinarians maintained their pharmacist role but were bound by product board regulation and communitarian certification to uphold professional standards.

7.7.3 *Default conditions*

The success of these reform efforts depends on the fulfilment of the *default conditions*. To what extent do the functionally defined interest associations within the collective-choice arena have sufficient control over their member behaviour? Theoretically, the implementation of the self-regulatory mechanisms in addition to growing awareness among all involved actors should guarantee compliance to both regulation and guidelines. However, the effective functioning of these mechanisms also depends on structural monitoring and sanctioning activities. To effectively change the behaviour of members, a combination of policy measures is necessary. State and/or Product Board regulation, bench-marking possibilities and market pressure through IKB-systems all play a role in bringing antibiotics use to a sustainable level. It is impossible for one actor, whether state, market or communitarian, to simultaneously implement and maintain all these measures. Their effectiveness depends on the strength of the associative order and the organizational trust within it. One respondent illustrated this as follows: *'The veterinary sector can basically be seen as the cockpit of an airplane. To keep the airplane on course we have to simultaneously turn various knobs just a little. If we turn one single knob to hard, however, you only disorganize the process or the airplane might even take a nosedive in the wrong direction.'* (R.J. Wessels, personal communication 2012). It is, therefore, important that all involved actors keep doing their part. Only through solid cooperation between the various representative organizations can the total package of measures be implemented. Virtually all respondents involved, acknowledged this fact. If a division between the various organizations might arise, this would effectively be the end of the current reduction efforts.

State pressure also remains an important instrument to ensure inter-organizational cooperation. New government legislation is continuously produced to supplement sectoral initiatives. By reinforcing the position of the NVWA, for example, the Dutch government sends off an important message to possible free-riders. Just like the IGZ, the NVWA will start to function as a means to legally enforce professional guidelines and/or sectoral agreements (Ministry of EL&I/Ministry of VWS, 2012). The Dutch government and parliament must, however, also be careful. If state agencies will start dominating the entire collective-choice arena, the various sector parties, whose cooperation is essential for effectively reducing the use of antibiotics, might loose heart and abandon self-organizational efforts. Essentially, state-regulation must aim at complementing and thus increasing the feasibility of associative-initiatives. Unfortunately, it is impossible to assess the outcomes at this point in time. To what extent are changing values concerning the structural use of antibiotics and self-organizational pressure able to confine the economic interest of individual farmers and veterinarian? At this point antibiotics are still an essential means of production in substantial parts of Dutch animal husbandry. The large decrease of total antibiotic sales that has occurred in recent years, however, is definitely a positive sign.

The next and final chapter will form the conclusion of my thesis. In it I will formulate a final answer to my research question and contemplate on the practical, theoretical and methodological issues that were raised during my research.

8 Conclusion

8.1 Introduction

In this final chapter I will put all the pieces of the antibiotics puzzle together. The conclusion of my thesis consists of several parts. First it will present a final answer to my research question. This is followed by a short discussion on the theoretical aspects in section 8.3 and a on the practical implications in section 8.4. The methodological strengths and limitations will once again be emphasized in section 8.5 and finally, section 8.6 will elaborate on the possibilities for further research in the future.

8.2 Answer to the Research Question

Historically, a large difference in the handling of antimicrobial agents could be observed between the human medical and veterinary sectors in the Netherlands. Where the Dutch were seen as forerunners with regard to prudent use in the medical sector, antibiotics were being used at a large and structural scale in animal agriculture. In addition, the Dutch human health care sector had years of experience concerning the use of self-regulatory mechanisms like community standards and guidelines. In the veterinary sector, on the other hand, these were never effectively implemented. This discrepancy functioned as the starting point of my thesis. After being applied to an institutional perspective the research question was formulated as follows:

In what way has the institutional-configuration within both the veterinary and human primary healthcare sectors affected their collective action capacity concerning the sustainable appropriation of antimicrobial agents?

The following sub-questions guided my research:

- ▶ Against which contextual background has the problem of antimicrobial resistance and inappropriate use of antibiotics manifested itself in both sectors?
- ▶ What are conditions for the effective and long-durable governance of CPR-systems?
- ▶ Against what institutional background can these conditions best be supplied on a sectoral scale?
- ▶ What institutional configurations are present in both the veterinary and human medical sectors?
- ▶ To which extent are the conditions for the effective and long-durable governance of CPR-systems supplied in the scrutinized sectors?

In the following pages these sub-questions will be answered in the order listed above. Finally, a concise answer to the research question will be given.

8.2.1 *The contextual background of antibiotic resistance*

The risk of antimicrobial resistance manifests itself on an interregional and intergenerational scale and presents society with an enormous economic and social burden. Within the Netherlands, the human medical care sector shows a relatively low consumption and an equally low presence of hospital-acquired MDR-bacteria. Within the veterinary sector, however, high usage has, according to both national and international reports, led to a relatively high prevalence of animal-related

MRSA. In order to better explore its complexity, the theoretical part of this thesis started off with a conceptual analysis of the fundamental nature of the antimicrobial resistance (AR). The problem of AR was translated into a common-pool resource (CPR)-dilemma, in which rational behaving individuals will, if left unchecked, always appropriate on a socially sub-optimal level. The positive health effects of antibiotics cause individual GPs or veterinarians to prescribe antibiotics in an inappropriate manner. Due to resistance-externality affiliated with antimicrobial consumption, however, this will provide society at large with a substantial economic and social burden, since existing antibiotics will be rendered ineffective.

8.2.2 *Governing sustainable and long-durable CPR-systems*

To overcome this possible tragedy of the commons, Ostrom (1990) propagates the creation of communitarian initiatives, in which individuals work together to provide a set of design principles that achieve effective collective action. She describes a set of eight design principles which lie at the base of virtually every sustainable and long-durable CPR-system. First of all, clear boundaries must indicate who is allowed to appropriate and who is not. Furthermore, appropriation rules must be adapted to local settings and individual appropriators must be included in the decision-making process on a collective-choice level. Monitoring activities are needed to prevent opportunistic behaviour from occurring and if rules are broken; graduating sanctions must be used to punish the perpetrator. Furthermore, state authorities must recognize these locally organized institutions and must refrain from distorting interference. Finally, in the case of larger resource-systems, nested enterprises on different societal levels must ensure the cooperation of individual communities. The creation of appropriating rules and monitoring must thus take place on a higher level, but still on a communitarian basis, without state involvement.

The supply of these design principles, however, depends on the close-knit and interpersonal structure of the community. Without this structure, individuals will inevitably run in to second-order collective actions dilemmas when supplying the required self-organizational institutions. In the case of AR, which manifests itself on a societal scale, it seems almost impossible to create such communities. As was explained in chapter 3, however, collective action on a societal scale is not impossible. Streeck and Schmitter (1984) introduced four ideal-typical models of social order, through which effective collective action can be accomplished. Labelled by their defining institutions these are: the state, market, community and association. The supply of Ostrom's design principles is most likely within a communitarian or associative institutional arrangement. If sufficient (inter-organizational) trust and reciprocity is present, the individuals within these arrangements are able to overcome possible second-order collective action dilemmas and supply the institutions necessary for sustainable and lasting resource appropriation.

To analyse the institutional background of the veterinary and human medical sectors, I translated Streeck and Schmitter's models of social order into so-called institutional rule-configurations. These configurations are composed out of separate rules that together form the institutional context of a sector. I then analysed the collective-choice arena of each sector based on these rule-configurations and determined how they affect their capacity to control antibiotic consumption. This strategy enabled me to not only analyse past policy, but also assess the effectiveness of current initiatives.

8.2.3 *The Institutional Context of Antibiotics*

Based on the case study conducted in this thesis, it can be stated that differences in the institutional background of antibiotic policy have a crucial effect on its effectiveness. Initially the collective-choice arena within Dutch veterinary policy was dominated by a *market-type institutional configuration*. Although access to the arena was limited through state legislation, it remained dominated by economic market relationships. Veterinarians were in general seen as economic entrepreneurs and livestock farmers as their customers. The notion of antibiotics as a cost-effective means of production was simply so embedded in the various animal sectors, that eventually preventive and structural use also became essential for keeping up animal health. Individual decision makers were left to pursue their interest in any way they saw fit. As a consequence, decisions were based on consumer preference with material prosperity as the main expected pay-off. Within this institutional *market-hierarchy*, communitarian initiatives aimed at achieving a more appropriate level of antibiotic consumption were futile.

Within primary health care, however, a *communitarian hierarchy* can be observed. The collective-choice arena consists of various professional associations, supplying and implementing guidelines that function as norms on the appropriate use of antibiotics. These norms are not only upheld by the practising community, but also by state agencies and private health care insurers. More importantly the prescription of antibiotics remains virtually uninfluenced by economic considerations; health care professionals are free to compare their own dealings on a local level with national standards. Decision-making, therefore, takes place according to professional standards and ethics and is based on common consent within national academic and local practising professional communities. Professional development, both collective as well as individually, can be seen as the main expected payoff. It is important to note, however, that compliance to these guidelines is not a hundred percent; instead they are used as a reference point that allows individual practitioners to become aware of their own behaviour.

8.2.4 *Institutional Evolution and the supply of self-organizational institutions*

Interestingly, the intensification of the national and international discussion on AR had large consequences for the institutional environment of antibiotic policy, both in the veterinary and human medical sector.

Within the veterinarian sector, the appearances of animal-related MRSA and ESBL on the public agenda changed the impact of the problem. For the first time the consequences of veterinary antibiotic use for public health became visible. As a result, a collective-choice level was formed in which functionally defined interest organizations, all considered essential for effectively reducing antibiotics usage, gained a dominant position, although under a shadow of state hierarchy. Individual interest was confined by aggregated organized interest and state formulated policy. Furthermore, decisions were made based on concurrent consent and on the changing views concerning the consequences of excessive antibiotics use. In their search for a more balanced use of veterinary antibiotics, the different sector partners hoped to achieve more predictable and sustainable socio-economic outcomes. In addition, material prosperity was also an expected benefit, since reputational damage was basically considered as 'bad for business'. The main purpose of this associative decision-making was to create a solid base for the transparent and responsible use of antibiotics. To achieve this goal, both state, communitarian as well as market-type barriers were built into the veterinary antibiotics market. Product Board regulation, for

example, obligated the registration of antibiotic use within a central database. In addition, the professional position of veterinarians was reinforced through the institutionalization of guidelines and the provision of target levels. Furthermore, the possible exclusion from IKB-systems, when guidelines and regulation are not upheld, provides both farmers and veterinarians with a direct economic incentive to rethink their antibiotic usage. Meanwhile, state activities like the introduction of quantitative policy objectives and intensified monitoring activities, put pressure on the involved parties to implement and maintain these policy measures. So, where decision-making initially took place through the aggregated pursuit of individual economic interest, these developments ushered in a new associative collective-choice arena under a shadow of state hierarchy. On an operational level, this in turn facilitated the supply of a set of *complementary self-regulatory institutions* which aim at assuring a more transparent and appropriate consumption of veterinary antibiotics. Norms on the appropriate use of antibiotics were introduced, compliance is monitored and sanctioning mechanisms are set in place on a sectoral level.

The intensification of the international debate on AR also had consequences for the human medical sector. Although, the Dutch have been relatively successful in limiting the bulk of antimicrobial agents used in human medicine, actors both inside and outside the professional community continuously reassess current measures. Currently, measures are mainly focused at intramural care. Guidelines should not only function as a manual for individual physicians, but should be incorporated in the physical structure of the hospital; a form antibiotic 'stewardship'. Although professional association still clearly have the lead in the provision of standards and protocols, market actors and state agencies are increasingly involved in their implementation and enforcement. Both private health insurers and the National Health Inspectorate see the prudent use of antibiotics as essential to the provision of high qualitatively care. They therefore engage in monitoring activities and also facilitate certification and bench-marking efforts within e.g. primary care. Essentially they are helping professional communities to overcome second-order collective action dilemmas. The ever more present threat of AR, therefore also gives way for the introduction of complementary state and market institutions to reinforce the existing collective action within the communitarian hierarchy.

In summary, the initial market hierarchy in animal agriculture hindered the effective implementation of self-organizational institutions. In recent years, however, an associative form of governance supplied the barriers, which hopefully will create a sound base for current and future sustainable self-organizational initiatives. In human primary care on the other hand, the virtual absence of market activity in relation to the supply of antibiotics, gave way to the formation of a professional communitarian hierarchy. To guarantee and enhance its effective functioning, however, state and market actors must complement the existing communitarian configuration by creating and facilitating transparency and reciprocity throughout the sector.

8.3 Theoretical Reflection

According to Elinore Ostrom and her colleagues, the institutional design that enables individuals to achieve a sustainable and durable CPR-situation is best supplied within local communities with a close knit social structure (Ostrom, 1990; Rose, 2002, p. 245). Based on my findings in the Dutch human primary sector, however, I dare to argue that is also possible to supply these institutions on a sectoral or societal level through the presence of complementary state, market and

communitarian institutions. The institutional setting within human primary care to a great extent resembles Ostrom's description of externally recognized communitarian institutions nested on different levels. For it to overcome second-order collective action dilemmas, however, complementary market and state institutions are a crucial condition. These institutions do not necessarily have to function in a punitive fashion, threatening with sanctions or market exclusion. Instead, simply by creating or facilitating transparency they enable individual appropriators to access one another's reputation, which gives way to reciprocity and eventually intra-communitarian trust. They thus supply the conditions necessary for a functioning communitarian order: trust, reciprocity and reputation.

I further argue that the presence of a dominant communitarian institutional hierarchy is not an absolute necessity for a successful CPR-situation. My findings within the veterinarian sector showed hopeful signs of associative self-organization within a predominantly market-environment. Through a process of bargaining and mutual adjustment, functionally defined interest organizations representing state, market and communitarian actors have managed to set into motion a process that eventually must lead to a more sustainable appropriation of antibiotics. Through this associative order, actors are trying to overcome economic interests within the collective-choice arena. As a result this enabled them to impose barriers into an initially free market environment. On an operational level, both state, market and communitarian measures were used to change both the behaviour and the mind-set of individual appropriators. An associative hierarchy on a collective-choice level enabled the supply of a set of, again, complementary institutions, which in turn must lead to the sustainable appropriation of antibiotics.

Finally, where Ostrom (1990) propagates a limited role of the state, I have argued that at least in these cases, state activity is a necessary condition for the effective handling of a CPR-situation. It can function as a counter-power against market forces within a sector. Although, state agencies should still refrain from direct intervention as much as possible, its pressure is of crucial importance to help market and communitarian actors overcome first and second-order collective action dilemmas. First of all, state pressure can move professional communities to reassess their activities or push individual interest organizations towards the bargaining table. Second, as Streeck and Schmitter (1985) argue, the state can keep organizational-interest in line within the public interest. Frequent (symbolic) policy initiatives or simple communication can, therefore, be an important factor in the supply of self-organizational design principles. Since the state is, however, fully dependent on professional and/or functionally defined interest organizations, it should also be careful not to exaggerate its demands. If societal actors are not able to keep up with state demands, resistance will become inevitable.

8.4 Views on the Future

Both human and veterinary antibiotic policy within the Netherlands is currently at a crossroads. Recent years have led to incredible changes within the veterinary institutional landscape. Only time will tell, however, whether the current efforts within Dutch animal food production will lead to a more durable and sustainable usage of antibiotics; or if they will just wither away as soon as public and political attention declines.

8.4.1 *Veterinary antibiotics use: an elite sports*

During my research I encountered more than a few metaphors that describe the core of the veterinary antibiotics problem. The most striking metaphor, I later realized, was that of the professional cyclist, who is struggling to maintain his position within the cycling squad. Being a professional athlete, the cyclist wishes to perform as best as he can within his capabilities. After a while he realizes that some of his cold-medicine, which he uses when he feels sick on a race day, does not only repress his sickness, but also makes him perform a whole lot better. Since this medicine is not on any list of banned or illegal substances the cyclist sees no reason not to use it for other than health purposes. Moreover, the team's sports physician is happy to supply the medicine, since he sees no real reason why not to and perceives it as useful service to his client. In addition, the cyclist's team managers and employer are more than content with the increased performance and cycling fans and sports critics all over the world are amazed by the tremendous level at which the athletes are performing. Meanwhile, the cyclist slowly becomes more and more dependent on its medicine and adjusts his training schedule accordingly, and after a sponsorship deal was cancelled, it provided a convenient way to postpone the necessity of new cycling equipment. He is able to push himself to the limit by repressing the physical consequences.

After some time, however, medical specialists back home start to discover all kinds of societal side-effects of the medicine. And within a broader societal discussion on a fair and clean cycling sport, pressure on the cyclist grows to limit the use of his medicine. By this time, however, the cyclist cannot simply stop. All his colleagues are also using the drug, so by quitting cold turkey he will most certainly lose his position in the racing squad.

It is impossible for the cyclist to limit his medicine use and still maintain his competitive position within the racing squad on its own. First, regulation must assure limited and transparent use, monitored by an independent anti-doping organization. Furthermore, the various cycling race-organizations should agree on excluding any cyclist or sports physician that does not uphold these regulations. In order to reduce his dependence on the drug the cyclist also needs all individuals around him: e.g. the advice of the team's medical staff and his dietician on how to reorder his training programme and diet, without doing harm to his performance. Furthermore, he needs the support of his sponsor, for example a large cooperative bank, to be able to buy the newest equipment. Finally, the cyclist simply needs time to let his body adjust to new circumstances or at least to lay the base for future generations of cyclists to participate in a clean and fair sport.

8.4.2 *Professionalization in an associative environment*

Based on my experiences I am cautiously hopeful when it comes to the reduction-efforts within animal agriculture. All actors I have interviewed, whether state, market or professional acknowledge the need for change and try to play their part in establishing a more transparent and appropriate use of antibiotics. Since, many efforts are still in their first stage of implementation or even on the drawing table; their effectiveness cannot yet be assessed at this time. However, the decrease in consumption that has been witnessed during the past years could certainly mean that the barriers build into the veterinary antibiotics market are doing their job. However, as many respondents have noted, the first steps are always the easiest. A time might come when these barriers are breached by economic considerations. Continued, inter-organizational cooperation seems crucial for enforcing the institutional barriers that have been put into place. Instead of shifting the blame to one another, the involved parties should simply look at the facts and take

action accordingly (H.W.A. Swinkels, personal communication, 2012). They must exploit inter-organizational trust as a means for effective collective action. Several respondents also expressed the need for a central management institution within the existing associative order. Such a central authority could continuously remind involved organizations of their responsibilities and would effectively further institutionalize associative governance the veterinary antibiotic policy. The implementation of centralized co-ordination and increased inter-organizational trust can in my opinion be seen as the next step towards a more sustainable consumption of veterinary antibiotics.

An overnight transition towards appropriate use, however, cannot be expected. Despite all innovative management tools within animal agriculture, livestock farmers still remain dependant on nature (R.J. Wessels, personal communication, 2012). The physical characteristics of an entire livestock population are not changed overnight. It took generations of breeding to create animals with an optimal production value and it will again take generations to breed them to being less susceptible to infections.

Finally, where the increase in scale initially led to the rise of antibiotics use, it now also presents opportunities to reverse this trend. Only large farms with professional operating plans are able to survive in the competitive market. Not only can they produce more efficiently, they can also attract funding for investment more easily. Furthermore, given their increased size, it becomes more attractive for other parties like veterinarians or animal feed suppliers to invest more time and supply tailor-made advice to individual farmers (B. Hutten, personal communication, 2012). This in turn increases their professional standing and knowhow. Over time, those farms without proper management will fall out of the market, leaving only those with the best management tools and, consequently, the lowest need for antibiotics.

8.4.3 Improvement through a complementary design

It is important not to forget that improvement is also still needed within human antibiotics use. Although a solid communitarian base is in place, compliance to guidelines can still be higher, both in intramural and extramural care. On many occasions, GPs overprescribe or use the wrong type of antibiotics. The international debate, however, already moves professional communities into action. And with a more active role of the Inspectorate and private health insurers, it is highly probable that the Dutch continue to be a guiding country when it comes to the appropriate use of antibiotics.

In light of the outcomes of my thesis, it is also interesting to reconsider the current market-orientating within the health care sector. According to its proponents, market incentives will lead to a more cost-effective type of health care. With regard to antibiotic consumption, however, free market activity would almost certainly produce substantial externalities, putting an enormous social and economic burden on society. Although, certain market incentives could surely contribute to a more sustainable consumption, it is important to consider the possible negative effects on communitarian self-organization if the creation of market competition is continued in primary care. Within a competitive environment GPs might be more susceptible to the demands of patients, which in turn might lead to more frequent antibiotic prescription.

8.5 Methodological Reflection

I discovered the trickiness of institutional analysis at an early stage. Abstract notions as institutions, especially on a collective-choice level, are often hard to pin-point. In my opinion, it cannot be seen as an exact-science; instead it gave me a simplifying lens through which I could look at reality. Through triangulation of sources and the feed-back of several respondents, however, I am convinced that I have managed to accurately uncover the abstract institutional configuration behind the complex and dynamic environment of antibiotic policy. The fact, however, that only two cases were observed makes it hard to make generalizing statements based on this study.

Furthermore, I encountered several difficulties along the way. Although I found many respondents that were more than willing to help me with my research, more would have always been better. Some respondents were not approached due to practical limitations and others were unfortunately not able or willing to contribute. Furthermore, the actuality of the subject sometimes made it hard for me to keep up with occurring developments. Both cases were very dynamic in nature, making early observations already outdated when the end was near. Some policy initiatives I describe, although very important for my research, are currently still being implemented, making an assessment of their effectiveness impossible. Often I therefore wished I conducted this research a few years earlier or later. This automatically brings me to the final part of my thesis: the recommendations for further research.

8.6 Recommendations for Further Research

The theoretical implications of this comparative case study can of course still use a great deal of confirmation. Within the field of antibiotic policy a start can e.g. be made with an international comparison. Due to practical limitations I have confined myself to national antibiotic policy. AR, however, very much remains to be an international issue. An interesting first step would be the application of the institutional analysis with this thesis to the Danish situation. The Danish have become to be known as a success story with respect to veterinarian antibiotic policy in Europe. What makes this case even more interesting, however, is the fact that they managed to become a success story through a very étatist approach, completely different from the associative approach in the Netherlands.

On a more practical note, it would also be important to look at the supply of new antimicrobial agents. Momentarily, decision makers within the field of antibiotics are struggling to find a balance between limiting the use of existing antibiotics, whilst at the same time not discouraging companies to invest in new types and classes. This side of the antibiotics issue has been deliberately left out in this thesis, but is nonetheless an area where policy analysts could still make a valuable contribution.

Finally, it would be interesting to apply the institutional rule-configurations used in my analysis to other sectoral collective action dilemmas. The combination of Ostrom's institutional rules and Streeck and Schmitter's models of social order could in my opinion use a great deal of fine-tuning. Afterwards, it could hopefully contribute to the understanding and analysis of societal collective action.

Appendix 1: Literature

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Appendix 2: Standard Interview Protocol

- 0. Introduction**
 - ▶ Thank respondent for taking the time
 - ▶ Introduction of interviewer and research (Student Public admin., AR, comparison Dutch veterinary and human health care sector)
 - ▶ Relevance of respondent and interview
 - ▶ Duration, possible objections against recording
 - ▶ Questions or interruptions are more than welcome and even encouraged
 - ▶ Structure of the interview (informal)

- 1. The problem of AR (General)**
 - ▶ Description of the problem (probes: severity, urgency)
 - ▶ Manifestation in the Netherlands (trends in usage and resistance)
 - ▶ Comparison human and veterinarian sectors

- 2. Dutch policy within the human and veterinary sectors (Boundary Rules)**
 - ▶ Surveillance of resistance (By whom?)
 - ▶ Regulation of usage (government or self-regulation)
 - ▶ Monitoring of regulation (By whom?)
 - ▶ Comparison between sectors

- 3. Position of main actors (Position Rules)**
 - ▶ Role of the own organization (or actor self)
 - ▶ Main state actors
 - ▶ Main professional organizations
 - ▶ Main market actors
 - ▶ Main interest/representative organizations

- 4. Limitations on antibiotics use (Choice Rules)**
 - ▶ Role of state policy objectives
 - ▶ Role of professional guidelines and standards
 - ▶ Presence of inter-organizational dependence
 - ▶ Absence of limitations

- 5. Decision-making within antibiotic policy (Aggregation Rules)**
 - ▶ Direct regulation and coercion
 - ▶ Professional reputation and peer recognition
 - ▶ Inter-organizational negotiation
 - ▶ Role of market mechanisms

- 6. Possible pay-offs of involved actors (Payoff Rules)**
 - ▶ External security of organization and predictability
 - ▶ Individual material gain/market reputation
 - ▶ Peer recognition /Professional development
 - ▶ Sustainability of the resource system

- 7. Ability of individual (collective-)actors to combat AR (Scope Rules)**
 - ▶ Administrative expertise and ability to enforce
 - ▶ Compliance to guidelines and ability to bench-mark
 - ▶ Existence of inter-organizational trust and control over member behaviour.

8. Changes in antibiotic policy (Institutional evolution)

- ▶ Scientific developments with regard to AR
- ▶ Changes in Public opinion and political pressure
- ▶ Learning: human/veterinary cooperation and knowledge exchange

9. Conclusion

- ▶ Summary of the main trends within antibiotic consumption and resistance in the Netherlands
- ▶ Summary of the effectiveness of policy within the field of antibiotics use
- ▶ Thank respondent, reinsure confidentiality; a draft version will be supplied if appreciated.

Appendix 3: List of Respondents

This overview lists the respondents that were interviewed. It contains their names, the main functions on basis of which they were asked to participate and the location at which the actual interview took place.

Face to Face:

- ▶ Mr. B.G.M. (Björn) Eussen: *Secretary FIDIN, Ten Hague.*
- ▶ Mrs. dr. C.J.M. (Christijanne) Brusckke: *Chief Veterinary Officer Ministry of Economic affairs, Agriculture and Innovation (EL&I), Ten Hague.*
- ▶ Mr. dr. A.W. (Arjen) van de Giessen: *Head of Division 'Dier&Vector' RIVM, Bilthoven.*
- ▶ Mr. dr. S.J. (Hugo) de Groot: *Association Executive, policy advisor Animal Production and Veterinary Public Health (AP-VPH) KNMvD; Freelance contract assessor/Expert Dutch Accreditation Council, Houten.*
- ▶ Mr. A. (Toon) van Hoof: *Board member ZLTO; Portfolio manager Animal Health & Welfare LTO Nederland; Dairy farmer, Asten-Heusden.*
- ▶ Mr. B. (Bennie) Hutten: *Commercial Manager ForFarmers, animal feed supplier, Lochem.*
- ▶ Mrs. dr. J. (Jolanda) Jansen: *Communication consultant at Wageningen UR Livestock Research; Expert on effective communication strategies to improve animal health, Nijmegen.*
- ▶ Mr. prof. dr. J.A.J.W. (Jan) Kluytmans: *Professor of Microbiology and Infection Control Vumc, Amsterdam; Consultant microbiologist at Amphibia Hospital, Breda.*
- ▶ Mrs. dr. M.F.M. (Merel) Langelaar: *Coordinating Inspector Dutch Health Inspectorate (IGZ) specialist in Infectious diseases, antimicrobial resistance & zoonosis; Scientific secretary Health Council of the Netherlands, Nijmegen.*
- ▶ Mr. prof. dr. D.J. (Dik) Mevius: *Professor Antimicrobial Resistance at CVI-Lelystad; Coordinator MARAN-reports; Member Expert panel Veterinary Drug Authority (SDa), Utrecht.*
- ▶ Mr. dr. A.J. (Han) de Neeling: *Laboratory for Infectious Diseases and Perinatal Screening, RIVM. Co-author Nethmap-reports, Bilthoven.*
- ▶ Mr. A. (Alfons) Olde Loohuis: *General Practitioner, Herpen; Coordinator GP-trainers at Radboud University Nijmegen Medical Centre, Nijmegen.*
- ▶ Mr. J. (Jos) van de Sande: *Manager Public Health at the Community Health Service (GGD) Hart voor Brabant, 's Hertogenbosch.*

- ▶ Mr. D. (David) Speksnijder: *Veterinarian; Phd Student Faculty of Veterinary Medicine involved in a study of antibiotic prescription by veterinarians, Utrecht.*
- ▶ Mr. H.W.A. (Henny) Swinkels: *Director Corporate Affairs VanDrie Group; Board Member of the Product board Livestock & Meat; vice-president of The Dutch Meat Association (COV); Board Member of The Foundation for Quality Guarantee of the Veal Sector (SKV).*
- ▶ Mr. Prof. dr. J. (Koos) van der Velden: *Professor and head of Department Public Health Radboud University Nijmegen Medical Centre, Nijmegen.*
- ▶ Mr. R.J. (Roeland) Wessels: *Owner-consultant St. Anna Advies; Spokesman of the Animal Health Authority (SDa), Nijmegen.*

Telephonic:

- ▶ Mrs. E.J. (Ellen) de Boer: *Policy Advisor Infectious diseases Ministry of Health, Welfare and Sports, Ten Hague.*
- ▶ Mr. prof. dr. ir. S. (Siem) Korver: *Director Public Affairs Food, VION N.V.; part-time professor Food, Farming, and Agribusiness Tilburg University; Board-member The Dutch Meat Association (COV); Vice-president Product Board Livestock and Meat, Tilburg.*
- ▶ Mrs. J.M.E. (Jolanda) van der Kamp: *Policy Advisor Infectious diseases Ministry of Health, Welfare and Sports, Ten Hague.*

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Appendix 5: List of abbreviations

AR	Antimicrobial Resistance
AMGP	Antimicrobial Growth Promoter
CIb	Centrum voor infectieziektebestrijding/Center for Infectious disease control
CPR	Common-Pool Resource
CVZ	College voor zorgverzekeringen/Health Care Insurance Board
DDD	Daily Defined Dosage
EMEA	European Medicines Agency
ECDC	European Centre of Disease prevention and Control
ESAC	European Surveillance of Antimicrobial Consumption
EL&I	Economische zaken Landbouw & Innovatie/Economic affairs, Agriculture & Innovation
ESBL	Extended-spectrum beta-lactamase
FIDIN	Fabrikanten en Importeurs Diergeneesmiddelen Nederland/Federation of the Dutch Veterinary Pharmaceutical Industry
FTO	Farmaco Therapie Overleg/Pharma-Therapeutic Consultations
IGZ	Inspectie voor de Gezondheidszorg/National Health Inspectorate
IKB	Integrale Keten Beheersing/Integrated Chain Management
KNMvD	Koninklijke Nederlandse Maatschappij voor Diergeneeskunde/ Royal Veterinary Association of the Netherlands
LHV	Landelijke Huisartsen Vereniging/National Association for General Practitioners
LTO	Land- en Tuinbouw Organisatie Nederland/Dutch Federation of Agriculture and Horticulture
MARAN	Monitoring of antimicrobial resistance and antibiotic usage in animals in the Netherlands
MDR	Multidrug Resistant
MRSA	Methicillin-resistant Staphylococcus aureus
NHG	Nederlandse Huisartsen Genootschap/Dutch Society of General Practitioners
NPA	NHG-Praktijkaccreditering/NHG-Practice Accreditation.
NVWA	Nederlandse Voedsel en Waren Autoriteit/the Netherlands Food and Consumer Product Safety Authority
nZA	Nederlandse Zorgautoriteit/The Dutch Healthcare Authority
RIVM	Rijksinstituut voor Volksgezondheid en Milieu/National Institute of Public Health and the Environment
SDa	Autoriteit Diergeneesmiddelen/Veterinary Drug Authority
SFK	Stichting Farmaceutische Kengetallen/the Foundation for Pharmaceutical Statistics
SWAB	Stichting Werkgroep Antibiotica Beleid/Dutch Foundation of the

	Working Party on Antibiotic Policy
UDD	Uitsluitend Door Dierenarts/ Exclusively by a Veterinarian
WHO	World Health Organization
WVAB	Werkgroep Veterinair Antibioticabeleid/Working party of Veterinary Antibiotic policy
ZLTO	Zuidelijke Land- en Tuinbouw Organisatie/Southern Federation of Agriculture and Horticulture