Engaging scientists : organising valorisation in the Netherlands

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1 Introduction

The goal of this first chapter is to introduce a focus for the empirical chapters and concluding chapter of this thesis. To this end, I will first consider the practical and scientific discussions about valorisation. First, I will provide a consise policy overview of valorisation as well as the response of academics to this policy in public debate (section 1.1). Then, I will discuss New Public Management (NPM) as a policy paradigm which has greatly influenced public sector policy-making, including science policy-making, in the past three decades (section 1.2). Next, I will consider the relationship between government and science. NPM is influenced by Principal-Agent Theory (PAT), which can be used to conceptualise the relationship between government and science as a principal-agent relationship (section 1.3). Understanding the characteristics of NPM and PAT will help us to understand the rationales behind valorisation policy, as well as the potential tensions between the policy and academic practice. Subsequently, I will discuss literature about the organisational (section 1.4.1) and evaluation aspects (section 1.4.2) of valorisation. After that, I will discuss the research questions of this thesis (section 1.5.1). I will explain how the insights from sections 1.1-1.4 have resulted in the research questions. Also, I will introduce the methodology and empirical chapters (section 1.5.2) and comment on the social robustness of the study (section 1.5.3). Finally, in section 1.6 I will indicate where this thesis aims to add to existing scientific literature.

1.1 Valorisation policy and the resulting debate in the academic community

In this section I briefly discuss the most important policy documents concerning valorisation. The purpose of this discussion is not to reconstruct or precisely understand how valorisation policies were developed, but rather to provide an overview of the policy documents that influenced the debate in the academic community.

In 2004 Dutch Minister of Science Van der Hoeven issued a policy paper (Wetenschapsbudget 2004) (Ministry of Education, Culture and Science 2004) in which the use of academic knowledge for the benefits of society was appointed a core goal of science policy in the Netherlands. The Minister was among the first to use the label 'valorisation' to describe the legally prescribed third task of universities: transferring knowledge for the benefit of society (Higher Education and Research Act (WHW) 1992, article 1.3). Terms such as societal impact, societal relevance, societal value and societal benefits had previously captured this task. Valorisation was introduced as a term in response to the European Lisbon Treaty to underline the importance of universities collaborating with private organisations in order to close the 'knowledge gap' (Ministry of Education, Culture and Science, 2004). It was announced that additional valorisation policies would be issued during the following years. Subsequent communications from the Ministry broadened the scope of valorisation by also including non-commercial activities (e.g. Ministry of Science 2005). The official definition of valorisation used by Dutch government is *'the process of creating value from knowledge by making it suitable and/or available for economic and/or societal use and translating it into competitive products, services, rocesses and entrepreneurial activity*[1]*'* (Nederland Ondernemend Innovatieland 2009).

1 Since 2009, the word 'competitive' has been omitted.

Minister Van der Hoeven may have been the first to use the label of valorisation, but she was not the first Minister of Science to touch upon the relevance of science for society. As early as 1974, in a bill on science policy (Nota Wetenschapsbeleid) Minister of Science Trip had questioned whether the investments in basic science since the Second World War had resulted in the desired consequences. The bill stated that the most important goal of future science policy would be to align research to society's priorities (Faasse 2011). To this end, three new policy instruments were introduced: Advisory Councils on Research, national research programmes in areas with societal and economic relevance, and foresight exercises. In 1979, Innovation-Oriented Research programmes were introduced; in the 1980s the government set up strategic research programmes and the research council introduced priority programmes to link basic research to societal challenges (Van der Meulen & Rip 1998); and in the 1990s the Fund for the enforcement of the Economic Structure (FES) supported science with the aim of strengthening the position of the Dutch knowledge economy.[2]

Nevertheless, the introduction of valorisation in 2004 was the first time contributions to societal benefits were expected across the entire spectrum of academic research: from basic science to applied science, from the humanities to physics and from the level of single projects and individual researchers to the level of large-scale research programmes and organisations. As announced, additional valorisation policies were developed and implemented. Examples are the Top Sector policy[3], the performance agreements between government and universities and the Science Vision 2025[4]. The growing importance of societal relevance in the Standard Evaluation Protocol (SEP) and the introduction of the knowledge utilisation paragraph by the Dutch research council NWO are a further results of the valorisation policy announced in 2004 (Nederland Ondernemend Innovatieland 2009). Gradually the term valorisation penetrated the vocabulary of Dutch academics.

In my personal vocabulary, valorisation refers to the ongoing process of academics interacting, before, during and after working on a specific research project, with individuals and organisations outside their own peer community, to realise a change in the way of thinking and/or acting of themselves and the individuals and organisations with which they interact, with the ultimate goal of contributing to a change in societal practice(s). This can be in direct interaction with individuals and organisations in society, but also by facilitating research by academics in other research fields.

Nowadays, hardly any Dutch discussion about science is held without explicitly or implicitly referring to valorisation, usually followed by critical remarks. It is discussed as a difficult task, which evokes many questions and sometimes even frustrations. I would like to discuss the

2 http://www.rathenau.nl/nc/web-specials/de-nederlandse-wetenschap/financiering/overheid/fes-programmas-voor-kennis-en-innovatie.html

3 The goal of the top sector policy is to intensify collaboration between public research and industry in nine sectors (http://topsectoren.nl/home accessed 10-07-2014). Since 2011, a significant share of the research council's annual budget has been earmarked for collaboration with private partners from one of these nine sectors.

4 As the Science Vision 2025 (Wetenschapsvisie 2025) of the Dutch Minister of Science (Ministry of Education, Culture and Science, 2014) was published after this thesis was written, it is not discussed in detail.

following examples to illustrate the – at times very emotional – reactions that valorisation evokes.

In 2013, four prominent Dutch scientists were invited to take part in a prime-time talk show (De Wereld Draait Door). They were asked to nominate a word as a candidate for abolition. One of them, a full professor in astronomy, nominated valorisation. According to this scientist, the Dutch research council NWO uses the label of valorisation to make academics promise commercial benefits of their research in advance of the research being carried out. As he said, simply hearing the word valorisation is reason *'…to get my Kalashnikoff'*. The other three academics participating in the discussion held similar, albeit less extreme, views. As we will see in Chapter 2, NWO does not use the label 'valorisation', but rather 'knowledge utilisation'. Also, NWO has a broad understanding of knowledge utilisation which is not limited to economic benefits. NWO even offers an opt-out for fundamental research without any opportunities for valorisation. This example shows that even experienced and prominent academics do not know exactly what is expected of them, which causes valorisation to be considered problematic.

The Young Academy (De Jonge Akademie, an independent platform of junior top scientists within the Netherlands Royal Academy of Arts and Sciences (KNAW)), (NRC 2010) reasons along the same lines. It argues that the term valorisation is mainly used to refer to the short-term application of knowledge for commercial benefits or governmental policy-making, of which the outcomes should be predictable and easily demonstrable. The Young Academy fears that valorisation will be detrimental for basic research. Again, this example demonstrates that valorisation is misunderstood. Additionally, it shows that academics fear the policy may interfere with academic practice and - most likely - not for the good.

Platform H.Nu (a platform of academics that strives for reformation within Dutch universities) describes the contemporary university as *'…a knowledge plantation where inspectors, control and Taylorism enforce as much valorisation as possible.'* The authors call for a change which entails universities as organisations that stimulate knowledge development and exchange (Halffman & Radder 2013). This example shows that academics experience valorisation policy as a negative influence, although they support the idea of knowledge exchange.

The Science in Transition (2013) movement (a collective of academics advocating a range of changes in the Dutch science system) holds another perspective. It suggests that there is a bitter taste to the term 'valorisation.' The movement argues that scientists are too involved with knowledge production for small peer communities, and calls for more societal influence on the scientific research agenda. It suggests valorisation (for instance a public lecture from time to time) is used as an excuse to continue niche research (De Groene Amsterdammer 2014). In other words, the movement invites academics to take their societal responsibility seriously.

Then there are those academics who muddle through, some more successfully than others, aiming to contribute to society by valorising their research. Their struggle becomes visible during such events as valorisation symposia that have been organised in recent years, for example by the Rathenau Instituut in collaboration with the Young Academy in 2011 and by the Department of Social Sciences of Utrecht University in 2014. The discussions during these

symposia show that, regardless of normative standpoints towards the policies, the practical aspects of valorisation are also ground for questions. Just a few examples of such questions are: Can academic autonomy be maintained when collaborating with a company? How much time should be devoted to valorisation? Will scientific quality suffer from valorisation efforts? Will valorisation activities add to academic reputation? The gut feeling concerning the answers to these questions differs per academic. In short, academic communities have not yet reached consensus about how to include valorisation in academic practice, and individual academics are struggling to include valorisation in their research.

The selection of responses by the scientific community to valorisation policies discussed above makes clear that science policy is not easily translated from government via intermediary organisations to academics. It is evident that valorisation policies and their intentions are not taken for granted. Is it the term, which suggests it is about commercialising research and making money, that accounts for this? Or is it the perception that another task is added to an already full agenda? Also, how to valorise research is not evident as the questions from academics indicate. Nevertheless, the idea of adding value to society is not readily rejected. To change the status quo we need to understand how valorisation policy is translated from government to academics and how valorisation can be included in academic practice.

1.2 Public sector policy-making: the decades of New Public Management

Science policy, including valorisation policy, is embedded in larger policy paradigms, which in turn reflect dominant political philosophies. In this section I position the current valorisation policy in the policy paradigm of New Public Management (NPM), which reflects the political philosophy of neoliberalism. First of all, this will help us to identify where tensions between valorisation policy and academic practice may originate from and as such bring focus to the research questions. Second, the larger policy paradigm is the frame in which recommendations to improve the current situation should be implemented. A basic understanding of this frame and its influence on science policy is important if we wish to formulate useful recommendations.

1.2.1 Origin and characteristics of New Public Management

In the mid-1980s a wind of change in policy-making, called New Public Management, gained force in the UK and then blew over the rest of Europe and other OECD countries. The basic idea of NPM entails that clear goals, control and evaluations, and market forces will result in an efficient and effective public sector (Pollit & Bouckaert 2000 cited by Braun 2005). NPM is inspired by two major theoretical sources of inspiration.

The first source can be found in economic theories. A basic idea is that government should let the market organise itself, and interfere as little as possible. It should only structure and steer the market in such a way that competition between organisations is increased. NPM introduced this element of competition to the public sector, aiming to lower costs and increase quality, which ultimately should result in a more efficient use of public funds. In a competitive market environment, the focus is on efficiency and achieving results. To operate in such an environment, the management of public sector organisations has become more autonomous and more powerful. Management behaves in an entrepreneurial fashion and focusses on inputs and

generated outputs rather than processes. It searches for new ways to enhance performance and explores business opportunities to scout for resources other than government funds (Braun 2005).

The second source of inspiration for NPM is principal-agent theory (PAT). PAT can be used to conceptualise the relationship between government and science as a principal-agent relationship in which government delegates the task of conducting research to science in return for such conditions as financial support. As the relationship between government and science is central to this thesis, the origin of PAT and its value for understanding the interaction between government and science will be discussed further in section 1.3.

The influence of PAT on NPM can be recognised in the delegation of tasks through contracts and monitoring. Despite increasing autonomy, public organisations are still largely funded with public resources. This gives government the right to formulate the goals that should be achieved and evaluate whether they actually are achieved (Braun 2005). Contracts include goals, and time-span and incentives are used to stimulate compliance. In some instances, even penalties are included for poor compliance. A well-known Dutch example is the financial penalty imposed on the Dutch railways (NS) if the percentage of trains that arrives late at their destination is higher than agreed. Monitoring is used to detect and counter non-compliance and, if necessary, to alter contracts. The delegation of tasks and monitoring of compliance resulted in the strengthening of hierarchical relationships, both between government and public organisations and between managers and employees within public organisations. As a result of the latter, monitoring within organisations has increased (Ferlie et al. 2008). This general trend is labelled 'accountingisation' (Power & Laughlin 1992, cited by Hood 1995).

Concluding, NPM gave the public sector more operational autonomy to function in a market environment. Simultaneously, the use of contracts to delegate tasks and the use of monitoring to secure compliance increased, which strengthened hierarchical relationships.

1.2.2 The influence of New Public Management on science

Science, among other public sectors such as telecommunications, health care, transport and education, has been subjected to NPM (Schimank 2005; Hansson 2002). What are the implications of the above-described NPM management style on science policy and science?

Before the NPM paradigm, roughly between 1945 and 1980, the relationship between government and science was one of 'blind delegation' (Braun 2003). The inspiration for this relationship of blind delegation was Bush's report 'Science – The endless frontier' (1945). Bush was the first to propose large-scale government funding for fundamental research in times of peace. The underlying assumption of the report is that science should produce knowledge for the benefit of society. In order to facilitate these benefits, Bush suggested that the US government should grant the science system access to long-term public funding as well as a large degree of autonomy and self-regulation (Guston 2000 cited by Lengwiler & Simon 2005; Brooks undated). The system was protected from market and political influences and allowed to produce knowledge in isolation. Results were believed to diffuse to society without any intervention and in this way contribute to societal progress in areas such as health care, safety and industry (Bush

1945). Hence, there was no need for government to develop additional science policies to steer scientific activities into a specific problem area or to stimulate knowledge transfer to society. Although the means in this post-World War II science policy were different, the goal is comparable to the goal of contemporary science policy: the production of scientific knowledge for the benefit of society.

However, in the 1980s it was realised that in economic terms Europe was falling behind the USA and Japan because of poor use of scientific knowledge. Policymakers had to address this gap and started exploring new ways to arrange knowledge production and diffusion (Braun 2005). The expectation of societal benefits from science can be recognised as early as the 1940s (e.g. the Manhattan project), but under NPM the emphasis on such results expanded greatly.

At the same time, policymakers had to address national financial deficits, which provided room for a more efficient and cost-conscious management style in science (Braun 2005). This allowed for external influences in academic quality control and an increase in assessments in all phases of research (Cozzens & Turpin 2000; Braun 2005). In the past, peer review within institutions aimed at assessing scientific validity and novelty was the norm in scientific quality control. Nowadays, assessments are organised at national and even international level and are intended to inform governments and stakeholders of scientific progress. In addition to scientific criteria, other criteria, such as societal relevance and viability of the research group, were introduced to verify whether goals of efficiency and societal value are met (Funtowicz & Ravetz 1993; Gibbons et al 1994; Elzinga 2012; VSNU, KNAW & NWO 2014).

The decreased trust in public services (science was no longer granted the monopoly on knowledge development), the importance attached to societal benefit, government budget cuts (scientists had to find ways to tap into other funds) and new forms of quality control gave society, as a consumer[5] of the science system, greater influence on science (Schimank 2005). Society's involvement can be in managing science, for example in boards of universities or research councils (Mayntz 2002; Ferli et al. 2008; Braun 2005), but also in the actual research process, which is described as participatory science (Braun, 2005; Funtowicz & Ravetz, 1993; Gibbons et al. 1994). The changes in peer review in science and the actual representation of society's voice within academic organisations shows the NPM body of thought is not exclusive to the domain of policy making at ministries. Another example is the focus on efficiency ('rendementsdenken') which university administrators have adopted and which currently is subject to heavy critique within Dutch universities. The critique is most visible at the University of Amsterdam (UvA) where the president of the board resigned as a result of the debate. Also, NPM-related vocabulary introduced by government policy makers is well known to academics, for instance 'knowledge competence cash' ('kennis kunde kassa'). Such words stick with academics and have resulted in uncertainties about the remaining opportunities for fundamental

5 Consumers in a market environment in the sense that their demands influence what is produced and offered. In the literature, multiple conceptualizations of society and members of society in relation to science can be found. For example, society and members of society can be conceptualized as consumers, stakeholders and societal actors. There are subtle yet important conceptual differences between these notions. These differences are discussed in box 3.

research. This shows NPM is not just a notion used to formulate policies at the level of government with limited effects outside ministries. Instead, NPM-inspired policies have resulted in some important changes in the Dutch science system, as discussed in box 1.

Box 1: Changes in the Dutch science system resulting from NPM

In recent decades, Dutch scientists, too, have lost their autonomy and have increasingly had to accept external influences. A first clear sign of the influence of NPM in Dutch science policy is recognisable in a policy paper from 1985 in which universities were given more organisational autonomy in return for conditional funding based on performance (Himanen et al. 2009). The same policy paper stimulated universities to define areas of strength that deserved priority and at national level research priorities were identified that would receive more funding (Geuna & Martin, 2003. From then on, government regularly published new initiatives to steer and monitor universities (Gornitzka & Maassen 2000 in Himanen et al. 2009). In 1993, the reformed Higher Education and Research Act moved away from a focus on facilitating science and instead focused on the output performance of the system. Furthermore, societal actors entered university boards at the expense of collegial governance (Ferlie et al 2008; De Boer 2003). Other examples are the Technological Top Institutes that were established from the late 1990s onward and the large scale national research programmes that ran between 1995 and 2014 (Van der Meulen & Rip 1998). The institutes and programmes are both alliances between science, industry and government which aim to enhance the societal application of research. The governmental valorisation policy introduced in 2004 which is the subject of this thesis is also an example of the increased involvement of societal actors in science. The most recent examples of NPM influences are the 2012 performance agreements between government and all thirteen Dutch universities.

1.2.3 Potential tensions resulting from New Public Management

The influence of consumers on science and the focus on results and assessments that characterise NPM and can also be recognised in the valorisation policy create a number of possible tensions for academics. The influence of consumers and the focus on results may direct science towards short-term, low-risk research, especially now that societal benefits are expected across the entire research spectrum. An often voiced fear is that this development could be unfavourable to science's role as the developer of a pool of new knowledge of which in some cases applications only follow decades later. Another tension is whether science can be held responsible for its results in terms of societal benefits. The conversion of scientific knowledge into societal applications is a difficult process involving many actors. Nevertheless, scientists convincingly have to show the benefits of their research and seem to be solely held responsible for the occurrence of these benefits.

1.3 Relationship between government and science

As briefly mentioned in the previous section, PAT was an important inspirational source for NPM. NPM introduced a principal-agent relationship to the interaction between government

and science. Some scholars argue that despite NPM influences scientists have retained their autonomy and describe the relationship between government and scientists as a 'two-way street' (Braun & Guston 2003). Others argue that NPM without a doubt introduced hierarchies to science, both within science and between scientists and society. It is argued that deans and rectors have become more powerful within universities and governments, and societal actors have become more influential in science (Schimank 2005). Both viewpoints share the idea of a relationship in which science is influenced by government. In this section I will discuss what PAT entails and how it influences the relationship between government and science. This will help to reveal potential tensions in this relationship. These tensions serve as an input to the research questions. Understanding the principal-agent relationship will also facilitate interpreting the results and formulating recommendations in the final chapter.

1.3.1 Origin and characteristics of principal-agent theory

PAT has its roots in agency theory, which aims to describe relationships in which tasks are delegated by one actor (the principal) to another actor (the agent), using the notion of a contract (Jenssen & Meckling 1976). Agency theory concerns two potential problems in relationships between principals and agents. The first relates to agency costs, which occur when the goals of the principal and the agent differ and it is difficult for the principal to examine what the activities of the agent entail. This refers to the costs of monitoring. The second concerns risk sharing. A potential problem is that the principal and the agent may behave differently because of different risk attitudes. This may cause the agent to behave differently than desired by the principal. In other words, the agent may not necessarily comply with the principal's goals. The unit of analysis is the contract between the principal and the agent in which the conditions of the relationship are agreed upon. The theory centres around the question: which contract is most efficient, given the context of the relationship? Specific, whether a contract should be behaviour (process) or outcome (output) oriented (Eisenhardt 1989.)

There are two streams within agency theory: positivist agency theory and PAT. Of these two, PAT is the most relevant for understanding the relationship between government and science as it concerns general principal-agent relationships. However, this stream is also quite abstract (Eisenhardt 1989.) We therefore need to specify PAT to the context of the relationship between government and science.

1.3.2 Theorising the government-science relationship as a principal-agent relationship

Guston (1996) introduced PAT to the field of science policy studies in an attempt to theorise the relationship between government (the principal) and science (the agent). In this relationship, government delegates the task of research to science, and in exchange for performing this task, science receives financial support (Braun & Guston 2003). Guston (1996) states that *'the problem of science policy is the problem of delegation.'* In other words, science policy is about how society can get scientists to do what society needs. For government this is a relevant question, since although science may inherently result in benefits for society, scientists may also have their own goals. The specific elements of the relationship between government and science in the Netherlands are discussed in box 2.

In its relationship with science, government has to make a number of choices, one of which is the degree of autonomy granted to scientists. Should scientists be autonomous in pursuing their own lines of investigation? Or should they be directed towards areas most likely to result in benefits for society? And if they should be directed, how much direction should be provided? A balance is required between directing scientists towards society's needs and allowing them the autonomy they need to thrive and develop new high-quality knowledge (Braun 2003).

The behaviour of scientists in their relationship with government can range from performing exactly as agreed upon to fully pursuing their own goals. The first option secures the promised financial support, but may be sub-optimal in terms of scientists achieving their own goals. The second option may provide more room for scientists to reach their own goals, but it carries the risk that government may cut funds. Performing as agreed upon is referred to as compliance, whereas successfully pretending to perform as agreed upon is referred to as symbolic compliance. If scientists were to fully pursue their own goals, this would be referred to as shirking or defecting. Another option open to scientists is to re-negotiate the contract that is at the basis of the relationship (Guston 1996; Van der Meulen 1998; Leisyte 2007).

In principal-agent relationships, information a-symmetry makes it difficult for the principal to control the behaviour of the agent. In the case of the relationship between government and science, scientists have knowledge about the practice of science that representatives of government do not. This information a-symmetry is the basis underlying two potential problems. The first is adverse selection: because government representatives lack expertise and in-depth insights in scientific research, government has difficulties selecting the right scientists to perform the task. The second is moral hazard: since government delegates a task without the expertise to verify whether the selected scientists perform the task as agreed upon, the scientists may behave in an undesirable manner. They may deliver poor quality, or may choose not to deliver at all (Guston 1996). Because of the internal(ised) motivation of scientists to adhere to standards set by the scientific community (Ryan 2014), moral hazard in the sense of not doing research is less of a problem in this specific principal-agent relationship. However, scientists also have their own goals. Therefore, the moral hazard problem in this relationship is more about whether the chosen research directions are the most promising ones (Schubert 2009). To restore the information symmetry, government acquired the right to monitor scientists' activities in exchange for its financial support (Coleman 1990, cited by Van der Meulen 1998).

Van der Meulen's (1998) conceptualisation of the principal-agent relationship between government and scientists as a game helps us to understand the dynamics created by monitoring. Central to the game are successive cycles of action-reaction in which government and scientists both try to maximise their outcomes of the relationship. In the beginning, government can choose a strategic position on a spectrum ranging from trusting scientists that they will perform as agreed upon to intensive monitoring. Scientists can also choose a strategic position, ranging on a spectrum from full compliance to maximal shirking. However, the trade-off is that if government suspects or detects shirking, this will result in an increase in monitoring. Assuming that the available financial resources to be spent on science remain equal during the game, both actors have good reasons to maintain a balance between their two strategies. The larger the share of the available resources that are required to be spend on monitoring because

scientists are suspected of non-compliance, the smaller the share available for performing the actual task of knowledge development. As such, both parties have an incentive to keep monitoring to a minimum, while safeguarding their own goals.

Within this game, intermediaries have a balancing role (Van der Meulen 1998; Guston 2000). They serve as a bridge between government and science. Usually, they employ peer review to solve the potential problems of adverse selection and moral hazard. There are several types of intermediaries, each serving a specific (set of) purpose(s). Important intermediaries concerning the valorisation policy are research councils, research evaluation systems, research programmes and universities. I will now briefly discuss their respective roles in the relationship between government and scientists.

Research councils serve as intermediaries where scientists select the best peers to perform a certain task and as such have a role in minimising adverse selection (Fernandez-Carro 2007). Additionally, agreements with selected researchers may be formalised in contracts to prevent moral hazard (Caswill 2003). However, the selection of researchers is not without cost and may be as large as twenty-five per cent of allocated funds (Van Arensbergen et al. 2013). The challenge for research councils is to maintain their intermediary position. Behaving too much in line with the goals of either government or scientists will create distrust on the part of the other party and harm the relationship with this specific actor (Van der Meulen 2003). An example is the balance between adopting the indicator culture and managerialism associated with NPM on the one hand and facilitating academic advancement on the other hand (Sa et al. 2013).
Research evaluation systems address moral hazard. These systems may employ indicators, peer review or a combination of the two and serve as a performance verification. During the past three decades, an increasing number of countries worldwide have adopted national research evaluation systems to increase efficiency through competition and accountability of academic research. Evaluations can be used to allocate funds (e.g. in the UK) or as a managerial tool (e.g. in the Netherlands). Also in this specific form of monitoring there are discussions about the financial costs involved. Their efficacy is debated as well, as competition might, for example, lead to homogenisation of research (Geuna &Martin 2003), which may be at the expense of deviating yet promising research lines.

Research programmes are a form of temporary intermediaries, often combining the functions of research councils and research assessments in a specific problem area. They allocate funds and monitor the progress of funded projects. As such, they can be understood as a means to coordinate the behaviour of a selection of scientists (Van der Meulen & Rip 1998; Wardenaar et al. 2014).

Finally, also research organisations, such as universities and other public research institutions are sometimes considered as intermediaries, brokering between the interests of government and scientists (Morris 2002). They translate government policies to academic practice and have a role in training and selecting scientists as well as monitoring their research activities.

Box 2: Relationship between government, intermediaries and scientists in the Netherlands

Current relationships between government, scientists and intermediaries in the Netherlands are characterised by aggregation and consensus building. The dense level of well-interconnected intermediaries and consensus building between representatives of different disciplines diminishes the steering capacity of government. For example, despite the emphasis on relevance, researchers were for a long time able to neglect this emphasis and continue to pursue their own goals. Increasingly, societal organisations are involved in the circuit of consensus building. For example, the Confederation of Netherlands Industry and Employers (VNO-NCW) was involved in developing the national valorisation agenda (Nederland Ondernemend Innovatieland, 2008.) If consensus between government and intermediaries is reached, horizontal co-ordination does not usually require much effort nor are strong incentives from government required to implement policies. Rather, the Dutch government has the task of setting up and facilitating fruitful interactions between intermediaries (Rip & Van der Meulen 1996; Van der Meulen and Rip 1998).

1.3.3 Potential tensions resulting from the principal-agent relationship between government and science

Conceptualising the relationship between government and scientists using PAT allows us to identify several issues concerning valorisation policies introduced by government. The first issue is whether scientists understand what the additional task delegated to them entails. Without a clear understanding, scientists may not be able to execute the task as intended. The second issue is how adverse selection and moral hazard can be minimised through monitoring in ex-ante and ex-post assessments by intermediaries in such a way that a balance between scientists' autonomy and government's direction is maintained. In the past decade, valorisation criteria have been introduced by research councils in a number of countries (Dance 2013) and ex ante assessment systems (e.g. in the UK and the Netherlands). Too much control and direction towards (certain areas of) valorisation may have a negative effect on science. The third issue is how scientists can unite the valorisation task with their own goals. Scientists have to redefine the balance between the development of new knowledge in promising areas and the production of benefits for society. The fourth issue is the role of intermediaries. They serve as a bridge between government and scientists by translating government policy to scientific practice on the one hand and by translating scientists' needs to government on the other hand. In the case of valorisation policies, intermediaries run the risk of becoming too much associated with government if they place a strong emphasis on valorisation. Conversely, if they do not implement valorisation policies, government may perceive them as being too closely associated with the scientific community.

1.4 Societal benefits of scientific research

From NPM management literature, we learned that government expects scientists to be susceptible to the influence of their consumers in society to generate societal benefits; scien-

tists are also expected to show that these benefits actually occur and are generated efficiently (Hicks et al 2004 cited by Donovan, 2007 and Donovan, 2007). PAT literature introduced two notions of uncertainty concerning these expectations. The first is adverse selection. In the context of valorisation, adverse selection is about the selection of scientists most capable of doing research in such a way that it leads to societal benefits. The second uncertainty is moral hazard. In the context of valorisation that is about whether scientists follow a research approach that is most likely to result in societal benefits. In section 1.4.1 I discuss why involving societal actors in scientific research is believed to induce societal benefits. Transdisciplinarity is discussed as an approach that is acknowledged as being an effective approach in this respect. In section 1.4.2 I discuss research evaluations as a means to stimulate, or even direct, scientists into involving societal actors and producing societal benefits. In both sections I will identify problems associated to current practices. These problems serve as an input for formulating the research questions.

In international scientific discussions, valorisation is best captured by impacts or benefits. As the meaning of valorisation is framed by the Dutch policy context, the meanings of the internationally used terms and valorisation do not perfectly overlap. To prevent misunderstandings, I will follow international scientific literature and use societal benefit in this section. Instead of the perhaps more often used term societal impact I use the broader term of societal benefits to describe the ultimate results of valorisation processes. Societal benefits refer to all benefits to society resulting from scientific research. They include specific societal impacts in the sense of changes in the behaviour or thinking of societal actors (Spaapen & Van Drooge 2011), but also more generic benefits such as an improved knowledge infrastructure.

1.4.1 Generating societal benefits

Involving societal actors to induce societal benefits
Government expects scientists to include societal actors in research to adapt knowledge production to their needs and to stimulate their use of academic knowledge. The involvement of societal actors is believed to contribute a practical perspective to science, as societal actors are not driven by scientific rewards but by rewards related to the solution of specific real-world problems (Podestá 2013). Indeed, their involvement has been linked to the production of research results with a practical application (e.g. Walter et al. 2007; Raftery 2009; Meagher 2008; Rogers 1995; Clark and Holmes 2010; Jolibert & Wesselink 2012). I use the term societal actors rather than the NPM concept of consumers or the much used notion of stakeholders when describing the influence of society on science. Box 3 offers an explanation for this decision.

Box 3: About consumers, stakeholders, societal actors and non-peers

NPM refers to consumers when discussing the influence of society on science. Within science studies, individuals and organisations in society are often referred to as stakeholders of science. In this box I will explain why in my opinion these terms fail to capture the diversity of roles actors from society can have in scientific research and hence why I

prefer the term societal actors. Also, I will explain why in some cases non-peers can have a similar role to societal actors.

'Consumers' suggests a rather passive role of society in generating societal benefits. A consumer can be defined as the final user (an individual or organisation) whose use does not improve the product. A consumer has the option to buy or not to buy and thereby may influence what is produced, but is not involved in developing the actual product. In other words, positioning society as a consumer excludes society from having a role in generating societal benefits.

The notion of a **stakeholder** introduces a dynamic element to the role of society in knowledge development. Freeman (1984:46) defines a stakeholder as *'any group or individual who can affect or is affected by the achievement of the organisation's objectives.'* In contrast to the rather passive notion of a consumer, a stakeholder can influence the development of societal benefits. However, the notion also suggests a division between user and producer. A stakeholder does not take responsibility for the actual process, but rather expresses needs or exerts influence from the side-line, awaiting the effects of the outcomes of the process. As such, the actual involvement of society in the primary process of knowledge development seems to be poorly captured using the notion of stakeholders.

Therefore, I prefer to use the term **societal actors** to describe the role of organisations and individuals in society in scientific research when discussing how societal benefits of science are generated. Acknowledging that science and scientists are part of society as well; 'societal' in societal actors emphasises that these actors' core activities are not within the realm of science. Their primary responsibilities can be found in other areas, for instance in policy-making, business or in public debate. Nevertheless, scientific knowledge may help them execute their tasks. 'Actor' in 'societal actors' emphasises society, and the individuals and organisations it is composed of may have an active role in the primary process of knowledge development and in generating societal benefits. In some instances this may even be as an equal partner to scientists, sharing full responsibility for both the research process as well as its outcomes.

Non-peers, academics from a different research domain, can have a role in valorisation similar to societal actors. Despite their prime responsibility being in research, this responsibility is within a different research domain. To improve their scientific work, non-peers may benefit from insights from other disciplines. For example, the results of this thesis may be used by academics outside the peer community of science policy studies to improve their valorisation practices. Non-peers have contributed to this thesis with their questions, data and experiences and will hopefully benefit from the insights from this thesis. In chapter 4 an explanation will be given of how valorisation between academics can lead to societal benefits.

To fully benefit from the involvement of societal actors, the literature suggests they should be involved in all phases of research (Pohl & Hirsh Hadorn 2008; Voinov and Brown Gaddis 2008; Peer & Stoeglehner 2013). But what are their specific contributions? According to the literature, in the initiating phase of a project, their involvement is believed to help orient the research towards practical applications by generating societally relevant research questions and contributing contextual knowledge (Rietchel et al. 2009; Brousselle et al. 2009; Molas-Gallart & Tang 2007; Phillipson et al. 2012; Jolibert & Wesselink 2012; Siegel et al. 2003). In the phase of actual research, societal actors can provide access to real-world cases, including otherwise difficult to obtain data (Voinov & Brown Gaddis 2013; Molas-Gallart & Tang 2007; Phillipson et al. 2012). In disseminating and implementing results, the involvement of societal actors is found to enhance the understanding of local contexts of application concerning issues such as practical constraints and the language used (O'Fallon & Deary 2002; Weichselgartner & Kasperson 2010).

Transdisciplinary research

A research configuration in which societal actors adopt an equal role to academic researchers is called transdisciplinary research. A uniform definition is not available (Pohl 2011), but a general description can be provided (Carew & Wickson 2010; Walter et al. 2007; Wagner et al. 2009; Wickson, Carew & Russel 2006). Ideally, it differs from traditional disciplinary research in several ways. Instead of scientific problems, the focus is on societal challenges, like climate change, healthy aging or sustainability. In transdisciplinary research researchers are no longer rewarded based on traditional academic rewards structures with their emphasis on publications and citations as identified by Merton (1957) (Carew & Wickson 2010). Also, the strict boundary between science as knowledge producer and society as knowledge user is relinquished. In these shifts, we can recognise the changes intended by NPM: science contributes to solving societal problems, loses its autonomy in doing research and is oriented to the market for rewards. The development of transdisciplinary research is recognised, but not necessarily labelled as such, by concepts like 'post-normal science' (Funtowicz & Ravetz 1993), 'Mode 2' (Gibbons et al. 1994) and 'Triple Helix' (Etzkowitz & Leydesdorff 2000).

Although it is a generally accepted belief that transdisciplinary research is conducive to generating societal benefits, it is less clear whether and how the two are linked to one another (Jolibert & Wesselink 2012; Phillipson et al. 2012). Understanding this link will help to develop quality criteria for the involvement of societal actors in academic research (Carew & Wickson 2010). However, Weingart (1997) questions whether there are any empirical examples of research that is in actually organised in a transdisciplinary research mode. For example, he argues that although research programmes may formulate transdisciplinary goals, projects within these programmes are still organised along disciplinary structures. According to Weingart, at best examples may be found of multidisciplinary research in which the research process is broken up into disciplinary sub-projects which are eventually integrated.

Altogether, it remains unclear whether research is organised in a transdisciplinary fashion on a large scale, whether research that is labelled as transdisciplinary is actually organised in that specific manner, and how transdisciplinary research results in societal benefits.

1.4.2 Demonstrating societal actor involvement and societal benefits

Evaluation as a part of life

Within the NPM paradigm, evaluation is believed to be a key mechanism to control public organisations (Lane 1993). An evaluation is usually characterised as a process in which four basic elements can be identified: 1) an evaluand, 2) a form of assessment based on a number of criteria, 3) a methodical approach to assemble the information on the performance of the evaluand on the criteria and 4) a clear aim for the use of its results. The process of evaluation considers day-to-day practice using unconventional viewpoints to analyse it. In that role, they provide room for questions and reflections that may lead to new interpretations and change of day-to-day practice (Dahler-Larsen 2011.)

Dahler-Larsen (2011) argues that we live in an evaluation society. In such a society, evaluation is institutionalised in everyday life. There are tools specifically designed to evaluate (evaluation methods), people who dedicate their professional life to evaluating (evaluators) and even systems which increasingly take over evaluating from individuals (Rist and Stame 2006). Also, evaluation is ongoing and has become an administrative routine (Hellstern 1986.) Evaluations facilitate learning and improvement and as such are believed to be inherently good and therefore are difficult for individuals to oppose as a phenomenon (Dahler-Larsen 2011). In other words: evaluation has become part of our culture.

The institutionalisation of evaluation and the belief that evaluation is a way to learn and improve may lead to unfounded optimism. There is the idea that evaluation based on a poor understanding and measurability of the process is better than no evaluation, as it will at least provide some insights. The then remaining measurement issues can be dealt with along the way. However, these good reasons to introduce evaluations may have unexpected and undesired consequences (Dahler-Larsen 2011).

The large-scale evaluation of societal actor involvement and societal benefits as a new phenomenon

As described above, in the post-World War II era, science was believed to inherently result in societal benefits by automatic diffusion of knowledge to society. Hence, assessment of societal benefits and the processes leading to these benefits were generally considered irrelevant. Nevertheless, the assessment of the societal benefits of specific mission -oriented programmes, such as travel to the moon, were an exception. From the 1970s onward, societal benefits of more generic strategic programmes were also assessed. Within these programmes basic science was carried out, with the expectation that it would lead to solutions for practical problems. The assessments were carried out by expert panels and evaluation professionals (Rip 2003.)

In recent years, there has been a trend of increasing evaluation of societal benefits. For example, the national research evaluation systems in the UK (Research Excellence Framework) (REF)) and the Netherlands (Standard Evaluation Protocol (SEP)) require all research units to present their realised societal benefits for ex-post evaluation (REF 2014; VSNU et al. 2014). Also, research councils in an increasing number of countries require researchers to address societal benefits in funding procedures. In some countries, it is even mandatory (Dance 2010). The evaluation of

societal benefits in national evaluations and by funding councils is usually done through peer review. However, most academics are inexperienced at evaluating societal benefits, and this development may have adverse effects (Martin 2011).

However, some promising evaluation methods are available. Best practices consist of narratives and additional relevant quantitative and qualitative indicators (Donovan 2011). Examples are the Payback Framework, which initiated and is mainly used in health research, but the scope of which has recently been expanded to also include the social sciences and humanities (Donovan & Hanney 2011; Klautzer et al. 2011) and the SIAMPI approach (Spaapen & Van Drooge 2011; Molas-Gallart & Tang 2011). Despite these practices, there are still numerous challenges to be tackled.

Challenges in evaluating societal actor involvement and societal benefits
Implementing poorly developed evaluation methods and procedures may have negative consequences (Dahler-Larsen 2011.) This warning is not stopping intermediaries in the science system to implement societal benefit evaluation on a large scale. What are the specific challenges related to the evaluation of societal actor involvement and societal benefits of academic research? In this sub-section I will discuss some of the methodological and more practical challenges. An overview of these challenges and related questions can be found in table 1.1. A concise description of current evaluation practices of societal actor involvement and societal benefits in the Netherlands is provided in box 4.

A first methodological challenge is selecting the right evaluation approach to assess societal actor involvement and societal benefits. Evaluations in the context of NPM and principal-agent relationships have a specific interest in assessing whether a task is performed as agreed upon. Such an evaluation in which the emphasis is on accountability is referred to as a summative evaluation. Its counterpart is a formative evaluation, in which the emphasis is on learning and improving (Scriven 1996). If accountability is the main objective, we have to deal with the issue of attribution (Spaapen & Van Drooge 2011). In many cases, multiple studies from multiple research collectives contribute to the ultimate societal benefit. On top of that, it is not only scientific contributions that matter, but also societal contributions and events. Some benefits would not have occurred without private investments, whereas other benefits may not have occurred because of a change in government. Acknowledging this, who should be given the credit for the benefits generated? And if benefits did not occur for reasons outside the span of control of researchers, can they be held accountable for that? If improving is the main objective, a focus on contribution instead of attribution may facilitate learning as it reveals the underlying processes (Spaapen & Van Drooge 2011; Molas-Gallart & Tang 2011)

A second methodological challenge is to define societal benefits. A definition will determine how societal benefits are assessed, but agreement has not yet been reached as to what this definition is (Grant et al 2009; Donovan 2011). Bornmann (2013) identifies three main strands of benefit definitions. The first considers societal benefit as knowledge with societal relevance embodied in a product, for example a book or software. A second strand considers impact as knowledge use by societal actors. This may be facilitated by products, for instance the use of a policy report by civil servants, or people, for instance researchers providing training for professionals. The third stream defines benefits as the positive results that actually occurred, in terms

of safety, health, business activity, culture etcetera. The difficulty of having multiple definitions of benefit is that this may distort the outcomes within an assessment and the comparability between assessments or research fields. Box 4 provides an overview of different terms and their definitions. Also, examples are provided to show how I use each term in this thesis.

Box 4: From societal relevance to societal benefits.

The rationale behind the definitions of the different terms related to societal benefits, is inspired by the basics of Logic Model development (W.K. Kellogg Foundation, 2001). A logic model visualizes the links between activities, outputs, outcomes and immediate, intermediate and ultimate impacts. As such, it shows the path from relevance to benefits.

Societal relevance is defined as the potential of research activities to result in societal benefits (Hessels 2010). It can be recognized in the topic of research, but for research to have societal benefits, additional efforts are required. For example, a study on bullying on schools' playgrounds may contribute to diminishing bullying, but the topic of research alone does not create a difference in bullying.

Societal output is defined as the products resulting from research that are used to communicate with societal actors. Although some studies (e.g. Boekholt et al. 2007) consider societal output as impact, I consider these outputs as a crucial step towards societal benefits, but not a benefit on its own. Building upon the example of bullying on schools' playgrounds, an intervention method that can be used by teachers to diminish bullying is an important step towards societal benefits. However, the mere publication and distribution of an intervention method is not enough to result in benefits.

Societal outcome is defined as the use of knowledge. Yet, in some studies use is considered as impact (e.g. Moffat et al. 2000; Roessner et al. 2006; Castro-Martinez et al. 2008). Again, I consider use as a crucial step towards benefits, but not as a benefit on its own. The use of an intervention method to diminish bullying on schools' playgrounds is required for the research to create societal benefits, but on itself does not guarantee societal benefits.

Societal impact is defined as the changes in the behavior or thinking of societal actors (Spaapen & Van Drooge 2011). In the case of the bullying example, this could be a difference in the way the teacher approaches bullying, a difference in the way children think about bullying and/or less bullying on schools' playgrounds.

Societal benefits is defined as the wider effect of research on society. This include specific societal impacts, such as less bullying, but also effects such as increased levels of happiness of school children and improved school grades.

A third methodological challenge is to develop a set of indicators that allows us to assess different types of benefits across different research disciplines without introducing undesired incentives. The emphasis of current indicators seems to be on technological and commercial impacts. For instance, patents represent a widely used indicator, but one that only assesses a potential in the earliest stages of impact (Donovan 2007). However, even in the natural and life sciences, only a minority of the researchers hold a patent (Balconi et al. 2004, Agrawal & Henderson 2002) and researchers in the social sciences and humanities are almost entirely excluded from using this indicator. As concerns all assessments, in assessing societal benefits, too, one has to be aware of the perverse effects indicators that may have (Rand, 2009). In the evaluation of scientific production, the 'number of publications' criterion directed some scientists towards strategies such as 'salami publishing' (publishing a study in multiple units to have more papers) (Broad 1981). This is a warning for the development of societal benefit indicators, for example to prevent irrelevant patenting or an overkill of courses for high school students. Also, valuing certain impacts more highly than others may stimulate these benefits more, whereas the less valued impacts may be neglected despite their importance for society.

A fourth challenge is to define the evaluand to which the benefits identified can be attributed or that can be said to have contributed to the benefits. The evaluand of societal benefit evaluations can be institutions, departments, groups, individuals, funding schemes, disciplines, programmes, projects or even single outputs. Examples of each can be found in the literature (e.g. Library House 2006; Hanney et al. 2004; DeLange & Muldur 2007; Simmonds et al. 2009; Walter et al. 2007; Boekholt et al. 2007; Burdorf et al. 2009; Prins 2008). The debate on what is the appropriate evaluand to evaluate societal benefits is still ongoing. Can individuals be expected to have an impact track record or is impact a group effort by nature? And should the results of every single project be assessed, risking the stimulation of disseminating knowledge to the societal domain that is not yet socially robust?

A fifth methodological challenge is how to define the appropriate instance of evaluation. Whereas outputs and possibly use can be evaluated after relatively short time frames, actual benefits may take time to occur and they may grow in size over time. However, waiting too long may introduce a hindsight bias (Sanna & Schwarz 2003) or create difficulties retrieving evidence and the individuals involved. This introduces the issue of temporality (Spaapen & Van Drooge 2011) and raises the question of what the appropriate time frames are to evaluate them. As researchers may have changed position within the applied time frame, a related question is to which institution the benefit can be attributed: the institution that employed the researcher at the time the research leading to the impact was conducted, the institution that employed the researcher when the impact occurred, or the institution that employs the researcher at the time of the evaluation?

A sixth methodological challenge is how to include the societal actor perspective in evaluations (Grant et al. 2009). Societal actors are not always easily identified as they may not necessarily be formal project partners (Olmos-Penuela et al 2014). Also, they may not be aware of all the benefits that occurred or of the contribution of the research to the benefits. And on what type of societal actors should the focus be placed? In the case of new technologies, is it about the commercial benefits for the company which adopted the technological knowledge, or is it about the impact these technologies have on patients, professional users or society at large?

The evaluation of societal actor involvement and societal benefits also has some practical challenges. The first is how to keep the burden related to collecting the relevant information as low as possible (Grant et al. 2009). To make a fair judgment, data is required on inputs (financial resources, time, involved individuals), the process (the ways societal actors were involved in the research), outputs (the products, such as workshops, reports, prototypes, used to communicate intermediate and final results with societal actors), outcomes (the application of knowledge), impacts (the resulting changes in thinking and/or behaviour) and benefits (the wider effects that occured) (W.K Kellog Foundation 2001). This requires an effort in determining which data are relevant and then collecting this data. Data might not be available for all indicators, as there is not yet a tradition in societal benefit evaluation. And even if collecting impact data were institutionalised, it may be difficult to collect all the relevant data. For example, government policies do not necessarily cite the reports they are inspired by.

The second practical challenge is how to scale the evaluation of societal actor involvement and societal benefits. Due to the broad scope of the proposals or reports submitted, reviewers already have difficulties assessing scientific quality (Van Arensbergen et al. forthcoming). Since the assessment of societal benefits is a relatively new phenomenon, one can expect that most academics are not experienced or trained in reviewing societal benefits. Because of the large scale of the assessments, even those peers who are experienced will lack the time to assess societal benefits using sophisticated methodologies. The development in which the assessment of societal benefits is transformed from a craft performed by experts to assembly work by lay-men could potentially do more harm than good (Martin 2011).

This overview of issues and accompanying questions is presumably far from complete. For example, across these issues there are questions concerning differences and similarities between the assessment of scientific disciplines (Donovan 2005), since there are differences in how fields organise their research and communicate with stakeholders (Whitley 2000). Already, the overview shows there is still a lot of work to be done before societal benefits can be evaluated in such a way that it fits the definition of evaluation (Donovan 2007; Martin 2011; Dahler-Larsen 2011). The aim of this dissertation is to contribute to the work that is to be done, acknowledging that it cannot solve, or even consider, all issues.

Table 1.1 Challenges related to the evaluation of societal actor involvement and societal benefits

Challenge	Prominent question(s)
Methodological	
Finding the right evaluation approach	Who should get the credits for the benefits generated? If benefits did not occur for reasons outside the span of control of researchers, can they be held accountable for that?
Defining societal benefits	Is it about products embodying knowledge, use of this knowledge or actual effects of the use of the knowledge??
Developing indicators	Which set of indicators can be used to assess a wide variety of involvement and benefits across disciplines? How can perverse side-effects of indicators be minimised or avoided?
Defining the unit of evaluation	Can individuals be expected to have an impact track record or is impact by nature a group effort? Should results of every single project be assessed, risking the stimulation of disseminating to the societal domain knowledge that is not yet socially robust?
Defining the right point in time of evaluation	When do benefits become visible? When are evidence and involved individuals still retrievable? When is the information given by individuals involved still reliable? To which individuals or organisations can benefits or contributions to these benefits be attributed?
Including the societal actor perspective	How can the social actors involved and/or affected be identified? Are societal actors aware of any or all the resulting benefits? Which societal actors should be included?
Practical	
Minimising the burden of evaluation	Which data are required? What is the best way to collect data?
Scaling evaluation	How can societal actor involvement and societal benefits be evaluated on a large scale?

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Box 5: Evaluation of societal actor involvement and societal benefits in the Netherlands

Traditionally, Dutch research evaluation has focused more on quality assurance and improvement than on accountability towards a funder (Van der Meulen & Rip 2000). A national ex-post evaluation system was announced in 1992 and introduced in 1994 by the Association of Dutch Universities (VSNU) to replace the system of conditional funding (Geuna & Martin 2003). Since 2003, the VSNU, The Netherlands Royal Academy of Arts and Sciences (KNAW) and research council NWO have jointly developed the protocol. Currently the evaluations are organised in a six-yearly schedule. The main elements of the procedure are a self-evaluation by the evaluand, a site visit by an international peer committee, a report by the peer committee and a formal response to the report by the university board (Van Drooge et al. 2013). The current indicators are scientific quality, relevance and viability, as in 2014, productivity was dropped as an

indicator (VSNU et al. 2014). Officially, one of the goals of the assessments is to inform the Ministry of Science. However, in practice the ministry is at large distance from the evaluations. Outcomes are mainly used by universities in internal policy-making and to show accountability in the media. In contrast to other countries, the outcomes of the evaluations are not used to allocate government funds (Van Drooge et al. 2013; Himanen et al. 2009; Geuna and Martin 2003).

In 2009, the Dutch research council introduced the knowledge utilisation paragraph as optional in some of its funding schemes. Since 2014 the paragraph has been mandatory in all funding schemes. It accounts for 20 per cent of the total review score of a proposal. In this paragraph, the research council invites applicants to reflect upon opportunities for knowledge utilisation. These opportunities may be identified within society, but also within other academic disciplines. Fundamental research without any knowledge utilisation opportunities is offered an opt-out (NWO 2013).

1.5 Methodology

In this section I will discuss the methodology of the study. First I will integrate the issues identified in sections 1.1-1.4 and use them to formulate research questions. Then I will explain how the data was collected. I will also introduce the cases. The link between the issues, research questions and cases is visualised in figure 1.1 at the end of section 1.5.2. Finally, I will discuss how I aimed to enhance the social robustness of the study.

1.5.1 Research questions

The first section of this introduction discussed the current situation concerning the valorisation policy in the Netherlands. Government introduced the valorisation policy in 2004, which fits within a trend of an increasing demand for societal benefits of science that emerged in the 1970s. In public debate, the academic community seems to consider valorisation as problematic or even undesirable. Clearly, the introduction of the valorisation policy is not without problems. This leads to the first main research questions of this thesis:

1 ***"How has the valorisation policy of Dutch government been translated to academic practice in the Netherlands between 2004 and 2014?"***

In the PAT section, it was explained that government delegates tasks to science. Valorisation can be understood as the delegation of a new task from government to science: producing benefits for society. For this task to be executed effectively, it is important that the task is comprehended and accepted by the academic community. Intermediaries play an important role in realising this by translating the policy from government to academic practice. Traditionally, Dutch intermediaries acted as a buffer between government and academic practice and protected the research community from too much government interference. However, the discussions concerning valorisation clearly indicate the research community is affected by government's valorisation policy. Therefore, it can be questioned whether the intermediary level still functions as a buffer between government and scientists. These theoretical and practical insights lead to the first sub research question of the first main research question, through which I aim to understand the perspective of academics:

1.1 "How do academic researchers respond to valorisation policies?"

The first section of this chapter also discussed the fact that academics struggle in integrating valorisation into their daily work. This inspired the second aim of this thesis: providing insights on how to improve valorisation of academic research. In the NPM section, the risk was identified that too much influence from society on scientific research will lead to an emphasis on research with short-term benefits. This relates to the balance scientists have to find between adhering to government's goals and pursuing their own goals, as identified in the PAT section. In the section on the generation of societal benefits, I concluded that although transdisciplinary research is believed to result in the societal benefits government aims to stimulate, it is unclear whether scientists opt for this research mode in large numbers and how this research mode leads to the desired benefits. To put it differently, it is unclear what behaviour can be defined as compliance to the valorisation policy. The second aim and the theoretical insights lead to the second sub-question of the first main research question:

1.2 "How do academic researchers include valorisation in academic practice?"

Valorisation is part of the performance agreements between government and universities; it is included in NWO granting procedures as the knowledge utilisation paragraph, and it is part of the national SEP for ex-ante evaluations. These developments fit in with the accountability trend associated with NPM. However, can academic researchers be held solely accountable for a process in which societal actors also take part and which they cannot fully control? PAT literature considers evaluation from a slightly different angle and conceptualises it as an instrument which government can use to secure compliance of scientists. How can evaluations be used to secure compliance with valorisation? Both questions focus on the design of the evaluation of valorisation. This leads to the second main research question:

2 "How can societal benefits of academic research be evaluated?"

Practical demands such as time frames used in evaluations and low administrative burdens will be taken into account when answering this research question. Societal benefits are defined as actual achievements, rather than potential relevance or the production of information carriers such as policy reports.

1.5.2 Research design

The overarching method to collect the data to answer the research questions of this thesis is the case study approach (Gerring 2007; George and Bennet 2005). The main reason to opt for this approach is that I study contemporary events on which behavioural control cannot be exerted. Yet, through interviews, surveys and documents there is the opportunity to study those individuals and organisations involved during or relatively shortly after events have occurred. An additional reason is that the research questions take the form of a 'how' question. In such cases, the case study approach is one of the obvious approaches (Yin 2003).

The focus of this thesis is on the effect of the Dutch government's valorisation policy on scientists. Doubtless, valorisation policies also have an effect on societal actors. They are increasingly expected to be involved in academic research and to invest in it. For valorisation policies to be successful, societal actors have to be willing and able to invest their resources in research and/or in adopting research results. Although societal actors have an active role in valorisation, this study will not specifically address their response to the policy.

One could also argue that in order to understand how valorisation was translated from policy to practice, the political and administrative processes preceding the policies have to be studied. Acknowledging that this will contribute to our understanding of policy dynamics concerning valorisation and the intentions of valorisation policies, this thesis puts the perspective of scientists at the centre. To understand this perspective, it is more important to study the documents in which policies are published than to study the preceding dynamics that, I assume, academics generally are not aware of. Besides this, academics react to the content of such documents in organised meetings or opinion pieces, as was recently the case when the Science Vision 2025 (Wetenschapsvisie 2025 (Ministry of Education, Culture and Science 2014) was published. This shows academics perceive these policy documents as potentially having an effect on their practice and that their content therefore is important to consider.

In terms of geography, the study is restricted to the Netherlands. The Dutch science system is one of the leading systems concerning valorisation. As discussed above, valorisation is expected across the full spectrum of academic research. Other leading systems in this respect include the UK (Kitagawa & Lightowler 2014), Australia (Donovan 2008) and Canada (Fisher et al. 2001). The importance of valorisation at European level can also be recognised in the Horizon 2020 framework[6,7].

The study entails four different cases[8]. Richard Whitley's (2000) typology of research fields has inspired the selection of cases. Whitley distinguishes seven types of research fields, based on their social and cognitive organisation. Within each field, researchers have a specific relation with their scientific and societal audiences. Some, such as the social sciences and humanities, have multiple types of audiences which have a more or less equal influence on research dynamics within the field. Other fields, like physics, have a limited range of audiences, of which one has a dominant influence on research dynamics. Concerning societal benefits, there is an abundance of studies focusing on the natural and life sciences (Hessels 2010). The emphasis of this study is therefore on other types of research fields.

In the first case (chapter 2), I include three types of research fields that cover the variety of research fields identified by Whitley (2000). These types roughly translate to the social sciences and humanities on the one hand and chemistry and physics on the other hand, with practice-oriented fields such as climate research and the biomedical sciences in between. I cast a wide net, to first get a science-wide view on academics' responses to the valorisation policies of government and intermediaries. This case concerns how academics understand the valorisation policy and the role of intermediaries in translating government policy to academic practices. Insights from this study serve as the main input to answer sub research question 1 of main research question 1.

6 Valorisation is a Dutch term. Comparable terms in other countries include for example social impact, third mission and knowledge exchange.

7 http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020, accessed 10-07-2014

8 All four studies have been performed in collaboration with co-authors. However, I take full responsibility for the positioning of the studies within the theoretical and methodological framework presented in this introductory chapter.

After obtaining a wide view, I focus on research fields in which I expect a broad variety of interactions with societal actors and on fields in which I expect the emphasis on valorisation to create additional difficulties compared to the natural and life sciences.

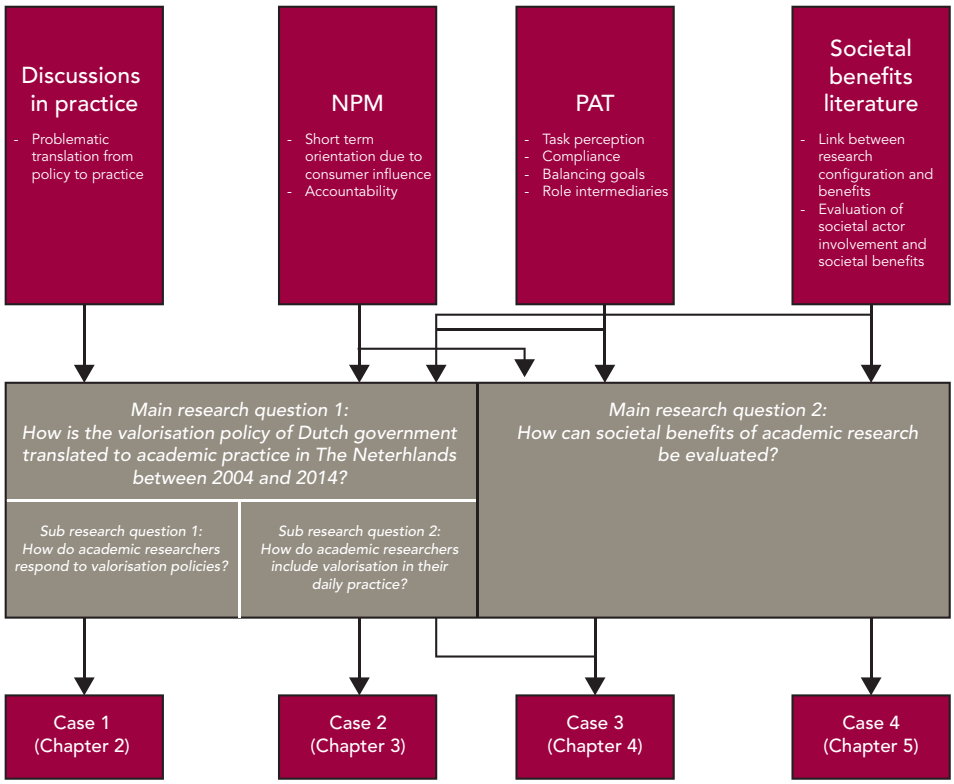
The second case (chapter 3) includes two research programmes in climate studies. This case is included in the study for two reasons. The first is that the two programmes are intermediaries in the science system, the two programmes are part of a larger policy scheme by government to coordinate research in a specific area with the explicit aim of generating societal benefits. The second reason is that within climate studies the focus is on solving a real-world problem: climate change. Moreover, within climate sciences, there is ample experience of interaction with societal actors. Therefore, by including this field I expect to find the research dynamics relevant for this study. I will explore the project dynamics using survey data and statistical analyses. Next, project dynamics are related to theory about transdisciplinarity and associated societal benefits. As such, this chapter is about how valorisation is integrated in academic practice, with a specific focus on transdisciplinarity and how this research mode leads to societal benefits. Together with the third case, this case serves as the main foundation to answer sub research question 2 of main research question 1.

The third case (chapter 4) focuses on ICT research. This field combines a research tradition in which methods are standardised, introducing a certain degree of scientific rigour, on the one hand, while interacting with a wide variety of societal actors on the other hand, which requires a certain degree of flexibility in the research process. This provides an opportunity to study how the task of generating societal benefits is integrated in scientific research. Within this study, I allow myself a minor diversion to the UK. The research system in the UK is comparable to the situation in Netherlands: NPM is influential in public policy-making (Boden et al, 2006), the UK has a productive science system of high quality; societal benefits is a criterion in funding procedures, and the UK has one of the most advanced national systems of research evaluation (Geuna and Martin, 2003), in which societal benefits is currently an important criterion. However, there is an important difference between the Netherlands and the UK. In the UK, the results of ex-ante evaluations have direct consequences for government funding for universities (Barker, 2007). This creates an important incentive for academics to aim for societal benefits. Although the countries are not systematically compared, including the UK brings in the perspective of a system in which academics already have an incentive to develop effective valorisation strategies. This case study concerns how valorisation takes shape in academic practice and how these insights can be used to design indicators, specifically to monitor societal actor involvement. Along with the second case, this case serves as the major source of empirical evidence to answer sub research question 2 of the main research question 1. Together with the fourth case, it is also the main input for the second research question.

The fourth case (chapter 5) deals with the evaluation of law and architecture research. These cases represent the types of research fields in which research priorities, methods and theories are manifold and in which the distinction between scientific and societal activities, achievements, audiences and impact is often difficult to make. In addition, evaluation of research within these fields is a challenge, as there is a tendency to evaluate their achievements using the same criteria applied to the natural and life sciences, whereas underlying research dynamics differ

greatly from these fields. It is suggested that, following scientific evaluations, societal benefits of these fields should now also be assessed using criteria that are less relevant in these fields, such as patents and spin-off companies. This case provides a setting to study how societal benefits come about in collaboration with societal actors and how indicators can be developed to assess societal actor involvement and societal benefits. This case is the second main data source to answer the main research question 2.

Figure 1.1 Link between discussion in practice, literature, research questions and cases



1.5.3 Social robustness

Apart from relying on scientific theories and methods to secure the academic quality of this thesis, I have interacted on multiple occasions with academics outside my peer community (non-peers) and science policymakers to enhance its social robustness. Characteristics of social robustness involve social actors testing research results outside the laboratory (which in my case is a desk with a laptop) and expanding and modifying knowledge based on interactions with societal actors (Nowotny 2003). Academics outside my own peer community and policy-makers have helped with identifying participants for focus groups and interviews, provided feedback on research designs (e.g. survey questions and selection of sub-cases) and reflected

upon outcomes. Results have been tested during multiple workshops and presentations for academics and policymakers and have even been used in preparing for a SEP evaluation (Van der Hoeven 2010). Interactions with academics and policymakers regularly resulted in new research questions, fine-tuning of interview and survey questions and rephrasing recommendations for practice.

1.6 Scientific relevance

In the sections above I have identified tensions in existing literature and practical discussions, I have formulated research questions and I have selected a methodology. In this section I summarize how these choices contribute to the scientific relevance of this thesis.
Previous studies have primarily focussed on how academics in the natural and life sciences deal with the increased demand for societal benefits voiced by government, intermediaries and society at large (e.g Hessels 2010). This thesis adds to existing literature by studying how academics in other research domains perceive this tension; how they practically deal with it and how their efforts can be evaluated by peers.

By taking the perspective of researchers concerning valorisation policies, the thesis also adds to the body of literature focusing on principal-agent relationships in the science system. This body of literature includes conceptual papers (e.g. Van der Meulen 1998; Guston 2000) and empirical studies on the role of intermediaries (e.g. Van der Meulen 2003; Shove 2003 and Wardenaar et al. 2014). However, the role of agents in this relation has received far less attention. An exception is the study of Morris (2004) on scientists' coping strategies with new policies.

The thesis further explores the value of process rather than output evaluations concerning societal benefits. It uses ICT research as test case for the SIAMPI approach. This approach was designed to solve the problem of benefit attribution by focussing on contributions (Spaapen & Van Drooge 2011). The value of the approach has already been tested in the social sciences and humanities (Molas-Gallart & Tang 2011). Also, the value of the concept of productive interactions, central to the SIAMPI approach, is further explored in the fields of law and architecture.
In the concluding chapter I further reflect on the contributions of the results of the thesis to the existing body of knowledge.

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